TAYLOR BAY BEACH CLUB HOA

PIERCE COUNTY **WASHINGTON**

TAYLOR BAY
BEACH CLUB

CONTRACT PROVISIONS

for

WASTEWATER TREATMENT FACILITY UPGRADE

G&O #22848.01
OCTOBER 2026

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TAYLOR BAY BEACH CLUB HOA

PIERCE COUNTY **WASHINGTON**

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10/7/2026

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ADVERTISEMENT FOR BIDS

TAYLOR BAY BEACH CLUB HOA
LONGBRANCH, WASHINGTON
WASTEWATER TREATMENT FACILITY UPGRADE

General Notice

Taylor Bay Beach Club HOA (Owner) is requesting Bids for the construction of the following Project:

Wastewater Treatment Facility Upgrade
G&O #22848.01

Bids for the construction of the Project will be received electronically by QuestCDN – Quest eBidDoc #10400489, until **Wednesday, November 11, 2026** at **11:00 a.m.** local time. At that time the Bids received will be **publicly** opened and displayed on the QuestCDN website. The Taylor Bay Beach Club HOA mailing address is 8215 175th Avenue SW, Longbranch, WA, 98351. The wastewater treatment facility property address is 8220 178th Court SW, Longbranch, WA 98351.

The Project includes the following Work:

1. Replace a section of existing 8-inch gravity sewer with a new 8-inch gravity sewer, including the installation of a new saddle manhole and a new sanitary sewer manhole.

2. Construct new concrete process tanks with covers, including an influent pump station, headworks, an equalization basin, an anoxic basin, an aerobic basin, two membrane basins, a return activated sludge (RAS) pump station, an odor control system, and install the equipment and instrumentation associated with each basin and pump station. Equipment associated with the influent pump station includes two influent pumps, and associated valve vault and influent sampler. Equipment associated with the new headworks includes a new influent magnetic flow meter, two influent rotary drum screens and an associated screenings washer compactor. Equipment associated with the anoxic basin includes a submersible mixer. Equipment associated with the aerobic basin includes a fine bubble air diffusion system. Equipment associated with the membrane basins includes components of the membrane equipment system, including four membrane modules, to be supplied by the Membrane System Supplier. Equipment associated with the RAS pump station includes two RAS pumps.

3. Installation of the Membrane System components as described herein. The Contractor shall be assigned the portion titled “Membrane Equipment System: Supply, Construction Services and Post-Construction Services” of the executed Contract titled “Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services.” The executed Contract titled “Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services” is attached to these Contract Provisions as Appendix A. The equipment, instrumentation, and materials to be provided by the Membrane Supplier are summarized in Specifications Section 11500 and detailed in the Supplier Design Submittal Documents and Drawings in Appendix B of the Contract Provisions and Appendix B of the Drawings.

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4. Construct a new waste activated sludge (WAS) storage tank, coarse bubble air diffuser system, waste sludge pump and associated haul truck discharge piping.

5. Construct the new operations building including a new office/control room, laboratory, restroom, process equipment room, and electrical room. Process equipment associated with the equipment room includes membrane equipment to be supplied by the Membrane System Supplier, one aeration blower, one WAS tank blower, two UV disinfection modules, an effluent sampler, a non-potable water tank, and two non-potable water pumps. Membrane equipment to be supplied by the Membrane System Supplier associated with the equipment room includes three permeate pumps, three air scour blowers, and a chemical cleaning system.

6. Install effluent piping system and connection to the new subsurface outfall in Case Inlet, which will have an existing capped connection point above the ordinary high water mark as discussed in Section 1.2.

7. Install a new storm filter catch basin to treat stormwater collected on the site and associated downstream storm drain piping to downstream manhole with connection to new outfall piping.

8. Demolish above grade and exposed portions of the existing outfall and abandon buried portions of the existing outfall.

9. Demolish the existing Equipment and Laboratory Building, storage shed, Aeration Basins and Settling Basins, Biosolids Tank, Outfall Structure, Influent Manhole, and UV Disinfection Shed.

10. Salvage existing Standby Generator and Propane Tank to Owner.

11. Install a new generator.

12. Furnish new laboratory equipment.

13. Provide all temporary bypass pumping systems as required.

14. Furnish and install all required piping and appurtenances.

15. Furnish and install all required plumbing, heating and ventilating work.

16. Furnish and install all required electrical, instrumentation and telemetry work.

17. Construct required site grading and asphalt paving.

18. Restore all surfaces disturbed by construction activities.

19. Furnish and install irrigation system.

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20. Furnish and install landscaping.

21. Furnish and install fencing.

22. Furnish and install site dewatering system for construction.

23. Provide testing, commissioning, and training as specified herein.

24. Provide all associated work as shown on the Drawings and specified herein, for a complete and workable system.

Bids are requested for the following Contract:

Wastewater Treatment Facility Upgrade

The Owner anticipates that the Project's total bid price will be **$7,800,000 - $8,500,000**. The Project has an expected duration of 360 working days (17 months).

This Project is funded by Taylor Bay Beach Club HOA, the United States Department of Agriculture Rural Development Program. Prevailing wages are not required by the Funding Agency or Owner for this project.

Small, Minority, and Women-Owned firms are encouraged to submit bids.

Obtaining the Bidding Documents

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

https://questcdn.com/#10400489

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, lists of registered plan holders, 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.

Pre-bid Conference

A pre-bid conference for the Project will be held on **Wednesday, October 28, 2026** at **10:00 a.m.** at **Taylor Bay Beach Club HOA, 8220 178th Court SW, Longbranch, Washington, 98351**. The Engineer and Client will be available at the scheduled pre-bid meeting to discuss the project plans and specifications, and review the existing treatment plant site. Contractors are encouraged to attend to help assure that bids are based on an understanding of the site. Taylor Bay Beach Club is a gated community, so Contractors that do not make the pre-bid conference will need to arrange for access with the Owner. Contractors with questions after the scheduled pre-bid meeting may email or call the the Engineer.

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.

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Domestic Preference

Buy America Build America Act (BABAA)

This project is subject to the Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953. Absent an approved waiver, all iron, steel, manufactured products, and construction materials used in this project must be produced in the United States. Contractor shall complete the Certification of Compliance with Domestic Preference which is located in Part 6. FORMS USED DURING CONSTRUCTION.

The following waivers apply to this Contract:

BABAA De Minimis, Small Grants, and Minor Components

All major components, for the wastewater treatment facility upgrade must comply with BABAA. Contractor shall complete the Domestic Preference DeMinimis List Format which is located in Part 6. FORMS USED DURING CONSTRUCTION.

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, but not limited to, 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.

Contractor shall complete the Certification of Compliance with Domestic Preference (AIS) which is located in Part 6. FORMS USED DURING CONSTRUCTION.

This Advertisement is issued by:

Owner: **Taylor Bay Beach Club HOA**
By: **Mitzi McCart**
Title: **President of Board**
Date: **Wednesday, October 14, 2026**

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CONTRACT PROVISIONS

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PART 1

INSTRUCTION TO BIDDERS

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.

B. *Domestic Preference* – The Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953.

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 notification when Addenda are issued by Owner. It is the Bidder's responsibility to verify addenda on the Bidding Document Website prior to submittal of bids.

2.04 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.

2.05 *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 **11.0** or later. It is the intent of the

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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. **AutoCAD/Civil3D files of project plans**

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.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within **2 business** days of Owner's request, Bidder must submit the following information:

A. Evidence of Bidder's authority to do business in the state where the Project is located.

B. Bidder's state or other contractor license number, if applicable.

C. Subcontractor and Supplier qualification information.

D. Information demonstrating compliance with Mandatory and Supplemental Bidder Responsibility Criteria.

3.02 Deleted

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3.03 A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1 through 8 in this Section:

The Owner will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1. Evidence that the Bidder meets Supplemental Criteria 2 through 8 shall be provided by the Bidder as stated later in this Section.

A. Criteria 1 – Federal Debarment

1. Criterion: The Bidder shall not currently be debarred or suspended by the Federal government.

2.

B. Criteria 2 – Delinquent State Taxes

1. Criterion: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder does not owe delinquent taxes to the Department of Revenue. If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Owner by the deadline listed below.

C. Criteria 3 – Claims Against Retainage and Bonds

1. Criterion: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the 3 years prior to the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.

2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder has not had claims against claims against retainage and bonds in the 3 years prior to the bid submittal date. If the Bidder has had claims against retainage and bonds in the three years prior to the bid submittal date, they shall submit a list of the public works projects completed in the 3 years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information (reference Appendix E – Supplemental Bidder Responsibility Criteria):

- Name of project
- The owner and contact information for the owner;

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- A list of claims filed against the retainage and/or payment bond for any of the projects listed;
- A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

D. Criteria 4 – Public Bidding Crime

1. Criterion: The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

E. Criteria 5 – Termination for Cause / Termination for Default

1. Criterion: The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.

2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

F. Criteria 6 – Lawsuits

1. Criterion: The Bidder shall not have lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.

2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date, along with a written explanation of the circumstances surrounding each such lawsuit. The Owner shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet of terms of construction related contracts.

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G. Criteria 7 – Contract Time (Liquidated Damages)

1. Criterion: The Bidder shall not have had liquated damages assessed on any projects it has completed 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet contract time.

2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had liquidated damages assessed on any projects it has completed within the 5 years prior to the bid submittal date, or shall submit a list of Projects with assessed liquated damages along with Owner contact information, and number of days assessed liquated damages.

H. Criteria 8 – Experience and Capacity

1. Criterion: The Bidder shall have sufficient current equipment, capacity, and experience to meet the requirements of this Project. The Bidder shall have successfully completed at least three projects, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

2. Documentation: The Bidder shall, if and when required as detailed below, on a form to be provided by the Owner, provide the Bidder's gross dollar amount of work currently under contract, the Bidder's gross dollar amount of contracts currently not completed, five major pieces of equipment anticipated to be on the project and whether the equipment is leased or owned, number of years the contractor has been in business, number of superintendents on staff, superintendent assigned to this project and their number of years of experience, and three project references of similar size and scope during the 5-year period immediately preceding the bid submittal deadline for this project. The Owner may check owner references for the previous projects and may evaluate the owner's assessment of the Bidder performance.

As evidence that the Bidder meets Supplemental Responsibility Criteria 2 through 8 stated above, the apparent two lowest Bidders must submit to the Owner by 12:00 p.m. (noon) of the second business day following the bid submittal deadline, a written statement verifying that the Bidder meets Supplemental Criteria 2 through 8 together with supporting documentation (sufficient in the sole judgment of the Owner) demonstrating compliance with Supplemental Responsibility Criteria 2 through 8. The Owner reserves the right to request further documentation as needed from the low bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Owner also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and supplemental criteria, and to use that information in their evaluation. The Owner may consider mitigating factors in determining whether the Bidder complies with the requirements of the Supplemental Criteria.

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The basis for evaluation of Bidder compliance with these mandatory and Supplemental Criteria shall include any documents or facts obtained by Owner (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Owner from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Owner which is believed to be relevant to the matter.

If the Owner determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Owner shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 2 business days of the Owner's determination by presenting its appeal and any additional information to the Owner. The Owner will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Owner will not execute a contract with any other Bidder until at least 2 business days after the Bidder determined to be not responsible has received the Owner's final determination.

Request to Change Supplemental Bidder Responsibility Criteria Prior To Bid: Bidders with concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility Criteria may make or submit requests to the Owner to modify the criteria. Such requests shall be in writing, describe the nature of the concerns, and propose specific modifications to the criteria. Bidders shall submit such requests to the Owner no later than 5 business days prior to the bid submittal deadline and address the request to the Engineer or such other person designated by the Owner in the Bid Documents.

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 be conducted for this Project.

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 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.

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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

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

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.

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.

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.

B. No Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference.

C. A pre-bid conference and site visit is scheduled for the time and location indicated in the Advertisement or invitation to bid.

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

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E. The project sites cannot be accessed without a gate code. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner contact for visiting the Site: **Steve Stemhagen, Facility Manager, stevestem@gmail.com, mobile: (206) 300-9871**. Bidder must conduct the required Site visit during normal working hours.

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, and investigations 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.

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 and Engineer, together 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 via the QuestCDN website. Contact information and submittal procedures for such questions are as follows:

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A.

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda posted on the Bidding Documents Website. 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 **5** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a cashier's check, postal money order, or 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 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.

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ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

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 shall include the Manufacturers' Certification for Compliance with Domestic Preference requirements. Refer to the suggested Manufacturer's Certification provided in these construction Contract Documents. Each such request shall include the Manufacturer's Certification for Compliance with AIS and BABA. 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. 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 Domestic Preference requirements. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

10.03 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 RCW 39.30.060 requires Bidders on public works projects expected to cost one million dollars or more to provide the names of the structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing and electrical Subcontractors to whom the Bidder will directly subcontract those portions of the Work if awarded the contract. The Bidder may not list more than one Subcontractor for each category of Work identified, unless Subcontractors vary with bid alternates, in which case the Bidder shall indicate which Subcontractor will be used for which alternate. Failure of the Bidder to list the names of such Subcontractors or to name itself

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to perform such Work, or listing two or more Subcontractors to perform the same Work, shall render the Bidder's Proposal unresponsive and void.

Per RCW 39.30.060, the required names of such Subcontractors shall be provided with the Proposal or within one hour after the published Proposal submittal time.

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 Work within five days after Bid opening.

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.

Deleted

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.

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.

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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

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 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.

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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 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.

14.04 Compete bids must be submitted with Bid Proposal Attachment A - Major Scope of Supply Components That Do Not Comply with BABA Requirements. Provide a list of items listed in Technical Specifications Divisions 11, 13, and 15, in the bidders scope of supply which do not comply with Build America, Buy America (BABA) Act requirements, including the cost of each item, listed by specification section and name, to be included in the summation of items for the BABA De Minimus waiver, and the total of all items listed.

The Engineer has performed market research for all major equipment and instrumentation items, and where possible has included one or two named manufacturer's and/or model numbers that comply with BABA requirements. If the Bidder finds at bid time that the named manufacturer's do not comply with BABA, those items can be included in the BABA De Minimus waiver and the Bidder shall include them in the Bid Proposal Attachment A.

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

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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.

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

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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. Deleted.

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. Deleted

F. Deleted

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—DELETED

ARTICLE 22—DELETED

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22.01 The Contractor shall be assigned the portion titled "Membrane Equipment System: Supply, Construction Services and Post-Construction Services" of the executed Contract titled "Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services." The executed Contract titled "Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services" is attached to these Contract Provisions as Appendix A. Bidder's attention is directed to the provisions of Article 5 of the Procurement Agreement which provide for the assignment of the Procurement Contract to the construction contractor. The Supplier (Kubota Water & Environment USA Corporation) will be required to perform the Procurement Contract after it has been assigned to the construction contractor (Contractor Assignee) in accordance with the provisions in the Procurement Contract. Timing of the assignment is addressed in the Procurement Agreement. Forms documenting the assignment of the Procurement Contract and for the agreement of the Seller's surety to such assignment are included as attachments to the Procurement Agreement. The Contractor shall be required to sign the Assignment of Procurement Contract, Consent to Assignment, and Acceptance of Assignment document included as Exhibit A in the Agreement of the Procurement Contract.

ARTICLE 23—FEDERAL REQUIREMENTS

23.01 Federal requirements for Davis Bacon wages do not apply to this project because Taylor Bay is not a public municipal agency. 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 (AIS) requirements apply to this project. The Certification form for compliance with AIS is included above in ADVERTISEMENTS FOR BID.

23.04 Buy America Build America Act (BABA) requirements apply to this project. The Certification form for compliance with BABA is included above in ADVERTISEMENTS FOR BID.

ARTICLE 24—STATE PREVAILING WAGE REQUIREMENTS

24.01 This contract is not subject to the minimum prevailing wage and hour requirements of RCW 39.12 and RCW 49.28 (amended or supplemented). Washington State prevailing wage requirements are further described in the Supplementary Conditions.

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PART 4

EJCDC STANDARD GENERAL CONDITIONS

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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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

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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

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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

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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.

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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.

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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

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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.

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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

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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;

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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

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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

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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

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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

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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

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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.

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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);

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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

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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.

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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.

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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;

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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:

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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.

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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

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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

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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

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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

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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.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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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

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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.

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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,

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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,

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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

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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.

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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;

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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

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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

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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.

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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,

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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.

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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,

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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

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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.

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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.

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PART 5

EJCDC SUPPLEMENTARY 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

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

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 at the end of the Paragraph:

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 at the end of the Paragraph:

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 Build America, Buy America Act (BABAA) - Requirements mandated by Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953-58 mandating domestic preference that all iron and steel, manufactured products, and construction materials are produced in the United States.

52.b Construction Materials - Those articles, materials, or supplies — other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or

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gravel; or aggregate binding agents or additives— that are or consist primarily of: non-ferrous metals, plastic and polymer- based products, glass, lumber or drywall.

52.c Contractor's Certification - Documentation submitted by the Contractor upon Substantial Completion of the Contract that all iron and steel, manufactured products, and construction materials are produced in the United States.

52.d De Minimis - Materials and products that represent a small portion of an infrastructure project, specifically no more than 5% of the project costs up to a maximum of $1,000,000,

52.e Domestic Preference - The Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953.

52.f Engineer's Certification - Documentation submitted by the Engineer that Drawings, Specifications, and Bidding Documents comply with Domestic Preference requirements.

52.g Manufactured Product – Items assembled out of components, or otherwise made or processed from raw materials into finished products. Manufactured products must be manufactured (assembled) in the United States, and the cost of components that were mined, produced, or manufactured in the United States must be greater than 55 percent of the total cost of all components of the product.

52.h Manufacturer's Certification - Documentation provided by the Manufacturer stating that Domestic Preference requirements have been satisfied for all provided items. 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.i Minor Components - Components within an iron and/or steel product otherwise compliant with the Domestic Preference requirements. This waiver, typically used by Manufacturers, 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 product must still meet the Domestic Preference requirements. This waiver does not exempt the whole product from the Domestic Preference requirements only Minor Components within said product and the iron or steel components of the product must be produced domestically.

52.j Primarily Iron or Steel - A product is made of greater than 50 percent iron or Steel on a materials cost basis.

ARTICLE 2—PRELIMINARY MATTERS

2.02 *Copies of Documents*

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

Owner shall furnish to Contractor five printed copies of the Contract Documents (including one fully signed counterpart of the Agreement).

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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.

The Contractor shall install and use the necessary computer hardware and software to receive and transmit project communications through the Engineer's web-based, online project communications system as specified in Sections 01110 and 01300. This website will be used by the Engineer, Field Representative, Owner and Contractor to communicate online between these parties to clarify design and construction requirements, to provide information concerning construction issues, and to post certain project documents.

The web-based project communication system will use the secure website and programming developed by the Engineer. The Engineer will provide the Contractor with the instructions and credentials for access and use of the website.

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

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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 to web-based project communication system under this EDP is **700** 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.

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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

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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 $130 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 Supplementary Conditions in this Article.

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ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

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

SC-4.01.B – Working Days

The Contractor shall complete all of the physical Work within the number of working days that are specified as the Contract Time. Every day will be counted as a working day unless it is a non-working day or the Engineer determines the day to be an unworkable day. A non-working day is a Saturday, a Sunday, a day on which the Contract suspends work, or one of the following holidays: January 1st; the third Monday of January; the third Monday of February; Memorial Day; July 4th; Labor Day; November 11th; Thanksgiving Day; the day after Thanksgiving; and Christmas. Whenever any of these holidays falls on a Sunday, the following Monday shall be counted a non-working day. When the holiday falls on a Saturday, the preceding Friday shall be counted a non-working day.

The days between December 25th and January 1st will be classified as nonworking days, provided that the Contractor actually suspends performance of the Work.

An unworkable day is defined as a partial or whole day that the Engineer determines to be unworkable because of weather, conditions caused by the weather, or such other conditions beyond the control of the Contractor that prevent the satisfactory and timely performance of the Work, and such performance, if not hindered, would have otherwise progressed toward physical completion of the Work.

Each working day shall be charged to the Contract Time as it occurs until the Work is physically complete. If requested by the Contractor in writing, the Engineer will provide the Contractor with a weekly statement that shows the number of working days: (1) charged to the Contract Time the week before; (2) specified for the substantial and physical completion of the Contract Time; and (3) remaining to achieve the substantial and physical completion of the Contract. The statement will also show the nonworking days and any partial or whole days that the Engineer declares to be unworkable. If the Contractor disagrees with any statement issued by the Engineer, the Contractor shall submit a written protest within 10 calendar days after the date of the statement. The protest shall be sufficiently detailed to enable the Engineer to ascertain the basis for the dispute and amount of time disputed. Any statement that is not protested by the Contractor as required in this Section shall be deemed as having been accepted as correct. If the Contractor elects to work 10 hours a day 4 days a week (a 4-10 schedule), the fifth day of that week will be charged as a working day if that day would be chargeable as a working day if the Contractor had not elected to utilize a 4-10 schedule.

SC-4.05 Paragraph is mandatory for WWD projects.

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

   a. 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:

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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 0.5 inch 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: 28 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 NOAA weather radio at KHB60 (162.55 MHz) or WWG24 (162.425) weather monitoring station covering Kitsap County and surrounding areas.

3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit **[exhibit number]**—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 **[exhibit number]**—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.

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Report Title	Date of Report	Technical Data
1. Geotechnical Report: Taylor Bay WWTF Outfall Replacement. Project No. 24-274. By PanGEO, Inc..	October 2024	The locations of Boring Logs in the intertidal zone are shown in figure 2B on page 27 of 37 pages. Boring log data for Test Site PG-2 is shown in Figure A-3, page 33 ; and Test Site PG-3 is in Figure A-4 on page 34. The location of the Boring Log on top of bluff is shown in Figure 2B. Boring log data for Test site PG-1 is shown on figure A-2 on page 32.
2. Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report. Taylor Bay Sewage Treatment Plant. Prepared by AESI, Inc.	May 20, 2024	Boring Logs on top of bluff. Location of boring logs shown on figure on page 39 of 66 pages. Boring log data EB-1 on page 43 and EB-2 on page 44 in Report

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: **[If there are no such drawings, so indicate in the table.]**

Drawings Title	Date of Drawings	Technical Data
N/A	N/A	**N/A**

G. Contractor may request from the Engineer, digital copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents.

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: **[If there are no such reports, so indicate in the table]**

Report Title	Date of Report	Technical Data
None		**[Identify Technical Data]**

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: **[If there are no such drawings, so indicate in the table]**

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Drawings Title	Date of Drawings	Technical Data
None		**[Identify Technical Data]**

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 – Disregard EJCDC Guidance Notes – Performance and Payment Bonds, Note 1. Performance and Payment Bonds are required for WEP projects.

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 (2010, 2013, or 2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

SC-6.01 – EJCDC Guidance Notes – "Other Bonds," Warranty Bond, Note 1. RD does not require a Warranty Bond, and RD will not accept a Warranty Bond in place of a Performance and Payment Bond. The decision to include a Warranty Bond is made by the Owner and their counsel. Please refer to EJCDC.

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.H.2 of the General Conditions:

3. Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 6.03. Parts F., G., H., I., and J. Upon request of the Owner, the Contractor shall provide evidence of such insurance.

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

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	$1,000,000

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Workers' Compensation and Related Policies	Policy limits of not less than:
Bodily injury by disease—aggregate	$1,000,000
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$2,000,000
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:	$1,000,000

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    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. Commercially reasonable efforts shall be evidenced by a signed statement by the Contractor's insurance broker indicating that endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01

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are not available and the endorsements submitted provide equivalent protection to the Additional Insured.

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:**
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

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K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$2,000,000
General Aggregate	$2,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $2,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

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	$1,000,000
General Aggregate	$1,000,000

Q. *Other Required Insurance:* N/A

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

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

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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)..

5. extend to cover damage or loss to insured property while in transit.

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."

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ARTICLE 7—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 7:00 AM to 6:00 PM.

2. Owner's legal holidays are January 1st, the third Monday of January, the third Monday of February, Memorial Day, July 4th, November 11th, Thanksgiving Day, the day after Thanksgiving, and Christmas. When the holiday falls on a Saturday, the Preceding Friday shall be counted as a non-working day. The days between December 25th and January 1st will be classified as non-working days, provided that the Contractor actually suspends performance of the Work.

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 cost or 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, 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 off-set against payments due under Article 15.

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

D. All products must meet Domestic Preference 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 components and ensure that the cost is less than 5 percent of total project cost for project up to a maximum of $1,000,000.

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 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."

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

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 Certification Letter provided in these Contract Documents.

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.

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.

SC-7.07.N - Add the following new paragraph immediately after Paragraph 7.07.M:

N. Prior to subcontracting any Work, the Contractor shall verify that every first tier Subcontractor meets the responsibility criteria stated below at the time of subcontract execution. The Contractor shall include these responsibility criteria in every subcontract, and require every Subcontractor to:

1. Possess any electrical contractor license required by 19.28 RCW or elevator contractor license required by 70.87 RCW, if applicable;

2. Have a certificate of registration in compliance with Chapter 18.27 RCW;

3. Have a current State unified business identifier number;

4. If applicable, have:

    a. Industrial insurance coverage for the bidder's employees working in Washington (Title 51 RCW);

    b. An employment security department number (Title 50 RCW);

    c. A state excise tax registration number (Title 82 RCW).

5. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or RCW 39.12.065(3);

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6. Verify these responsibility criteria for every lower tier subcontractor at the time of subcontract execution; and

7. Include these responsibility criteria in every lower tier subcontract.

SC-7.12.A Amend paragraph by adding the following after "written interpretations and clarifications,":

Manufacturers' Certifications,

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 and any waivers in order to document compliance with Domestic Preference requirements, as applicable.

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 Domestic Preference requirements. Contractor shall provide Certification to Owner and Engineer. Refer to the Sample Language for Contractor's Certification provided in these Contract Documents.

ARTICLE 8—OTHER WORK AT THE SITE

No Supplementary Conditions in this Article.

ARTICLE 9—OWNER'S RESPONSIBILITIES

No 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.

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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.

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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

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.

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 the Agency.

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

For Owner-authorized changes in the Work, the Contractor will provide the Manufacturer's Certification, or waiver, for materials subject to Domestic Preference requirements except when sole-source is specified, in which case the Engineer will provide the Manufacturer's Certification, or waiver.

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

c. For change orders involving materials subject to Domestic Preference requirements, Contractor shall include a Manufacturer's Certification or waiver, as applicable. Refer to the Sample Language for Manufacturer's Certification provided in these Contract Documents.

ARTICLE 12—CLAIMS

No 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

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provisions of this Contract is the most current edition of the AGC/WSDOT Equipment Rental Agreement.

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.

SC-13.02.C – Delete paragraph in its entirety and insert "Deleted".

13.03 *Unit Price Work*

SC 13.03.E – Delete paragraph in its entirety and replace with SC 13.03.E as shown in the EJCDC C-800 Supplementary Conditions.

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

SC-14.03.G – Add new paragraph immediately after Paragraph 14.03.F:

G. Installation of materials that are non-compliant with Domestic Preference requirements shall be considered defective work. Contractor should ensure that Engineer has an approved Manufacturer's Certification, or waiver, prior to any domestic preference compliant item being delivered to the project site.

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 paragraph:

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

SC-15.01.B.5 – Add new paragraph immediately after Paragraph 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 Domestic Preference requirements. Manufacturer's Certification for material(s) satisfy these requirements. Refer to the Sample Language for Manufacturer's Certification provided in these Contract Documents.

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

d. The materials presented for payment in an Application for Payment comply with Domestic Preference requirements.

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SC-15.01.D.1 – Delete 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.

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

15.03 *Substantial Completion*

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

Contractor shall also submit the Contractor's Certification of Compliance certifying that to the best of the Contractor's knowledge and belief all Iron and Steel products, Manufactured Products, and Construction Materials proposed in the Shop Drawings, Change Orders, and Partial Payment Estimates, and those installed for the Project, comply with Domestic Preference requirements.

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.

15.06 *Final Payment*

SC 15.06.E Delete subparagraph 15.06.E and replace it with the following:

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. Release of retainage will be made within the statutory period following the last date for filing of claims pursuant to RCW Chapter 60.28, provided that the following conditions are met:

1. A release has been obtained from the Washington State Department of Revenue;
2. A "Certificate of Payment of Contributions Penalties and Interest on Public Works Contract" is received from the Washington State Employment Security Department;
3. The Washington State Department of Labor and Industries indicates the Contractor is current on the payment of industrial insurance and medical aid premiums;
4. All claims by the Owner against the Contractor have been resolved;
5. No claims have been filed against the retained percentage;
6. All required "Affidavits of Wages Paid" are on file with the Owner for the Contractor and all Subcontractors, regardless of tier;

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7. In the event that claims are filed against the retainage, the Contractor will be paid the retained percentage less an amount sufficient to pay all such claims, together with a sum determined by the Owner to be sufficient to pay the costs of foreclosing on claims and to attorneys' fees, all in accordance with applicable law.

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 Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *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

18.08 *Assignment of Contract*

SC-18.08 Add the following new paragraph immediately after Paragraph 18.08.A:

B. The contract dated January 2025 between Owner as "buyer" and [Kubota Water & Environment USA Corporation] as "seller" for Procurement of Membrane Equipment System and Services ("procurement contract") will be assigned to Contractor by Owner, and Contractor will accept such assignment. A form documenting the assignment is attached as an exhibit to this Contract.

1. This assignment will occur on the [Effective Date of the Contract], and will relieve the Owner as "buyer" from all further obligations and liabilities under the procurement contract.

2. Upon assignment, the "seller" will be a Subcontractor or Supplier of the Contractor, and Contractor will be responsible for seller's performance, acts, and omissions, as set forth in Paragraph 7.07 of the General Conditions just as Contractor is responsible for all other Subcontractors and Suppliers.

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3. Notwithstanding this assignment, all performance guarantees and warranties required by the procurement contract will continue to run for the benefit of the Owner and, in addition, for the benefit of the Contractor.

4. Except as noted in the procurement contract, all rights, duties and obligations of Engineer to "buyer" and "seller" under the procurement contract will cease [upon the assignment to Contractor].

SC-18.11 – Add 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 Squaxin Island 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 party 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" (Exhibit G of this Bulletin) 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

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or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

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

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

19.08 *Equal Employment Opportunity*

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

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 a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

19.10 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, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.

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

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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 the 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 the 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 reasonably 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.

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v. Work may continue in other areas of the undertaking where no historic properties, burial sites, 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 Conditions 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 the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic 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, or 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

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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 Materials.

B. The following waivers apply to this Contract:

1. *De Minimis*,
2. Minor Components,
3. Pig iron and direct reduced iron, and

SC-20 – Add the following new Article 20 immediately after Article 19:

ARTICLE 20 – FEDERAL PREVAILING WAGES

20.01 Prevailing Wages

Prevailing wages are not required for this project.

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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.	web-based project communication system	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.	web-based project communication system	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.	web-based project communication system	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	web-based project communication system	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	web-based project communication system	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	web-based project communication system	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	web-based project communication system	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 **1.6** or later
DWG	Autodesk® AutoCAD .dwg format Version **2016 or later**
DOC	Microsoft® Word .docx format
EXC	Microsoft® Excel .xls or .xml format
DB	Microsoft® Access .mdb format

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PART 6

FORMS USED DURING CONSTRUCTION

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
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 + Line 5.c)				$ -

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:**	

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
Contract:			

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

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

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
Contract:			

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

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

EJCDC C-620 Contractor's Application for Payment

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
Contract:			

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

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

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
Contract:			

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

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

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Stored Materials Summary

Contractor's Application for Payment

Owner:	Taylor Bay Beach Club HOA	**Owner's Project No.:**	
Engineer:	Gray & Osborne, Inc.	**Engineer's Project No.:**	22848.01
Contractor:		**Contractor's Project No.:**	
Project:	Wastewater Treatment Facility Upgrade		
Contract:			

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

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
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) ($)
								-			-	-
								-			-	-
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								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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

Owner:	Taylor Bay Beach Club HOA	Owner's Project No.:	
Engineer:	Gray & Osborne, Inc.	Engineer's Project No.:	22848.01
Contractor:		Contractor's Project No.:	
Project:	Wastewater Treatment Facility Upgrade		
Contract Name:			
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:		

EJCDC® C-940, Work Change Directive.
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CHANGE ORDER NO.: [Number of Change Order]

Owner:	Taylor Bay Beach Club HOA	Owner's Project No.:	
Engineer:	Gray & Osborne, Inc.	Engineer's Project No.:	22848.01
Contractor:		Contractor's Project No.:	
Project:	Wastewater Treatment Facility Upgrade		
Contract Name:			
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:	_____	_____

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FIELD ORDER NO.: [Number of Field Order]

Owner:	Taylor Bay Beach Club HOA	Owner's Project No.:	
Engineer:	Gray & Osborne, Inc.	Engineer's Project No.:	22848.01
Contractor:		Contractor's Project No.:	
Project:	Wastewater Treatment Facility Upgrade		
Contract Name:			
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: _____

EJCDC® C-942, Field Order.
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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:	Taylor Bay Beach Club HOA	Owner's Project No.:	
Engineer:	Gray & Osborne, Inc.	Engineer's Project No.:	22848.01
Contractor:		Contractor's Project No.:	
Project:	Wastewater Treatment Facility Upgrade		
Contract Name:			

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: _____

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DOMESTIC PREFERENCE *DE MINIMIS* LIST FORMAT

Notes to User: This exhibit is an example format for Contractors to use in maintaining a list of items to document the use of the De Minimis waiver of the Domestic Preference requirements. This list or similar is required to be filled out throughout the construction Contract as needed. The State Engineer may periodically ask to review this information. At the Contract completion, this list, along with all Manufacturers' certifications, are to be given to the Engineer for delivery to the Owner. This list is applicable for projects governed by BABAA. USDA-RD State Office can provide guidance if AIS applies to the project instead.

DE MINIMIS COSTING WORKSHEET

Project Name: _____

Contract Name/# (if more than one) _____

Contractor (Company Name): _____

Representative: _____

Date: _____

Total Project Costs : $ _____

Allowable Total *De Minimis* Costs (5% of project costs) $ _____

Total Cost of all *De Minimis* Items $ _____

Remaining Amount Allowed for Future *De Minimis* Items $ _____

No.	Detailed Description and Manufacturer or Local Source of *De Minimis* Material	Quantity	Cost Per Item	Total Item Cost
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

SAMPLE LANGUAGE FOR CONTRACTOR'S CERTIFICATION OF COMPLIANCE

Notes to User: This exhibit provides sample language that the Contractor can use to certify compliance with the Build America Buy America Act requirements. Note that the language can be modified (for example if the project is subject to AIS the BABAA reference should be replaced with language such as "American Iron and Steel (AIS) requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 and subsequent annual appropriations for WWD programs"). A certification is to be provided by Contractor to Engineer for delivery to the Owner and Agency at Substantial Completion. The certification should be on letterhead and should be signed and dated by an authorized company representative.

Project Name
Owner / Applicant
Contract Number

I hereby certify, that to the best of my knowledge and belief, all Iron and Steel products, Manufactured Products, and Construction Materials 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 the Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953 or are the subject of a waiver approved by the Secretary of Agriculture or designee.

_____ _____

Name of Contractor Authorized Representative Date
Contractor Company Name
Contractor Address

SAMPLE LANGUAGE FOR MANUFACTURER'S CERTIFICATION OF COMPLIANCE

Notes to User: This exhibit provides sample language for the Manufacturer's Certification of Compliance with Domestic Preference requirements. Contractor should ensure that Engineer has an approved Manufacturers' Certification prior to any domestic preference item being delivered to the project site. The Manufacturer's Certification should be on letterhead and should indicate the project, specific item being certified, reference which domestic preference requirement is being certified and be signed by an authorized company representative. The Manufacturer's Certification may include multiple domestic preference requirements. It is important for the governing domestic preference requirement (whether AIS, BABAA or other) to be clearly included within the certification.

Date:

Company Name:

Company Address:

Subject: Domestic Preference Requirement Certification for {*Owner's Name* and *Project Name (City, State)}* Certification for Project (X), Owner's Name, and Contract Number
Sample text:

I hereby certify that the following product(s) and / or material(s) shipped or provided for the subject project are in full compliance with the Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953.

[List common name of items, products and/or materials]

NOTICE OF ACCEPTABILITY OF WORK

Owner:	Taylor Bay Beach Club HOA	Owner's Project No.:	
Engineer:	Gray & Osborne, Inc.	Engineer's Project No.:	22848.01
Contractor:		Contractor's Project No.:	
Project:	Wastewater Treatment Facility Upgrade		
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: _____

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PART 7

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

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DIVISION 1

GENERAL TECHNICAL REQUIREMENTS

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

The work specified in this Section consists of furnishing all labor, materials, and equipment necessary for construction of the Taylor Bay Beach Club HOA Wastewater Treatment Facility (WWTF) Upgrade to be constructed at the existing WWTF site at the following address: 8220 178th Avenue Court SW, Longbranch, Washington. Work shall include, but not be limited to, the following:

A. Replace a section of existing 8-inch gravity sewer with a new 8-inch gravity sewer, including the installation of a new saddle manhole and a new sanitary sewer manhole.

B. Construct new concrete process tanks with covers, including an influent pump station, headworks, an equalization basin, an anoxic basin, an aerobic basin, two membrane basins, a return activated sludge (RAS) pump station, an odor control system, and install the equipment and instrumentation associated with each basin and pump station. Equipment associated with the influent pump station includes two influent pumps, and associated valve vault and influent sampler. Equipment associated with the new headworks includes a new influent magnetic flow meter, two influent rotary drum screens and an associated screenings washer compactor. Equipment associated with the anoxic basin includes a submersible mixer. Equipment associated with the aerobic basin includes a fine bubble air diffusion system. Equipment associated with the membrane basins includes components of the membrane equipment system, including four membrane modules, to be supplied by the Membrane System Supplier. Equipment associated with the RAS pump station includes two RAS pumps.

C. Installation of the Membrane System components as described herein. The Contractor shall be assigned the portion titled "Membrane Equipment System: Supply, Construction Services and Post-Construction Services" of the executed Contract titled "Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services." The executed Contract titled "Taylor Bay Beach Club HOA Procurement of Membrane Equipment System and Services" is attached to these Contract Provisions as Appendix A. The equipment, instrumentation, and materials to be provided by the Membrane Supplier are summarized in Specifications Section 11500 and detailed in the Supplier Design

Submittal Documents and Drawings in Appendix B of the Contract Provisions and Appendix B of the Drawings.

D. Construct a new waste activated sludge (WAS) storage tank, coarse bubble air diffuser system, waste sludge pump and associated haul truck discharge piping.

E. Construct the new operations building including a new office/control room, laboratory, restroom, process equipment room, and electrical room. Process equipment associated with the equipment room includes membrane equipment to be supplied by the Membrane System Supplier, one aeration blower, one WAS tank blower, two UV disinfection modules, an effluent sampler, a non-potable water tank, and two non-potable water pumps. Membrane equipment to be supplied by the Membrane System Supplier associated with the equipment room includes three permeate pumps, three air scour blowers, and a chemical cleaning system.

F. Install effluent piping system and connection to the new subsurface outfall in Case Inlet, which was installed as part of the Taylor Bat Outfall Replacement Project, and has an existing capped connection point above the ordinary high water mark as discussed in Section 1.2.

G. Install a new storm filter catch basin to treat stormwater collected on the site and associated downstream storm drain piping to downstream manhole with connection to new outfall piping.

H. Demolish the exposed portion of the existing, currently operational outfall piping from the beach to the bluff penetration. Abandon the buried portion of the existing, currently operational outfall piping from the bluff penetration to the existing outfall structure. Abandon the buried/submerged existing, currently operational outfall piping from the beach to the subsurface outfall by plugging the pipe at the beach with non-shrink grout.

I. Demolish the existing Equipment and Laboratory Building, storage shed, Aeration Basins and Settling Basins, Biosolids Tank, Outfall Structure, Influent Manhole, and UV Disinfection Shed.

J. Salvage existing Standby Generator and Propane Tank to Owner.

K. Install a new generator.

L. Furnish new laboratory equipment.

M. Provide all temporary bypass pumping systems as required.

N. Furnish and install all required piping and appurtenances.

O. Furnish and install all required plumbing, heating and ventilating work.

P. Furnish and install all required electrical, instrumentation and telemetry work.

Q. Construct required site grading and asphalt paving.

R. Restore all surfaces disturbed by construction activities.

S. Furnish and install irrigation system.

T. Furnish and install landscaping.

U. Furnish and install fencing.

V. Furnish and install site dewatering system for construction.

W. Provide testing, commissioning, and training as specified herein.

X. Provide all associated work as shown on the Drawings and specified herein, for a complete and workable system.

1.2 COORDINATION WITH OTHER CONTRACTORS

Not Used.

1.3 PROJECT INFORMATION

The Contract Documents show the location, arrangement, and type of work to be performed under the proposed project.

The Contractor shall note that the area within the 50-foot top of slope setback is at risk of landsliding. This area may be used for field offices, temporary storage, and laydown at the Contractors risk. The Contractor shall note that there is limited space available on site for field offices, storage sheds, and laydown area. The Contractor shall coordinate with the Owner and nearby property Owners for nearby areas available for these purposes.

The Washington State Department of Ecology has prohibited bypassing of sewage to state waters. The existing wastewater treatment plant and transmission facilities shall remain operational during construction at all times. The Contractor shall pay all costs of any damages and/or Regulatory Agency penalties resulting

from plant bypassing or overflows caused by his actions or inactions, all costs of which shall be included in the prices bid for the various items as indicated in the Proposal.

It is expected that dewatering of the deeper project excavations will be required, and it shall be the responsibility of the Contractor to provide equipment and perform the work to dewater these sites as necessary to perform construction activities.

The Contractor shall take all necessary precautions required to prevent damage to existing piping, utilities, and structures above or below ground during construction. Verification of elevations and locations of existing items shall be the responsibility of the Contractor. The Contractor shall videotape the existing site and structures prior to construction and after completion of construction.

The Contractor shall be responsible for proper notification to and coordination with all utility districts, service districts, and all other persons and services that will be affected by this project at least one week in advance of beginning any construction that affects them.

It is the intent and purpose of these Contract Documents to have constructed complete facilities in good working order for the least practical cost to the Owner. Suggestions, recommendations, as well as inquiries from the Contractor that will serve this purpose are welcome and will be given consideration by the Owner and the Engineer.

1.4 SUSPENSION OF WORK AND NOTICE TO COMMENCE CONSTRUCTION

Due to long lead times for some items of materials and equipment, including the motor control centers, it is anticipated that there will be a suspension or suspensions of the work and associated contract time during construction. The Contractor may request a suspension of contact time at any time after submittals for long-lead time items have been approved, as listed below. The suspension will be granted provided that documentation is submitted that long-lead time materials have been ordered. No on-site work may be completed during suspension of contract time. If a suspension is requested and granted after on-site work has commenced, the Contractor shall secure the uncompleted work so that it is not damaged during the suspension and shall clean up the site so that it is useable by the Owner during the suspension. Any suspensions of contract time will be at no additional cost to the Owner. The Contractor shall provide the Owner with a written request to Commence Construction 40 working days prior to the date of commencing construction and associated contract time. The Owner will not issue a Notice to Commence Construction until the items listed below are complete.

The Owner will not issue the suspension of work approval until the following actions are complete:

1. Progress schedule approved by Owner, including the suspension of work schedule.

2. Submittals for all Division 11 and 13 equipment approved by Owner.

3. Submittals for generator assembly, transfer switches, control panels, and motor control centers approved by Owner.

4. Delivery dates for items listed above provided to Owner.

The Owner will not issue the Notice to Commence Construction until the items listed below are complete:

1. Temporary bypass pumping plan approved by Owner.

2. Dewatering plan submittal approved by Owner.

3. Temporary shoring and bracing plan submittal approved by Owner.

4. Stormwater pollution prevention plan (SWPPP) submittal approved by Owner.

1.5 WEB-BASED PROJECT COMMUNICATION SYSTEM

The Contractor shall install and use the necessary computer hardware and software to receive and transmit project communications through the Engineer's web-based, online project communications system. This website will be used by the Engineer, Field Representative, Owner and Contractor to communicate online between these parties to clarify design and construction requirements, to provide information concerning construction issues, and to post certain project documents.

The web-based project communication system will use the secure website and programming developed by the Engineer. The Engineer will provide the Contractor with the instructions and credentials for access and use of the website.

The website shall be used for posting and responding to the following communications and documents:

- Submittals
- Request to Sublet
- Progress Estimates
- Requests for Information
- Construction meeting minutes
- Job photos
- Change order proposals
- Weekly Working Day Reports
- Material Testing Reports

No hard copy submittals will be accepted without the Engineer's prior approval. All other reporting requirements shall remain in effect for this project.

1.6 CONTRACTOR USE OF SITE AND PREMISES

Construction operations shall be limited to the areas noted on the Drawings and subject to the approval of the Engineer and the Owner.

The Owner has obtained temporary construction easements as indicated on the Plans. The Contractor shall meet all conditions of the easements while performing their work.

The Contractor shall submit a traffic control plan for all site access and egress routes for construction vehicle traffic per Section 01950.

The Contractor shall plan their work to be completed within the time limits indicated in these Specifications. The hours of construction work shall be confined to the period of 7:00 a.m. to 6:00 p.m., Monday through Friday. No construction equipment shall be started, warmed up, or tested prior to 7:00 a.m., and all construction equipment shall be promptly shutdown at 6:00 p.m. No work shall be permitted on holidays without prior approval of the Owner. A recognized holiday shall be a day currently accepted by the trades or occupations in the locality where the work is being performed, and shall include New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day, Native American Heritage Day, Christmas Eve and Christmas Day. Exceptions to these work hours will be allowed only for startup, testing, and commissioning as specified, or for work which requires lower nighttime flows, and only then with prior review and approval by the Engineer and the Owner of the work and methods to be employed.

The Contractor shall allow representatives of the Owner, funding, and regulatory agencies access to the project site at all times.

The Contractor shall be aware that the Owner's archaeologist may observe and sample excavated material for cultural artifacts during the Contractor's excavation work. The Contractor shall allow this work without extra compensation.

The Contractor shall notify the Owner (or other water utility purveyor) at least 48 hours in advance of any proposed water system shut downs. The Contractor shall also be responsible for notifying all impacted water users 48 hours in advance of any water shutoff.

1.7 ORDER OF WORK

The order of work will be at the option of the Contractor, except as noted below, in keeping with good construction practice, time restrictions, requirements of the permits applicable to this project, and the order of work as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of work to allow the existing facilities to remain operational during the construction of the Project and shall coordinate all of their activities through the Engineer with the Owner's operations and maintenance staff. In order to allow the treatment facility staff to maintain the required level of treatment, the Contractor will be required to ensure that a number of unit processes are in service at all times during the course of the Project. The Contractor shall provide a written plan of activities to the Engineer and Owner each Thursday for the following week, for review and coordination with existing facility operations.

The implementation of any measure required to protect the environment shall supersede any order of work designated within these Specifications. The Contractor shall meet the conditions as outlined in any and all permits and requirements of the Federal, State, County, and Owner regulatory agencies.

The Contractor shall keep the disruption of the existing facility operations to a minimum. Bypasses of untreated sewage will not be permitted. The Contractor shall be responsible for all temporary pumping to include all connections, piping, pumping equipment, temporary electrical service and controls, and appurtenances.

Access to the existing operations areas shall be maintained. Disruption of this access shall be kept to a minimum and must be prearranged and scheduled through the Engineer with the Owner.

In general, the treatment plant design was developed to allow the Contractor to construct the new treatment facilities, while the existing treatment facilities

remain in service. There are, however, a number of constraints that the Contractor should consider when developing the order of work.

The following summary shall be used as a general guideline of the constraints that the Contractor shall consider when developing the order of work. The tasks are generally listed in the order of completion. The tasks, however, can be completed in a different order than listed herein, including performance of two or more tasks concurrently. The Contractor shall prepare a complete project schedule, which shall be provided in accordance with the limitations specified herein.

A. TEMPORARY EROSION AND SEDIMENTATION CONTROL AND DEWATERING SYSTEMS

Before beginning excavation or any clearing and grubbing activities on the project site, the temporary erosion and sedimentation control (TESC) system and dewatering system (Specification Section 02240) must be completed and in operation.

B. EXISTING OVERHEAD POWER RELOCATION

The Contractor shall coordinate with Peninsula Light Company for relocation of the existing 240/120-volt, 1-phase overhead power line that runs along the west side of the road adjacent to the plant as required to construct the new facilities. 240/120-volt, 1-phase, 4-wire power shall be provided to the existing Equipment and Laboratory Building at all times until the new WWTF is operational.

C. WWTF SITEWORK

The WWTF site dewatering and excavations may begin once the TESC is in place.

D. NEW PRIMARY ELECTRICAL SERVICE INSTALLATION

The Contractor shall coordinate work with the Peninsula Light Company for the of the primary electrical service to provide 600A, 480V, 3-phase, service to the new Operations Building.

E. INSTALLATION OF NEW FORCE MAIN CONNECTION TO BLUFF LIFT STATION, GRAVITY SEWER LINES AND MANHOLES

The work associated with the new Bluff Lift station force main, and new gravity sewer line from the new saddle manhole on the existing 8-inch influent sewer line to the new influent pump station may begin at any time. The final connection to the new influent pump station may not be

completed until the new influent pump station, headworks, equalization basin, anoxic basin, aerobic basin, membrane basins, return activated sludge (RAS) pump station, odor control system, and all equipment in the new operations building are completed and operational.

The Contractor shall provide temporary piping and pumping as required to transfer influent sewage from the gravity collection system and Bluff Lift Station to the existing aeration basin inlet screen baskets at all times until the new facilities above are operational.

F. DEMOLITION OF THE EXISTING INFLUENT MANHOLE AND INFLUENT SAMPLER

The Contractor shall provide influent flow measurement and sampling at all times. The existing influent manhole houses the existing channel mounted flow meter, which consists of a 6-inch, insertion-type Palmer-Bowlus Flume and associated ultrasonic flow level sensor, and the existing influent sampler is located adjacent to the influent manhole. The existing flow meter and sampler will have to be relocated or demolished for construction of the new RAS pump station and Process Tanks. The Contractor may provide temporary influent flow measurement and sampling by relocating the influent flow meter to a new permanent or temporary manhole upstream and a temporary influent sewer line to the existing aeration basins. The Contractor may also provide a temporary influent flow meter of equivalent accuracy to the existing unit (+/- 5%) until the new influent flow meter is operational and a temporary influent sampler meeting the requirements of Specification Section 11520 until the new influent sampler is operational.

G. DEMOLITION OF THE EXISTING AERATION BASINS, SETTLING BASINS, EQUIPMENT AND LABORATORY BUILDING, GENERATOR AND UV DISINFECTION SHED

The existing aerations basins, settling basins, equipment and laboratory building, generator, and UV disinfection system, shall remain operational until the new influent pump station, headworks, equalization basin, anoxic basin, aerobic basin, membrane basins, RAS pump station, odor control system, and all equipment in the new operations building are completed and operational. The Contractor shall relocate the existing propane tank and associated 3/4-inch LPG lines to allow the existing generator to remain operational at all times until the new facilities are operational.

The Contractor shall remove all liquid, solids, surface deposits, scum, and grit from the tanks and haul it offsite for disposal prior to prior to demolition of the structures.

H. DEMOLITION OF THE EXISTING BIOSOLIDS TANK

Pumping of waste activated sludge (WAS) to the existing biosolids holding tank or the new WAS storage tank shall be maintained at all times. Aeration of the WAS/biosolids shall be maintained at all times. Access for pumping WAS/biosolids to a sludge haul vactor truck shall be maintained at all times. The existing biosolids tank and associated piping shall be temporarily relocated to allow for the installation of the process tanks as shown on the Plans.

I. DEMOLITION/ABANDONMENT OF THE EXISTING OUTFALL

The existing outfall shall remain operational until the new outfall, influent pump station, headworks, equalization basin, anoxic basin, aerobic basin, membrane basins, RAS pump station, odor control system, and all equipment in the new operations building are completed and operational and all excavation dewatering activities are complete. The existing outfall shall remain in operation until the new NPDES permit is issued by the Department of Ecology. Ecology is aware of the construction schedule associated with this project and has provided assurance that the new NPDES permit will be issued prior to the time projected for startup of the new facilities.

J. NEW PROCESS TANKS

Construction of the new process tanks can begin at any time after the biosolids tank has been relocated and is operational.

Contractor shall provide written notice to Owner and Engineer three weeks prior to operational testing of the new process tanks and shall allow Owner 3 days prior to beginning operational testing to fill the process tanks with mixed liquor seed from another facility.

K. NEW OPERATIONS BUILDING

Construction of the new operations building can begin at any time.

L. CONSTRUCTION OF NEW GENERATOR

Construction of the generator can begin at any time.

M. CONSTRUCTION OF NEW WAS STORAGE TANK

Construction of the WAS storage tank can begin at any time after the existing aeration basins and settling basins have been demolished.

1.8 SUGGESTED CONSTRUCTION PHASING

In addition to the order of work constraints described in the preceding section, the treatment plant design was developed based on two distinct construction and startup phases, described herein as Phase 1 and Phase 2. This has been done to allow the Contractor to construct most of the new facilities, while the existing facilities remain in operation with limited interim bypass pumping and temporary piping. The contract time to Substantial Completion allowed per the agreement assumes a 5-month period for approval of submittals for long-lead item equipment, followed by a suspension of work period, and then a 12-month period of work following the commencement of on-site construction, for a total contract time of 17 months.

A. CONSTRUCT PHASE 1 COMPONENTS

The following major Phase 1 components may be constructed concurrently within the constraints outlined in Section 1.7 – Order of Work:

- Provide submittals and items as listed in Section 1.4 suspension of work. Upon completion of suspension of work, provide a Notice to Commence Construction to Owner per Section 1.4.

- Install temporary erosion and sedimentation control (TESC) system and dewatering system to include a temporary construction dewatering discharge connection to the existing outfall piping and associated temporary/permanent piping and pumping as required.

- Relocate the existing overhead power line to allow for crane operation.

- Relocate the existing fire hydrant located on the east side of the property.

- Install the new gravity sewer line from the new saddle manhole 38A on the existing 8-inch influent sewer line to the new downstream manhole 38B with a temporary gravity sewer to the existing aeration basin inlet basket screens. All bends in the temporary gravity sewer line shall be 45 degree maximum with a standard cleanout to grade. Upon completion of water testing and operational testing, the temporary gravity sewer line can be demolished or abandoned in place and the flow to the new influent pump station can begin via the new permanent gravity sewer line

and the new manholes shall have grout channels for all permanent gravity sewer connections.

- Install a temporary force main extension to connect Bluff Lift Station force main to the manhole 38A (upstream of the influent flow meter).

- Relocate the existing influent Palmer-Bowlus flume flow meter and influent sampler to temporary location in new upstream manhole 38B. The insertion type flume shall be installed at the manhole inlet pipe to maintain the required upstream straight run of pipe.

- Relocate existing biosolids tank and associated piping to temporary location as shown on the Plans.

- Install dewatering system and shoring required for process tanks and operations building.

- Construct the new process tanks, influent pump station, RAS pump station, influent screens, odor control system, auxiliary generator, and operations building and associated new equipment, piping and electrical systems as discussed in the Summary of Work.

B. PROVIDE WATER TESTING OF PHASE 1 COMPONENTS

Provide water testing of the major Phase 1 construction components as specified in 01800.

C. PROVIDE OPERATIONAL TESTING OF PHASE 1 COMPONENTS

Provide operational testing of the major Phase 1 construction components, including the MBR Initial Performance Testing, followed by commissioning as specified in 01800.

Contractor shall provide written notice to Owner and Engineer three weeks prior to operational testing of the Phase 1 components and shall allow Owner 3 days prior to beginning commissioning to fill the process tanks with mixed liquor seed from another facility.

D. CONSTRUCT PHASE 2 COMPONENTS

The following major Phase 2 components may be constructed concurrently within the constraints outlined in Section 1.7 – Order of Work:

- Demolish the existing aerations basins, settling basins, equipment and laboratory building and UV disinfection system.
- Construct the new WAS storage tank.

E. PROVIDE WATER TESTING OF PHASE 2 COMPONENTS

Provide water testing of the major Phase 2 construction components as specified in 01800.

F. PROVIDE OPERATIONAL TESTING OF PHASE 2 COMPONENTS

Provide operational testing followed by commissioning of the major Phase 2 construction components as specified in 01800.

***** END OF SECTION *****

SECTION 01150

SURVEYS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes all survey for the project. The Contractor shall provide all construction survey for the Work. The Engineer will provide primary horizontal and vertical control data and monuments, as shown on the Plans.

At the Contractor's request, the Engineer will provide the Plans in electronic format. Electronic files are provided for the Contractor's convenience and are not part of the Contract. Calculations shall be made from the Plans.

During the prosecution of the work, the Contractor shall make all necessary measurements to prevent misfitting, and shall be responsible for the accurate construction of the work.

1.2 DEFINITIONS

The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping, and the American Society of Civil Engineers.

1.3 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01720	Record Drawings

1.4 QUALIFICATIONS

The Contractor shall employ a Professional Land Surveyor (PLS) registered in the State of Washington and acceptable to the Owner. All surveying shall be completed by or under the direct supervision of the PLS.

1.5 SUBMITTALS

The Contractor shall submit the name, address, and license number of the Professional Land Surveyor before starting construction.

1.6 QUALITY ASSURANCE

The Contractor shall ensure a surveying accuracy within the following tolerances:

	Vertical	Horizontal
Slope Stakes	±0.1 feet	±0.10 feet
Subgrade Grade Stakes Set 0.04 foot Below Grade	±0.01 feet	±0.5 feet (parallel to alignment) ±0.1 feet (normal to alignment)
Stationing on Roadway	N/A	±0.1 feet
Alignment on Roadway	N/A	±0.04 feet
Surfacing Grade Stakes	±0.01 feet	±0.1 foot (parallel to alignment) ±0.1 feet (normal to alignment)
Roadway Paving Pins for Surfacing or Paving	±0.01 feet	±0.1 feet (parallel to alignment) ±0.05 feet (normal to alignment)
Alignment of sewer and storm manholes and catch basins	±.01 feet	±0.1 feet
Stationing on Structures		±.02 feet
Alignment on structures		±.02 feet
Superstructure elevations	±.01 feet variation from Plan elevation	
Substructure	±.02 feet variation from Plan grades	

When the following items are included in the project, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances:

- Piles
- Shafts
- Footings
- Columns

The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for accuracy by the Contractor

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

The Contractor's PLS shall establish all secondary survey controls, horizontal and vertical, as necessary to assure proper placement of all Work based upon the primary control points provided by the Owner. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, clearing limit stakes, slope stakes, and grades for the Work. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the lines and grades shall be the Contractor's responsibility.

Survey records shall be maintained by the Contractor's PLS, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Engineer within three working days of Engineer's request.

All surveyed points shall be established by placing hubs and tacks with marked stakes in unpaved areas or P.K. nails with painted markings in paved areas. All surveying stakes shall be marked in accordance with WSDOT Standard Plan A-10.10-00. When stakes are needed that are not described in the Standard Plans, then those stakes shall be marked as ordered by the Engineer. The Contractor's surveyor shall maintain and replace survey hubs, stakes, nails and markings immediately if destroyed, removed, or the Engineer determines the stake or pavement markings are illegible.

The Engineer is responsible for locating and referencing those monuments shown on the Plans that will be removed or destroyed during construction. The Engineer will also prepare all required permit forms with the Department of Natural Resources (DNR) for those monuments only. The Contractor shall protect all survey markers, monuments and property corners unless shown otherwise on the Plans. The Contractor shall work to preserve the existing monumentation as provided in RCW 58.09.130 and WAC 332-120. The Contractor shall notify the Engineer immediately if it becomes apparent that a survey marker will be disturbed due to construction. The Contractor shall allow 5 working days for the Engineer to acquire adequate information so that the monument, including property corners, may be replaced referenced in its original position prior to disturbance. All cost associated with replacement of monuments that have been disturbed before being referenced due to lack of proper notification by the Contractor shall be deducted from monies due to the Contractor.

***** END OF SECTION *****

SECTION 01160

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section contains information pertaining to permits and licenses, and use of private property.

1.2 PERMITS AND LICENSES

Except as noted below, the Contractor shall be responsible for obtaining and paying all fees associated with all the necessary permits, licenses, approvals, and construction permits necessary for the execution of this Contract, whether they be Owner, County, State, or federal permits.

The Owner is in possession of, or will be responsible for obtaining the following approvals and permits, and will pay the fees associated with the application and procurement of such approvals and permits. The Contractor is advised to become familiar with these approvals and permits as necessary for this project. The Contractor shall comply with all conditions of each approval/permit as if the conditions were detailed herein. Copies of these permits are required to be onsite at all times.

A. WSDOE plan review and approval (obtained by Owner)

B. WSDOE, NPDES Discharge Permit for Existing and New Wastewater Treatment Plant Facilities (Existing Permit)

C. Pierce County Building Permit No. 1066265 (obtained by Owner)

D. Pierce County Fire Final Permit No. 1069158 (obtained by Owner)

E. Pierce County Site Development Permit No. 1068155 (obtained by Owner)

F. Pierce County Mechanical Permit No. 1068152 (obtained by Owner)

G. Pierce County Plumbing Permit No. 1068149 (obtained by Owner)

H. Pierce County Site Development Gate Permit No. 1071934 (obtained by Owner)

I. Pierce County Fire Permit No. 1074593 (obtained by Owner)

J. Conditional Use Permit (obtained by Owner)

K. Shorelines Permit (obtained by Owner)

L. Hydraulic Project Approval (obtained by Owner)

1.3 OTHER PERMIT REQUIREMENTS

The Washington State Department of Ecology has prohibited bypassing of sewage to state waters. The existing wastewater treatment plant and transmission facilities shall remain operational during construction at all times. The Contractor shall maintain the conveyance and treatment facilities in continuous operation during the entire construction period and until the project has been accepted by the Owner. The Contractor shall pay all costs of any damages and/or Regulatory Agency penalties resulting from plant bypassing or overflows caused by their actions or inactions.

The Contractor shall provide timely notice to owner of any instances that may lead to a violation of the existing NPDES permit so that both the Owner and operator in charge can ensure that all reporting requirements are being followed.

1.4 USE OF PRIVATE PROPERTY

The Contractor shall be responsible for all conditions of any arrangements the Contractor makes for the use of any privately-owned property.

In the event any dispute occurs and claims for damages are filed by the property owners, the Owner will request that the Contractor give evidence that they have requested their insurance company to make personal contact with the claimants. Any settlement for insurance claims shall be strictly an act restricted to the claimant, the Contractor, and their insurance company.

The Contractor is advised that in the event of any property damage, the Owner reserves the right to withhold monies to protect the property owner.

1.5 PROPERTY RELEASE FORM

The Contractor shall be held responsible for acquiring signed property release forms, in the format provided on the following page, for all properties that have been disturbed or damaged by the Contractor's operations, or utilized by the Contractor for staging, storing, or stock piling of materials or equipment.

This work shall include submitting the form(s), as further shown herein, by certified mail to each property owner effected and further including therein a self addressed stamped envelope for the property owner's use. The enclosed self addressed envelope shall be addressed to: Taylor Bay Beach Club Homeowner's Association, 8215 175th Avenue, Longbranch, WA 98351. Contractor shall provide evidence of all certified mailings.

***** END OF SECTION *****

PROPERTY RELEASE

_____
(Property Address)

_____

_____

DATE:_____

I, _____, owner of _____
(Property Owner's Name) (Property Description or

_____, hereby release
Address)

_____, from any property
(Contractor's Name)

damage or personal injury resulting from construction adjacent

to or on my property located at _____,
(Property Address)
during construction of the Wastewater Treatment Facility Upgrade.

My signature below is my acknowledgment and acceptance that my property, as identified above, was returned to a satisfactory condition.

Name: _____

Signed: _____

Address: _____

_____

Phone: _____

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SCOPE

This Section further defines Measurement and Payment for this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
General Conditions Article 15	Measurement and Payment
01290	Schedule of Values
01300	Submittals

1.3 MEASUREMENT

Measurement for all items shall be as indicated in these Specifications for unit price and lump sum price bid items. Bid items are outlined in detail in this Specification Section and listed in the Proposal.

Measurement shall be in accordance with Section 1-09.1 of the WSDOT Standard Specifications. Volumes of gravel materials and concrete volumes shall be measured by the Engineer in the field and quantities will be limited to the relative neat line dimensions shown on the Plans or as approved by the Engineer in the field.

Weighing equipment, scale verification checks, load tickets for quarry spalls, rock riprap, cobbles, gravel materials, hot mix asphalt, bituminous construction materials, etc., shall conform to Section 1-09.2 of the WSDOT Standard Specifications. Load tickets shall include all gravel materials, cast-in-place concrete, cement grout, CDF, hot mix asphalt, ATB, and reinforcing steel. The Owner will pay for no material received by weight unless they have been weighed as required in this Section or as required by another method the Engineer has approved in writing. All costs incidental to weighing shall be merged into the various unit prices bid.

1.4 INDIVIDUAL BID ITEMS

The following is a list of bid items for the project. The contract price for each item constitutes full compensation for furnishing all equipment, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the various bid items in accordance with the Contract

Documents. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. If a particular item of work shown on the Plans or described in Specifications is not described in a specific bid item, this item of work shall be considered as incidental to the work and the costs for this work shall be merged into the various respective unit price and lump sum bid items.

A. BASE BID

1. Wastewater Treatment Facility Upgrade

a. Measurement: Will be measured by lump sum.

b. Payment: The lump sum contract price for WASTEWATER TREATMENT FACILITY UPGRADE shall include costs for the labor, materials, and equipment required to provide a complete and operable Wastewater Treatment Facility, as shown on the Plans and as specified herein, with the exception of all labor, materials and equipment included in other bid items.

2. Membrane Equipment System Supply, Construction Services and Post Construction Services

a. Measurement: Shall be measured by lump sum.

b. Payment: The lump sum contract price shall include all costs for labor, materials, and equipment required to provide Membrane Equipment System Supply, Construction Services, and Post Construction Services in accordance with the attached Contract in Appendix A.

3. Membrane System Installation

a. Measurement: Shall be measured by lump sum

b. Payment: The lump sum contract price shall include all costs for labor, materials, and equipment required for full installation of the supplied membrane system.

4. Mobilization and Demobilization

a. Measurement: Will be measured by lump sum.

b. Payment: The lump sum contract price for MOBILIZATION AND DEMOBILIZATION shall include all costs for the labor, materials, and equipment required for mobilization and demobilization on the project as described in Section 01505.

Payment for MOBILIZATION AND DEMOBILIZATION shall be as follows:

35% Payment: When Contractor has mobilized on-site and temporary facilities are in place.

50% Payment: When 5 percent of the total pay items are completed (not including payment for materials on hand).

75% Payment: When 50 percent of the total pay items are completed (not including payment for materials on hand).

100% Payment: When Project is completed and recommended for acceptance.

5. Trench Excavation Safety Systems

a. Measurement: Will be measured by lump sum.

b. Payment: The lump sum contract price for TRENCH EXCAVATION SAFETY SYSTEMS shall include all costs for labor, materials, and equipment required to provide sheeting, shoring, and bracing of trenches and open excavations as required to meet the Washington Industrial Safety and Health Act, Chapter 49.17 RCW and Section 02250. These costs shall not be considered incidental to any other bid item.

6. Dewatering

a. Measurement: Will be measured by lump sum.

b. Payment: The lump sum contract price shall include, but not be limited to, all costs for design, installation, and operation of wells, pumps, and other machinery as may be required for dewatering, including permit requirements and

the construction of any temporary facilities required to dispose of water.

7. Erosion Control

   a. Measurement: Shall be measured by lump sum.

   b. Payment: The lump sum contract price for EROSION CONTROL shall include all costs for the labor, material, and equipment for installation and maintenance of all temporary erosion and sediment control measures and best management practices (BMPs), as shown on the Plans and as further described in Section 02370.

8. Unsuitable Excavation

   a. Measurement: Will be measured by the cubic yard, in-place and shall be to the limits as designated by the Engineer. There shall be no payment if the Engineer believes removal of materials is needed because of damage caused by the Contractor's operations.

      All quantities will be measured and recorded by the Engineer in their Daily Report and the Contractor shall be responsible for reconciling their quantities with the Engineer on a daily basis.

   b. Payment: The unit price per cubic yard for UNSUITABLE EXCAVATION shall include all cost for labor, material, and equipment to excavate and wastehaul unsuitable native subgrade materials, including backfilling the resulting excavations with compacted foundation gravel materials.

      The Contractor is advised that the excavation of any and all unsuitable material must be authorized by the Engineer in writing prior to the commencement of said excavation by the Contractor.

9. Peninsula Light Company Charges for Electrical Service Provisions

   a. Measurement: Shall be measured by lump sum.

   b. Payment: The lump sum contract price for PENINSULA LIGHT COMPANY CHARGES FOR ELECTRICAL

SERVICE PROVISIONS shall include all costs associated with the modifications to the electrical service. For bidding purposes, an amount of $175,000 will be included in the proposal for PENINSULA LIGHT COMPANY CHARGES FOR ELECTRICAL SERVICE PROVISIONS line item. The Owner will pay the actual invoice cost of service modifications completed by Peninsula Light Company. All other costs of coordination with the Peninsula Light Company shall be included in the lump sum cost of WASTEWATER TREATMENT FACILITY UPGRADE.

10. Minor Change

a. Measurement: Will be negotiated prior to commencing any such work under this pay item and shall be for work to remedy unforeseen conditions, utility conflicts, minor landscaping, minor drainage improvements, or special surface restoration.

b. Payment: Payment or credits for changes amounting to $40,000 or less may be made under the Bid Item MINOR CHANGE. At the discretion of the Owner, this procedure for Minor Changes may be used in lieu of the more formal procedure as outlined in General Conditions Section 3.04.6. The Contractor will be provided a copy of the completed order for Minor Changes. The agreement for the Minor Changes will be documented by signature of the Contractor or notation of the verbal agreement. If the Contractor is in disagreement with anything required by the order for Minor Changes, the Contractor may protest the order as provided in General Conditions Section 3.04.8.

Payments or credits will be determined in accordance with General Conditions Section 3.04.6. All Minor Change work will be within the scope of the Contract Work and will not change Contract Time. For the purpose of providing a common Proposal for all Bidders, the Owner has entered an amount for MINOR CHANGE in the Proposal to become part of the total Bid by the Contractor.

1.5 PROJECT MATERIALS ON HAND

See General Conditions Section 3.04.12(6).

1.6 PAYMENT

Payment for all work will be made at the contract unit price or lump sum price as indicated in the Proposal, payment of which shall constitute full compensation, for a complete installation.

For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice.

Final operating and maintenance manuals per Section 01300 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

***** END OF SECTION *****

SECTION 01290

SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section establishes the procedures for preparing the schedule of values used for preparation of the Contractor's progress pay estimates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
General Conditions Article 15	Measurement and Payment
01200	Measurement and Payment
01300	Submittals
01320	Progress Schedules

1.3 DESCRIPTION

Within 14 calendar days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all lump sum bid items showing the value assigned to each portion of the work. The schedule of values shall be prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.

***** END OF SECTION *****

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes requirements that apply to all equipment and materials supplied on the Project.

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Contract Documents. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where their submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors and shall verify such coordination on all submittals.

Where noted in the Contract Documents, the structural, mechanical, and electrical designs associated with the indicated equipment items are specific to the manufacturer and model number specified. Any structural, mechanical, or electrical modifications required to utilize an approved substitution to the specified equipment shall be made by the Contractor at no additional cost to the Owner. Where approved substitutions of specified equipment affect other materials or equipment, mechanical, structural, or electrical work, the Contractor shall note in the equipment submittal any necessary changes to accommodate the substituted equipment. It shall also be the responsibility of the Contractor to coordinate other mechanical, structural, or electrical equipment submittals to make sure that all changes necessary to accommodate the substituted equipment are addressed in these submittals as well.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01290	Schedule of Values
01320	Progress Schedules
01400	Quality Control
01530	Temporary Bypass Pumping

Section	Item
01720	Record Drawings
01800	Testing, Commissioning, and Training
01950	Traffic Control Plan
02240	Dewatering
02275	Geotextile Fabric
02530	Utility Structures
02700	Gravel Materials
02710	Gravel Surfacing
02820	Chain Link Fence and Gate
02900	Landscaping
02950	Site Restoration and Rehabilitation
Division 3	Concrete
Division 4	Masonry
Division 5	Metals
Division 6	Wood and Plastics
Division 7	Thermal and Moisture Protection
Division 8	Doors and Windows
Division 9	Finishes
Division 10	Specialties
Division 11	Equipment
Division 12	Furnishings
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

1.3 WORK INCLUDED

Submittals required for this work shall include any or all of the following as required by the particular specification section and the submittal schedule:

A. Schedules and Plans

B. PRODUCT SUBMITTALS

1. Manufacturer's Literature
2. Shop Drawings
3. Color and Material Samples
4. Design Calculations
5. Test Reports
6. BABA and AIS Compliance Certifications

C. Equipment Operation and Maintenance Manuals

D. Record Drawings

1.4 SUBMITTAL INFORMATION

Shop, catalog, and other appropriate drawings and information shall be submitted to the Engineer for review prior to fabrication or ordering of all equipment and materials specified. The number of copies of submittal information to be submitted shall be as indicated below.

All submittal information shall be sent to the Engineer through the Contractor. The Contractor shall assign a separate submittal number to each item or group of items that relate to each specification section. Submittal numbers shall be assigned in consecutive ascending order, with the first project submittal assigned the number "1." Resubmittals shall be numbered using the same number followed by an alphabetical suffix. All submittals shall bear the Contractor's certification that they have reviewed, checked, and approved the submittal information prior to transmitting to the Engineer. The submittal number and related specification section shall be marked on each submittal.

PART 2 PRODUCTS

2.1 GENERAL

When the Contract Documents require a submittal the contractor shall submit the following number of documents.

Type of Submittal	Number of Copies	Hard Copy Required?
Schedules or Plans	1	N/A
Materials Testing Laboratory	1	N/A
Product Submittal	1	N/A
Design Calculations	1	N/A
Test Reports	1	N/A
Color and Material Samples	3	Yes
Preliminary Equipment Manuals	1	N/A
Final Equipment Manuals	4	Yes

The Contractor shall submit all submittals on the Web-Based Project Communication System. The Contractor shall submit the specified information as PDF files on the web-based project communication system, with a table of contents bookmarked to provide a navigation link to each section of the submittal. The PDF shall consist of one submittal for each submittal number and shall not be broken up into separate documents.

2.2 PRODUCT SUBMITTALS

A. GENERAL

When indicated in the Contract Documents the contractor shall submit product data for review by the Engineer. Unless otherwise specified, within 30 calendar days after receipt of the submittal, the Engineer shall review the submittal and return three copies of the marked-up submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment, or work method complies with the project Specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in operation and maintenance data, a corrected copy shall be provided.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at their own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

4. If the review indicates that the material, equipment, or work method does not comply with the project Specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations that have not been identified clearly may be rejected. Except at their own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

B. MANUFACTURER'S LITERATURE

Where the contents of submitted literature include data not pertinent to the submittal, the portion(s) of the contents being submitted for the Engineer's review shall be clearly indicated.

C. SHOP DRAWINGS

Shop drawings shall be submitted in the form of blue-line or black-line prints of each sheet. Blueprint submittals will not be acceptable.

All shop drawings shall be accurately drawn to a scale sufficiently large enough to show pertinent features and method of connection or joining. On all shop drawings, figure dimensions shall be used as opposed to scaled dimensions.

D. COLOR AND MATERIAL SAMPLES

All material samples shall be of the exact article proposed to be furnished for the work and shall be submitted in the quantity required. Samples shall be returned to the Contractor, with one retained by the Engineer.

Unless the precise color is specifically described in the Contract Documents, or whenever a choice of color or pattern is available in a specified product, accurate color charts shall be submitted to the Engineer for their review and selection.

E. DESIGN CALCULATIONS

Where required in the Specifications, design calculations shall be submitted to the Engineer. Design calculations shall be complete, concise, and in an easy-to-read format. All design calculations shall be stamped by a Professional Engineer licensed in the State of Washington.

F. TEST REPORTS

Copies of all test reports shall be submitted to the Engineer.

G. BUILD AMERICA, BUY AMERICA COMPLIANCE

Applicable submittals shall include a statement that the submitted item complies with the Build America, Buy America requirements.

H. AMERICAN IRON AND STEEL COMPLIANCE

Applicable submittals shall include a statement that the submitted item complies with the American Iron and Steel requirements.

2.3 EQUIPMENT MANUALS

A. GENERAL

For all items of equipment, manufacturer's equipment operation and maintenance manuals shall be submitted to the Engineer for review. One copy will be returned to the Contractor with comments.

All operation and maintenance information shall be comprehensive and detailed, and shall contain information adequately covering all normal operation and maintenance procedures.

For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment specification number as it appears in the project Specifications. The information shall be organized in binders. The binders shall be provided with a table of contents to permit easy location of desired information.

It shall be the responsibility of the Contractor to ensure that all operation and maintenance materials are obtained. Material submitted must meet the approval of the Engineer prior to project acceptance.

The following information shall be furnished for all items of equipment installed on the project requiring operational and/or maintenance procedures, and for any additional items indicated by the Engineer.

1. Lubrication Information

   This shall consist of the manufacturer's recommendations regarding the lubricants to be used and the lubrication schedule to be followed. Lubricants shall be described in detail, including type, recommended manufacturer, and manufacturer's specific compound to be used.

2. Electrical and Control Diagrams

   Diagrams shall show internal and connection wiring.

3. Startup Procedures

   These instructions consist of equipment manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.

4. Operating Procedures

   These instructions consist of the equipment manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.

5. Preventive Maintenance Procedures

   These instructions consist of the equipment manufacturer's recommended steps and schedules for maintaining the equipment.

6. Overhaul Instructions

   These instructions consist of the manufacturer's directions for the disassembly, repair, and reassembly of the equipment and any safety precautions that must be observed while performing the work.

7. Parts List

   This list consists of the generic title and identification number of each component part of the equipment.

8. Spare Parts List

   This list consists of the manufacturer's recommendations of number of parts, which should be stored by the Owner and any special storage precautions, which may be required.

9. Exploded View

   Exploded or cut views of equipment shall be provided if available as a standard item of the manufacturer's information. When exploded or cut views are not available, plan and section views shall be provided with detailed callouts.

10. Test Documentation

Reports, records, data and forms documenting the results of equipment factory tests, including pump and blower performance curves, shall be provided, with the operating points for the specific equipment designated. When a special factory test of the supplied equipment is not performed, the manufacturer's standard performance reports and curves, with specified operating points, shall be provided for the supplied equipment.

11. Specific Information

Where items of information not included in the above list are required, they will be provided as described in the specifications for the equipment.

12. Warranty Information

13. Maintenance Information Summaries

In addition, the following items of equipment shall be provided with Maintenance Information Summaries in each appropriate section of the equipment manuals, prepared according to the format specified herein:

- Composite Samplers
- NPW Pumps
- WAS Pump
- Influent Pumps
- RAS Pumps
- Rotary Drum Mechanical Fine Screens
- Anoxic Mixer
- Aeration Blowers
- Air Diffusion Equipment
- Ultraviolet Disinfection System
- Hoists
- Odor Control Equipment
- Sampling Equipment
- Sump Pumps
- Water Heater
- Flow Meters
- Dissolved Oxygen Meters
- Radar Level Sensors

- Submersible Level Sensors
- Heating and Ventilation Equipment
- Valves (larger than 1-inch in size)
- Plant Instrumentation, Telemetry, and Control Equipment
- Electrical Equipment

Maintenance information summaries shall be prepared on 8-1/2-inch x 11-inch paper only and shall contain the following information compiled from manufacturer's recommendations in the order shown.

1. Description or name of item of equipment.

2. Manufacturer.

3. Name, address, and telephone number of local manufacturer's representative.

4. Serial number (where applicable). The Contractor shall verify that it matches the equipment installed on the project.

5. Equipment nameplate data including model number.

6. Recommended maintenance procedures:

    a. Description of procedures.

    b. Maintenance frequency required.

    c. Lubricant(s) or other materials required (where applicable), including type of lubricant, lubricant manufacturer, and specific compound.

    d. Additional information as required for proper maintenance.

7. Recommended spare parts.

The maintenance information summary shall be placed at the beginning of the manual.

B. EXTRANEOUS DATA

Where the contents of the manuals include manufacturers' standard brochures or catalog pages, the exact item(s) used in this installation shall be clearly indicated and all manufacturers' data which is extraneous shall be clearly deleted.

C. FINAL EQUIPMENT MANUALS

The Contractor shall be responsible for tracking and coordinating each separate manufacturer's equipment operation and maintenance manual submittal and shall resubmit, as necessary, until the Engineer's review indicates that the submittal is acceptable. The Contractor shall maintain equipment manual files until final approval copies are delivered to the Engineer. The Contractor shall be responsible for collating the approved operation and maintenance submittal sections into complete final manufacturers' equipment operation and maintenance manuals bound in post binders which are indexed to the Specifications. The Contractor shall deliver the complete final operation and maintenance manuals to the Engineer prior to project completion. All copies final manufacturers' equipment manuals submitted will be retained by the Engineer or Owner.

The Contractor shall submit the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. GENERAL

Each submittal shall be accompanied by a letter of transmittal showing the date of transmittal, specification section, or drawing number to which the submittal pertains, submittal number, and a brief description of the material submitted.

B. RESUBMITTALS

When material is resubmitted for any reason, it shall be submitted under a new letter of transmittal and referenced to the previous submittal.

3.2 REVIEW OF SUBMITTALS

The Engineer will review all submittals for general conformance with the design and other requirements of the Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents. Submittals may be rejected based on inadequate information and/or not meeting the requirements of the Contract Documents. Rejection of submittals requires action on the part of the Contractor to correct the reason for the rejection. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, and for techniques of assembly and installation.

3.3 COORDINATION OF PRODUCT SUBMITTALS

A. GENERAL

Prior to submittal for review by the Engineer, all data shall be fully coordinated, including the following:

1. All field dimensions and conditions.

2. All trades and public agencies involved, including necessary approvals.

3. All deviations from the Contract Documents.

B. GROUPING OF SUBMITTALS

1. All submittals shall be grouped with associated items, unless otherwise specifically permitted by the Engineer.

2. The Engineer may reject the submittals in their entirety or any part thereof, if not in accordance with the Contract Documents.

C. CERTIFICATION

Submittals shall bear the Contractor's certification that they has reviewed, checked, and approved the shop drawings prior to forwarding them to the Engineer.

3.4 TIMING OF PRODUCT SUBMITTALS

A. GENERAL

1. All submittals shall be made far enough in advance of installation to provide all required time for reviews and securing necessary approvals.

2. In scheduling, the Contractor shall allow for the time indicated in Part 2.2A for the Engineer's review following their receipt of the submittal.

B. DELAYS

No additional or separate payment will be made for costs of delays occasioned by tardiness of submittals on the part of the Contractor.

3.5 EQUIPMENT MANUALS

The preliminary copies of the manufacturer's equipment manuals shall be delivered to the Engineer for review not later than the time of equipment delivery to the project site.

Final copies of the manufacturer's equipment manuals shall be delivered to the Engineer at least 14 calendar days prior to requesting payment in excess of 90 percent completion for the project. Prior to submittal of the final equipment manuals, the Contractor shall check the manuals for accuracy and completeness and shall verify that prior review comments have been addressed.

***** END OF SECTION *****

SECTION 01310

PROJECT MEETINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes information pertaining to the various meetings that will be held during the course of constructing this project.

1.2 PRECONSTRUCTION CONFERENCE

As soon as possible following the award of the Contract, a preconstruction conference shall be scheduled for representatives of the Owner, the Contractor, the Engineer, funding agencies, regulatory agencies, and affected utilities.

1.3 PROJECT PROGRESS MEETINGS

The Owner and the Engineer will schedule and attend regular biweekly meetings with the Contractor for coordination, administrative, and procedural requirements of the project. The Contractor shall provide a meeting room with table and chairs at or near the site for project progress meetings.

1.4 CONSTRUCTION MEETINGS

The Contractor shall schedule and hold regular meetings during the project:

A. Safety Meetings (Contractor's subcontractors shall attend if they are working onsite.)

B. Project Progress Meetings

C. Equipment Installation Meetings

D. Coordination Meetings

E. Startup and Testing Meetings

The Contractor shall notify the Owner and Engineer in advance of all meetings. The meetings may or may not be attended by the Owner and Engineer.

***** END OF SECTION *****

SECTION 01320

PROGRESS SCHEDULES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section further defines the progress schedule requirements described in the General Conditions. This Section specifies the procedures for preparing and revising the cost-loaded construction schedule used for planning and managing construction activities. The schedule provides a basis for determining the progress status of the project relative to the completion time, specific dates, and for determining the acceptability of the progress payment estimates.

1.2 DESCRIPTION

The Contractor shall prepare a time-scale network schedule using a critical path method (CPM). A general guide for preparing such a schedule is contained in "The Use of CPM in Construction, a Manual for Contractors and the Construction Industry," published by the Associated General Contractors of America.

The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted by the Contractor. Assigned values for each part of the work shall be indicated. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.

Completion time and all specific dates and sequencing requirements shall be shown on the schedule. Activities making up the critical path shall be identified.

No activity on the schedule shall have a duration longer than 14 consecutive days or an assigned value greater than $25,000, except activities comprising only fabrication and delivery, which may extend for more than 14 consecutive days. Activities which exceed these limits shall be divided into more detailed components. The scheduled duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

1.3 SUBMITTALS

The CPM Progress Schedule shall be prepared using a computerized system. The schedule shall be submitted in the form of an arrow diagram or precedence diagram with activity listings. The following shall be included:

A. Network diagram shall show in detail and in order of sequence all significant activities, their descriptions, durations, and dependencies, as necessary and as required to complete all work and each separate part of the work.

B. The activity listing shall show the following information for each activity shown on the network diagram:

1. Description

2. Duration

3. Start and finish dates

4. Total float time and free float time

C. Milestone activity completions shall be shown and clearly defined.

D. The critical path shall be clearly indicated.

E. A legend defining any abbreviations used on the schedule shall be provided.

F. All CPM schedules shall conform to the requirements of the Owner's overall Project schedule and the Contract Documents.

The Contractor shall submit four hard copies (bluelines or blacklines) plus an electronic file with each schedule submittal. The hard copies shall be full size (22" x 34") and the electronic copy shall be in pdf format. Electronic files may also be viewable using Microsoft Project®. All schedule reports shall be 8-1/2-inch x 11-inch format. The Contractor shall provide, in chronological order, a list of constraints used, if any, in the preparation of the schedule.

Within 14 calendar days after receipt of the schedule, the Owner and Engineer will return a copy of the schedule to the Contractor with comments. Review of the schedule is for purposes of evaluating the Contractor's ability to complete the Work within the Contract time. Review shall not constitute approval or acceptance of the Contractor's construction means, methods, or sequencing.

The Contractor shall submit an updated Progress Schedule with each application for payment or whenever actual construction progress deviates significantly from the current schedule.

***** END OF SECTION *****

SECTION 01385

DOCUMENTATION OF EXISTING CONDITIONS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the video recording requirements for the project.

The Contractor shall provide the Engineer with a computer-readable digital format of the project area prior to and upon completion of all construction. The video recording shall utilize equipment that will visually document an accurate audio-visual description of the existing and post-construction conditions.

The Contractor shall notify the Engineer prior to the recording to allow the Engineer to witness the video recording. The Contractor shall provide preconstruction video recording of the existing conditions for the entire project site.

Upon completion of the work, the Contractor shall provide video recording in the same manner and vantage point as the preconstruction video recordings. The intent of this Specification section is to provide a comparison between existing and post-construction conditions.

The rate of speed the documentation will be video recorded at, the panning rates, and the zoom-in/zoom-out rates will be controlled so that playback will produce a clear television picture of the areas video recorded.

The video recording shall be accomplished during a period of good visibility. Unless otherwise directed by the Engineer, video recording will not be allowed during times of precipitation or poor visibility.

When available light is not sufficient to produce a clear screen image, additional lighting shall be supplied by the photographer to ensure good picture quality. The camera crew shall be able to work independent of any power source, utilizing battery power to operate the camera, and lighting.

A legible reader board shall be provided by the photographer to visually document the date, job title, and site identification. The audio portion of the video recording will be used for identification purposes, addresses, and any other audio required or as directed by the Engineer.

***** END OF SECTION *****

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the control tests, test sample collection, required field-testing, and special inspections as specified herein, and indicated on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
02300	Earthwork
02700	Gravel Materials
02710	Gravel Surfacing
02740	Hot Mix Asphalt
03300	Cast-In-Place Concrete

1.3 PAYMENT

All testing as required by this Section shall be paid for by the Contractor. All costs to prepare and implement the sample and testing program shall be included in the bid prices for the various items associated with the sampling and testing program.

Retesting and reinspection required because of defective work and testing performed for the convenience of the Contractor shall also be paid for by the Contractor.

Testing requirements shall not be cause for claims of delay by the Contractor and all expenses accruing therefrom shall be deemed incidental to the performance of the Contract.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall be responsible for all material testing specified in the Contract Documents and any applicable permits and codes. The materials testing laboratory shall be accredited for performing the various testing methods either by AASHTO R18, AASHTO 150/IEC 17025 or the American Association for

Laboratory Accreditation and further approved by the Owner. The materials testing laboratory shall send test results directly to the Engineer.

2.2 EARTHWORK AND GRANULAR MATERIALS

A. COMPACTION CONTROL

Optimum moisture content and maximum density tests shall be determined by the following method:

ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort

B. IN-PLACE TESTS

In-place density and moisture content tests shall be made by an independent testing laboratory according to the following methods:

ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2.3 AGGREGATES

All aggregates shall be tested in accordance with applicable WSDOT test methods:

Title	**Test Method**
Sampling	AASHTO T2
Sieve Analysis of Fine and Coarse Aggregates	104A
Material Finer than No. 200 Sieve in Aggregates	102A
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	603A
Organic Impurities	111A
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	101A
Sand Equivalent	109A

2.4 CAST-IN-PLACE CONCRETE

Cast-in-place concrete shall be tested in accordance with applicable parts of Chapter 16 of ACI 301. Concrete reinforcement and concrete special inspections shall be performed in accordance with local Building Official and WABO requirements.

2.5 HOT MIX ASPHALT

Paving asphalt shall be tested in accordance with the following WSDOT test methods:

Characteristics	**Test Method**
Tests on Residue from RTFC Procedure	208
Absolute Viscosity at 140 degrees F, poise	203
Kinematic Viscosity at 275 degrees F., cSt, min.	202
Penetration at 77 degrees F., 100 g/5 sec., min.(1)	201
Percent of Original Penetration at 77 degrees F, min.	2
Ductility at 45 degrees F., cm, min.	
Flashpoint, (Cleveland Open Cup), degrees F min. (test on original asphalt)	206
Solubility in Trichloroethylene percent, min. (test on original asphalt)	214

(1) Original penetration, as well as penetration after RTFC loss shall be determined by AASHTO Test Method T 49.

A. COMPLETE EXTRACTIVE OF UNCOMPACTED MIX

Test methods shall be in accordance with the following:

1. AASHTO T68

2. ASTM D2172

3. AASHTO T30

B. DENSITY OF COMPACTED MIX

Test method shall be in accordance with AASHTO T166.

1. The Contractor shall employ an independent testing laboratory approved by the Owner to conduct complete extraction tests on the uncompacted asphalt concrete pavement mix.

2. The Contractor shall provide the Engineer with an affidavit from the asphalt supplier of the characteristics of the paving asphalt.

The paving asphalt shall be tested in accordance with WSDOT Construction Manual and Standard Specifications, 2023 edition.

PART 3 EXECUTION

3.1 SAMPLING AND TESTING FREQUENCY

A. GENERAL

The Contractor shall provide the following quality control tests at the number and frequency described herein. On-site testing technicians and testing laboratories shall be WABO-certified. The precise location of the tests shall be designated by the Engineer. The Contractor shall cooperate with laboratory personnel employed to conduct the density testing, sampling of material(s), and special inspections. The Contractor shall provide safe access within the work site for laboratory personnel such that density testing and visual inspection can be performed. The Contractor shall provide samples of materials to be tested in the quantities required and herein specified to the appropriate laboratory personnel. The Contractor shall furnish all labor, equipment, tools, and materials necessary to obtain and deliver samples as herein designated. They shall also provide and repair any test holes required in order to facilitate the testing and sampling and to provide for the testing laboratory's exclusive use for storage and curing of test samples until removed to the laboratory.

Any areas tested and further failing compliance with the Specifications shall be recompacted and retested at the Contractor's expense, until a successful density test indicating compliance with these Specifications has been achieved.

B. SOIL TESTING

The following soil quality control tests shall be completed at the given frequency:

Material	Test	Minimum Sampling & Testing Frequency
Backfill for foundations, walls, trenches and roads	Gradation[1]	One every 500 cy or one per day for quantities exceeding 25 cy. For trenches, one every 750 feet of trench.

Material	Test	Minimum Sampling & Testing Frequency
	In-Place Density[2,3,4]	One every 500 cy or one per day for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.
	Moisture-Density Relationship[3]	One prior to start of backfilling operation, one every 20 densities and any time material type changes.
Pipe Bedding	Gradation[1]	One every 750 feet of trench.
Subgrade and Fills	In-Place Density[2,3]	One every 500 cy of each type material.
	Moisture-Density Relationship	One for every 20 densities for each material.
	Gradation	One for every moisture-density.

1. All acceptance tests shall be conducted from in-place samples.
2. Additional tests shall be conducted when variations occur due to the Contractors, operations, weather conditions, site conditions, etc.
3. The nuclear densometer, if properly calibrated, may be used but only to supplement the required testing frequency and procedures. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.
4. Depending on soil conditions, it is anticipated that compaction tests shall be required at depths of 2 feet above the pipe and at each additional 5 feet to the existing surface plus a test at the surface.

C. HOT MIX ASPHALT TESTING FREQUENCY

The following hot mix asphalt quality control tests shall be completed at the given frequency:

Material	Test	Minimum Sampling & Testing Frequency
Mix Design (By Contractor)	Submittal	Design Mix (include test results). Aggregate (each size) – 100 pounds. Asphalt - 1 gallon. Mineral Filler – 10 pounds.

Material	Test	Minimum Sampling & Testing Frequency
Asphalt (including prime and tack coat)	Sample and Tests	Submit a 1-quart sample and material certification with test results for each shipment or lot of asphalt. A duplicate 1-quart sample shall be retained by the Contractor until the completion of the job.
Aggregates (from bins or source)	Gradation	One test prior to start of paving operation and one every 1,500 tons or 1,000 cy.
	Fractured Faces	Same as gradation.
	LA Abrasion	One test prior to start of paving and one test every 10,000 tons thereafter.
	Specific Gravity	Same as gradation.
Hot Mix Asphalt (including Asphalt Treated Base)	Marshall Method Test	One initial test during mix design and one per 3,000 tons thereafter.
	Specific Gravity	One per each Marshall test.
	Compaction	One per 50 Tons

D. CONCRETE TESTING

All testing shall conform to applicable portions of ACI. Special inspections of concrete and concrete reinforcement shall comply with WABO requirements.

All concrete must meet the specified requirements for minimum 28-day compressive strength.

All concrete cylinders shall be molded and tested for strength by an independent testing laboratory employed by the Contractor.

The Contractor shall furnish all concrete required for molding of the cylinders. In cases where cylinders are stored at the project site, the Contractor shall provide storage and protection for the cylinders in accordance with ACI requirements.

Concrete tests and testing frequency shall be in accordance with the more stringent of the testing requirements specified in Section 03300-3.17 of these Specifications, and the following table:

Material	Test	Minimum Sampling & Testing Frequency
Coarse Aggregate (for each grading size)[1]	Gradation	One test every 500 cy of concrete.
	Deleterious Substances	One test initially and thereafter when appearance makes the material suspect.
	L.A. Abrasion	One every 2,000 tons of aggregate.
	Moisture specific gravity and absorption[1]	One initially and every 250 cy thereafter. One moisture to be conducted prior to any batching and more frequently if hauling and storage does not provide a consistent moisture content.
Fine Aggregate[1]	Gradation and fineness modules	One every 250 cy of concrete.
	Deleterious Substances	(same as coarse aggregate).
	Moisture, specific gravity and absorption[1]	(same as coarse aggregate).
Concrete	Slump	Conduct one test every day of placement and one additional test for every 50 cy placed and more frequently if batching appears inconsistent. Conduct in conjunction with taking concrete cylinders.
	Entrained Air	Conduct with each slump test.
	Ambient and concrete temperatures	Conduct with each slump test.

Material	Test	Minimum Sampling & Testing Frequency
Concrete	Compressive strength and evaluation of results per ACI 214. (includes unit weight of each cylinder)	For all concrete placement, take one set of four cylinders per day and one additional set of cylinders for every 50 cy of each class of structural concrete. Cylinders shall be 4 inch by 8 inch. Test one cylinder at 7 days and two at 28 days. Fourth cylinder shall be held in reserve. A plot and statistical evaluation shall be maintained in accordance with ACI 214 for compressive strength results. Field cure cylinders shall be made when insitu strengths are required to be known.

1. Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement (w/c) calculations.

E. SPECIAL INSPECTIONS

Contractor shall perform all required Special Inspections per WABO requirements (Chapter 17 of the IBC). Special inspections include, but are not limited to, cast-in-place concrete, concrete reinforcement, structural welded connections, bolted connections, compaction testing for building and structure foundations, concrete masonry units (CMU), and epoxy adhesive bolting.

***** END OF SECTION *****

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary facilities required for this project, but not necessarily limited to:

A. Temporary utilities such as water, electricity, telephone, off-site staging, and off-site parking.

B. Temporary piping, pumps, valves, fittings, manholes, vaults, and appurtenances necessary to keep existing facilities fully operational during construction.

C. Sanitary facilities.

D. Temporary enclosures such as fences, tarpaulins, barricades, and canopies.

E. Alarms or monitoring systems for any temporary pumping facilities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01510	Maintenance of Treatment Facility
01520	Field Offices and Storage Sheds
01530	Temporary Bypass Pumping

PART 2 PRODUCTS

2.1 UTILITIES

A. TEMPORARY ELECTRICITY

The Contractor shall provide temporary power for construction at the project site. They shall make arrangements with the electrical utility (to obtain temporary power) and shall pay all costs and fees charged by the utility associated with connection of temporary power. The Contractor shall provide all special connections, receptacles, panelboards, etc., which are required for temporary service, and are not provided by the utility.

The Contractor shall furnish and install all temporary wiring and associated equipment required to keep all portions of the existing facilities in operation at all times.

Area distribution boxes shall be furnished, installed, and so located that the individual trades may use their own construction-type extension cords to obtain proper power and artificial lighting at all points where required. The Contractor shall provide a main disconnect on all temporary wiring panels, labeled "MAIN DISCONNECT," to ensure the safety of personnel using extension cords and hand tools. Panels shall also be properly grounded and equipped with GFCI breakers in accordance with WISHA requirements.

The Contractor shall provide the Engineer single line diagrams of the temporary wiring showing all circuit breakers. These diagrams shall be provided prior to installation of this wiring. These diagrams are necessary to provide information to Owner personnel for off-hours operation.

The Contractor shall pay all demand, consumption, taxes, and fees associated with the temporary electrical service.

B. WATER

The Contractor shall be responsible for providing water necessary for construction. This includes costs for supplying potable water for hydrostatic pressure leak testing of all water-holding structures and operational testing of all equipment and processes. Water is available from the Owner subject to payment for water used by the Contractor at the water rates in effect at the time of water useage. The Contractor shall install a meter with backflow prevention device prior to obtaining water from the Owner.

C. TELEPHONE

The Contractor shall provide and pay for telephone service at their construction site office. Cellular service is acceptable if coverage is available. If cellular coverage is not available, the Contractor shall provide temporary telephone service with a land line.

2.2 TEMPORARY PIPING

The Contractor shall furnish and install all temporary piping and pumping and, upon completion of the work, remove all such temporary piping as required, except as designated on the Plans to remain as a part of the Project. Prior to installation, the Contractor shall submit drawings to the Engineer showing the proposed installation of temporary piping and pumps, including location, type of pipe, fittings, and valves. The Contractor shall obtain the Engineer's approval for temporary piping and pumping plan prior to installation.

Temporary piping and pumping shall be provided as necessary to maintain the existing facilities in operation until the new facilities are constructed, operational. An effort has been made on the Plans and/or Specifications to note instances and locations where temporary piping and/or pumping may be required; however, this in no way limits the temporary piping and pumping to be provided by the Contractor at these locations.

2.3 SANITARY FACILITIES

The Contractor shall provide toilet and wash-up facilities for their workforce and the Engineer at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

2.4 OFF-SITE STAGING AND PARKING

The Contractor shall note that space is limited throughout and adjacent to the construction site. Employees of the Contractor, all subcontractors, vendors, suppliers, and associated personnel shall not be allowed to park onsite during the course of construction without prior approval from the Owner. It shall be the responsibility of the Contractor to provide sufficient parking facilities in authorized area(s) other than the construction site for the above-mentioned personnel. The Owner may provide recommendations for possible parking and staging locations. The Contractor shall require approval from the Owner for proposed parking and staging locations prior to use.

The Contractor shall not be allowed to stockpile and store equipment and materials throughout the construction site. The Contractor shall coordinate their schedule so that all equipment and materials shall be brought to the construction site only when they are to be installed/utilized.

The Contractor shall provide storage of equipment and materials at an offsite, bonded warehouse, to be approved by the Engineer. The Contractor shall pay all costs associated with off-site delivery, storage, and transfer to the construction site.

2.5 ENCLOSURES

The Contractor shall furnish, install, and maintain during the project time all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

2.6 ALARM SYSTEMS

The Contractor shall provide alarm systems for temporary pumping facilities utilized during construction. Alarms shall warn the Contractor and/or system operators of high/low level alarms and similar conditions, which, if left unattended or uncorrected, could lead to spillage or overflow of raw or treated sewage or sludge from a wet well, pumping facility, or portion of a treatment plant or lift station.

PART 3 EXECUTION

All temporary facilities and controls shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Owner.

***** END OF SECTION *****

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of mobilization and demobilization. Mobilization consists of preconstruction activities and preparatory work for the project necessary to mobilize labor, materials, and equipment to the project site. Demobilization consists of activities to remove materials and equipment from the project site upon project completion, including final cleanup. Items which are not considered mobilization or demobilization include but are not limited to:

A. On-going activities throughout the duration of construction.

B. Profit, interest on borrowed money, overhead, or management costs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
Division 1	General Technical Requirements

PART 2 PRODUCTS

Products and materials required for mobilization and demobilization are described in the various sections of Division 1 and in other parts of the Contract Documents.

PART 3 EXECUTION

Complete mobilization and demobilization as required by the various sections of Division 1 and other parts of the Contract Documents.

***** END OF SECTION *****

SECTION 01510

MAINTENANCE OF TREATMENT FACILITY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the steps that the Contractor shall take to ensure that the existing facilities or temporary facilities remain fully operational during all stages of construction and modifications to the various existing facilities. Bypasses of untreated sewage will not be permitted.

The Contractor shall be responsible for all scheduling and arrangements for temporary sewage handling. This shall also include all connections of temporary pumping equipment with temporary electrical service with controls. The Contractor shall coordinate work efforts with the Owner.

To ensure continuous operation of the existing treatment systems, the Contractor shall inform the treatment plant operator of the details of operation of all temporary piping and electrical power and controls.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01110	Summary of Work
01200	Measurement and Payment
01500	Temporary Facilities
01530	Temporary Bypass Pumping

1.3 WASTEWATER TREATMENT FACILITY

The specified work is expected to require temporary sewage pumping or interruption of normal plant operation. The Contractor shall schedule their work so as to minimize interruption of the treatment or the transportation of sewage. Prior to starting construction, the Contractor shall confer with the Engineer and the Owner and develop a construction sequence and schedule which will provide for adequate temporary pumping, if necessary, and/or treatment during the required modifications. The Contractor shall take all steps necessary to ensure that the existing facilities or a temporary facility remains fully operational during all stages of construction and modifications to the various existing facilities. Bypasses of untreated sewage will not be permitted. The Contractor shall be

required to have a standby pump, equal in capacity to the temporary pump, onsite and capable of operation should the temporary pump fail.

In the event that inadequately treated sewage reaches the receiving water as a result of the Contractor's activities, the Contractor shall immediately notify the Owner and take corrective action. Following any such incident, the Contractor shall submit to the Owner a written report summarizing the beginning and ending times of the bypass, approximate volume bypassed, reason for bypass, and corrective measures taken.

Any and all actions required by the Contractor to remedy waste spillage or contamination of receiving waters shall occur at their own expense.

1.4 EXISTING UTILITIES

There now exists within and adjacent to the site boundaries a domestic water system and sanitary sewer system owned by the Owner, as well as privately owned and operated telephone, communication, internet, and overhead electric lines and poles. The utilities are vital to the continuous operation of the existing treatment facilities.

The Contractor shall be responsible for the protection of these utilities and be responsible for notifying the utility company if their services are necessary. All poles, piping, wiring, etc., of the various utilities shall be braced and protected from nearby excavations at the Contractor's expense.

Whenever the Contractor is excavating in the area of these utilities, they shall make arrangements to have emergency repair equipment, materials, and manpower available within 30 minutes of the project location. The Contractor shall submit their contingency plans to the Engineer for approval at least 14 calendar days prior to performing any excavation.

If any damage is done to these lines, the Contractor shall repair the line(s) immediately so the operation of the facility is unimpaired. If the Contractor fails to repair the lines, the Owner shall repair the line(s) and deduct the costs thereof from the monies or payments due or to become due to the Contractor.

Where the Contractor is responsible for damage to an underground or overhead utility, they shall make the repair immediately, at their expense.

The Contractor shall be responsible for protecting and repairing, if damaged, all existing roadway, catch basins, culverts, fences, rockeries, retaining walls, shrubbery, and all other items that are visible and where the removal or demolition is not ordered or provided for in this Contract.

A set of record drawings of the existing treatment plant are available for review from the Owner and/or the Engineer. Said record drawings are made available for information only and not as a warranty of existing conditions. The Contractor shall be held responsible for verifying the accuracy of the record drawings.

The Contractor shall work with the Owner's Water & Wastewater Management & Operations by calling 253-255-1539 and the Utilities Underground Location Center, by calling 1-800-424-5555 to advise them of the proposed construction area and the proposed schedule of work sequence so that respective participating utilities may mark their systems. The Contractor shall also check individually with those utilities not participating. The Contractor shall, by letter and copies thereof, demonstrate to the Owner their efforts to fully inform the nonparticipating utilities, Owner's Water & Wastewater Management & Operations, and the Utilities Underground Location Center of their activities. Furthermore, the Contractor shall demonstrate full cooperation with each utility involved in this Project.

The Contractor is hereby advised that the exact locations of the existing underground waterlines, sludge lines, sewer lines, drainage lines, electrical conduits, and chlorine sample and solution lines at the plant site are not known. The Contractor shall locate and mark these lines prior to construction.

***** END OF SECTION *****

SECTION 01520

FIELD OFFICES AND STORAGE SHEDS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes the requirements for field offices on this project. The Contractor shall note that the area within the 50-foot top of slope setback is at risk of landsliding. This area may be used for field offices, temporary storage, and laydown at the Contractors risk. The Contractor shall note that there is limited space available on site for field offices, storage sheds, and laydown area. The Contractor shall coordinate with the Owner and nearby property Owners for nearby areas available for these purposes.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
02300	Measurement and Payment
01500	Temporary Facilities

PART 2 PRODUCTS

2.1 FIELD OFFICES

During the performance of the Contract, the Contractor shall maintain a suitable office at or near the site of the work, which shall be the headquarters of the Contractor's representative. Office location on the site shall be approved by the Owner and Engineer.

Contractor shall make available a separate 10-feet-wide x 14-feet-long (minimum) office trailer at the project site, approved by the Engineer, for use by the Engineer. The Contractor shall supply the office with:

1. Heat, air conditioning, and thorough ventilation system.

2. Electric lights and power.

3. Plain paper copier/scanner, which will sort copies and copy up to 11" x 17" paper. The Contractor shall provide all necessary maintenance and service for the copy machine.

4. High speed internet connection with a static IP Address and wireless capabilities.

5. Black and white printer with USB connection, toner, and paper.

6. Desk (3' x 5' minimum).

7. Layout table (4' x 6' minimum).

8. Conference Table (3' x 8')

9. Two chairs.

10. Drafting stool.

11. One four-drawer lockable metal file cabinets.

12. Dry Erase Board with 4 markers.

13. Cylinder door lock and three keys.

14. Sanitary facilities (unless existing facilities are available).

15. Windows and doors shall be reasonably airtight.

16. Coffee maker with filters.

17. Potable water cooler for drinking water.

18. One microwave oven.

2.2 STORAGE SHEDS

The Contractor shall provide storage for the protection of equipment, materials, supplies, and tools and shall ensure that a building be used for the storage of materials that deteriorate when exposed to moisture. Workshops and storage buildings shall be located in the general area of the work and shall be clean and in proper order. Storage of materials at the project sites shall not obstruct access or use by the Owner's employees of existing facilities.

PART 3 EXECUTION

All storage sheds shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities as rapidly as progress of the work will permit or as directed by the Engineer. The Engineer's field office and accessories shall remain in service until the project is accepted by the Owner.

***** END OF SECTION *****

SECTION 01530

TEMPORARY BYPASS PUMPING AND PIPING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the requirements for all temporary bypass pumping of wastewater flows required to construct the project.

The Contractor shall provide all safety control measures required and provide pumps and equipment adequate in capacity and in good condition to prevent any spills or overflows during the transfer of flows.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
01510	Maintenance of Treatment Facility

1.3 SUBMITTALS

The Contractor shall submit a Temporary Bypass Plans including drawings and complete design data in accordance with these specifications as outlined under Section 01300, Submittals, showing methods and equipment the Contractor proposes to utilize for bypass sewage pumping. The submittal shall include the following information:

A. Drawings indicating the location of pumps, temporary sewer plugs, bypass discharge lines, and staging areas.

B. Capacities of pumps, prime movers, and standby equipment.

C. Method and type of temporary pipe plugs.

D. Design hydraulic calculations providing adequacy of the bypassing system and selected equipment.

E. Details of bypass pump monitoring and alarm system.

F. Schedule for installation and maintenance of bypass piping.

1.4 PROTECTION

The Contractor shall ensure that service for connecting laterals and side sewers are not disrupted. All bypassed flow shall be discharged as approved by the Owner. No bypassing to the ground surface, receiving waters, or any area which results in groundwater contamination or potential health hazards shall be permitted. Contractor shall ensure that no cross contamination occurs during bypass pumping. Contractor shall reference the NPDES permit in Appendix G regarding reporting of spills or overflows.

1.5 SCHEDULING

Temporary systems for sewage pumping shall not be shut down between shifts, on holidays or weekends, or during work stoppages without permission from the Owner.

PART 2 PRODUCTS

2.1 BYPASS PUMPING EQUIPMENT

Bypass pumping systems for the process streams necessary to facilitate project sequencing must have the capacity specified below, with one unit out of service, as described in Section 01110. The Contractor shall maintain on site a standby pump capable of maintaining bypass pumping with the largest duty pump out of service. Standby pumps shall be fueled and operational at all times. The Contractor shall maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping and other parts or system hardware to ensure immediate repair or modification of any part of the system as necessary. If electric pumps are being used, standby generators shall be available to ensure continuity of the pumping operation in the event of a power failure.

The Contractor shall provide bypass pumping systems that meeting the following total design flow and operational conditions. The Contractor shall furnish the necessary labor and supervision to set up and operate the pumping and bypass system with redundancy. Pumps and bypass lines shall be of adequate capacity and size to control the flows.

The contractor shall provide a monitoring and alarm system for the bypass pumping system.

A. RAW SEWAGE/INFLUENT WASTWATER/EFFLUENT/WASTE ACTIVIATED SLUDGE

The design flow shall be a minimum of 80 gpm. The bypass pumping systems shall be operated to maintain a constant level in the basin that they are pumping from.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall be responsible for supplying, installing, operating, monitoring, and maintaining all wastewater bypass pumping and piping systems. The Contractor shall pay all demands, consumption, connection, taxes, and fees associated with electrical service for the temporary bypass pumping system. The Contractor shall pay for fuel costs associated with the temporary bypass pumping system.

Refer to Section 01510 for requirements to ensure that the wastewater treatment facility remains fully operational during all stages of construction. An effort has been made in the Plans and Specifications to note the instances and locations where temporary piping and pumping may be required; however, this in no way limits the temporary piping and pumping to be provided by the Contractor. The Contractor shall be solely responsible for the adequacy of the methods, systems, and equipment to control, remove, handle, treat, and dispose of wastewater in conformance with all requirements of these Specifications.

The Contractor shall bear full responsibility for taking all reasonable precautions necessary to ensure continuous successful operation of the temporary sewage pumping system. This includes establishing and/or monitoring adequate marking of all sewage pumping elements.

Where a sewage pumping discharge line requires crossing for access into, out of, or around the excavations or access of work, steel ramps shall protect the system from vehicular traffic. All ramps shall have the strength to support the heaviest equipment onsite and shall provide at least 6 inches of clearance between the sewage pumping system element and the under side of the ramp. The Contractor shall clearly identify all vehicular access points across the sewage pumping system with brightly colored or flagged poles a minimum of 8-feet high on each side of the access point. The Contractor shall valve all ramped pipelines on both sides of the ramp.

The Contractor shall carefully coordinate its construction activities with National Weather Forecasts to reduce the probability of high flows and/or surcharging from stormwater during construction.

3.2 DAMAGES

The Contractor shall cleanup and repair, without cost to the Owner any damage that may result from inadequate or improper design, installation, maintenance and operation of bypass pumping systems, including mechanical or electrical failures.

***** END OF SECTION *****

SECTION 01580

PROJECT IDENTIFICATION SIGNS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the required signs at the project site for identification of this project. The Funding Agency specifications, provided in the Agency's general conditions, contains guidelines for preparing the sign for the project. Prior to constructing the project sign, the Contractor shall obtain the required sign wording and location from the Engineer.

All participating funding agencies shall be listed in a noteworthy format on the project sign.

If the Contractor elects to also erect his own company sign on the site, it must contain the words "An Equal Opportunity Employer."

***** END OF SECTION *****

SECTION 01720

RECORD DRAWINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the record drawings, which shall be maintained and annotated by the Contractor during construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals

1.3 INFORMATION PROVIDED BY THE OWNER

The Contractor will be provided with the following items to maintain record drawings for the project:

A. One full size paper set of Plans.

B. One set of AutoCAD drawing files for the Project.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall maintain the following record drawings for the project:

A. A neat and legibly marked set of Contract Plans showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;

B. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Contract Documents; and

C. Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office. At the completion of the work, prior to final payment, a paper copy and a scanned pdf of all record drawings shall be submitted to the Engineer.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

A. Additions - Red

B. Deletions - Green

C. Comments - Blue

D. Dimensions - Graphite

Legibly mark drawings to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

The Contractor shall be responsible for furnishing the Owner one full size, signed mylar, with as-built information in AutoCAD format on CD-rom. Each record drawing shall be stamped and signed by the onsite field representative of the Contractor.

The Contractor's record drawings (full-size hard-copy) will be reviewed monthly for completeness by the Engineer prior to preparing the progress estimate for payment. If the record drawings do not reflect the work performed, payment for that item of work will not be included in the progress estimate.

***** END OF SECTION *****

SECTION 01740

CLEANUP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the maintenance of the building, structures, and site(s) in a standard of cleanliness throughout the construction period as described herein.

Throughout the construction period, the Contractor shall maintain the cleanliness of the site and structures as described herein. The Contractor is also to maintain access to all existing, operating equipment such that the equipment may be serviced and operated.

Dust of all kinds, including concrete dust produced by construction activities, shall be controlled to avoid damage to existing, operating equipment. Enclosures, ventilation, and air scrubbing may be required where significant potential for damage is determined by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

In addition to standards described in this Section, comply with all requirements for cleaning up when described in other sections of these Contract Documents.

1.3 QUALITY ASSURANCE

A. INSPECTION

The Contractor shall conduct daily site inspections, and more often if necessary, to verify that requirements are being met.

B. CODES AND STANDARDS

In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. GENERAL

Retain all stored materials and equipment in an orderly fashion allowing maximum access, not impeding drainage or traffic, and providing protection.

Do not allow the accumulation of scrap, debris, waste material, and other items not required for this work.

At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.

Provide adequate storage for all materials awaiting removal from the project site, observing all requirements for fire protection and protection of the environment.

B. SITE

Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, arrange, or otherwise service all arrangements to meet the requirements above.

Maintain the site in a neat and orderly condition at all times so as to meet the approval of the Engineer.

C. STRUCTURES

Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, sweep clean all interior spaces. "Clean" shall be interpreted to mean free from dust and other materials that can be swept with a broom using reasonable diligence.

In preparing to install succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material. Use all equipment and materials required to achieve the required cleanliness.

D. STREETS

All paved and unpaved streets in the vicinity of the project shall be kept free of material tracked from the project site(s) or dropped from vehicles entering and leaving the site(s). The Contractor shall inspect roads in each active area daily, and all material deposited on the road from the Contractor's activities shall be removed prior to the end of the workday. This shall include sweeping, as required, to collect any mud, dirt and dust from the surface. All catch basins and culverts in the work area shall be inspected before completion and cleaned as directed by the Engineer.

3.2 FINAL CLEANING

A. DEFINITION

Except as otherwise specifically provided, "clean" shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance equipment and materials.

B. GENERAL

Prior to final inspection, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final project cleaning as described below.

C. STRUCTURES

1. Exterior

Visually inspect all exterior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior

Visually inspect all interior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only appropriate cleaning materials and equipment.

3. Glass

Clean all glass inside and outside.

D. TIMING

Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean project, ready for occupancy.

***** END OF SECTION *****

SECTION 01800

TESTING, COMMISSIONING, AND TRAINING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems and completed portions of the work.

See also Section 16050 for additional electrical and instrumentation system testing requirements.

The Supplier will provide testing, commissioning, and training for the Membrane Equipment System as specified in Sections 01800 and 11500 of the Procurement of Membrane Equipment System Supply and Services Contract provided in Appendix A of these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01110	Scope of Work
01200	Measurement and Payment
01300	Submittals
01400	Quality Control
01500	Temporary Facilities
01530	Temporary Bypass Pumping
11000	Equipment General Provisions
11500	Membrane System
15050	Piping Systems
15400	Plumbing
15700	HVAC
16050	Basic Electrical Materials and Methods
Appendix A	Procurement of Membrane Equipment and Services

1.3 QUALITY ASSURANCE

A. INSTALLATION

All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the Contract Documents, including the manufacturer's requirements. Should a

manufacturer's installation recommendation conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any additional costs arising out of changes authorized by the Engineer to accommodate manufacturer's installation recommendations will be considered extra work. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

B. TESTING

1. General Requirements

All equipment and partially complete or fully completed portions of the work included in this Contract shall be tested and inspected to prove compliance with the Contract requirements. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor. For the purpose of this Section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic, or hydraulic connection. Installed leakage tests and other piping tests shall be as specified in Sections 15050 and 15400. Installed tests for heating and ventilation systems shall be as specified in Section 15700. Installed tests for electrical and instrumentation devices and systems shall be in accordance with Division 16.

No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

Tests and inspection shall include:

a. The delivery acceptance test and inspections.

b. The installed tests and inspections.

c. The operational testing of completed sections of the facility.

d. Component and System Testing and Initial performance Testing of the Membrane System (see Appendix A, Sections 01800).

e. The commissioning of completed sections of the facility by Owner's personnel. The commissioning shall be performed with the process fluid at normal flows.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers, including the Membrane System Supplier (Kubota). The Contractor shall allow for up to two additional setpoint changes during testing. No extra costs or time allowances shall be provided as long as this setpoint allowance is not exceeded.

The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in their presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms that include all test information, including specified operational parameters. The content of the forms used shall be acceptable to the Engineer.

A master test log book shall be maintained by the Contractor, which shall cover all tests including piping, equipment, electrical, and instrumentation. The master test log book shall be provided with loose-leaf pages that shall be copied weekly after updating for transmittal to the Engineer. The master test log book shall be transmitted to the Engineer upon completion of the Project.

2. Delivery Acceptance Tests and Inspections

The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified herein and shall include the following:

a. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this

Contract. Tests other than those specified shall be in accordance with Section 01400.

b. Inspection of all items delivered at the site or to any authorized place of storage so that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct their inspection. Should the Engineer find, in their opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance.

3. Installed Tests and Inspections

a. General

All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

b. Procedures

i. General

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer, in quintuplicate, details of the installed tests and inspection procedures he proposes to adopt for testing and start-up of all equipment to be operated singly and together, except when such procedures have been covered in the technical specifications.

The procedures shall be divided into two distinct stages; preoperation checkout and water test. Testing procedures shall be designed to duplicate, as

nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Engineer, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.

The Membrane System Supplier will have full responsibility for the performance of the required inspection, startup, testing, training, and commissioning of the Membrane System. The Contractor shall provide coordination with and assistance to the Membrane System Supplier in the performance of these activities.

ii. Pre-operation Checkout

The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation. Preoperation checkout procedures shall include, but not necessarily be limited to:

(1) Piping system pressure testing and cleaning as specified in Division 15.

(2) Electrical system testing as specified in Division 16.

(3) Membrane System testing as described in Appendix A.

(4) Alignment of equipment.

(5) Preoperation lubrication.

iii. Water Test

Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has not found deficiencies in that portion of the work, individual systems, including Component and System Testing of the Membrane System, may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. Test media for these systems shall be water.

The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including temperatures and vibration, to observe performance characteristics, including performance throughout the specified range for blowers and pumps, and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Engineer.

If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests, except repeat of Membrane

System testing, unless the cause of the test failure of the membrane System is determined to be the fault of the Contractor due to Contractor damage to or improper installation of Membrane System equipment of Contractor-furnished equipment required for Membrane System operation.

Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, excessive temperature, noise, and/or vibration or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. All machines or devices, which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.

Test results shall be within the tolerances set forth in the detailed Specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer, and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then, the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be conducted by the Contractor at their expense.

Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all water, power, fuel, compressed air supplies, labor and all other necessary items and work required to complete all tests and inspection specified herein, including Component and System testing of the Membrane System. The Contractor shall provide, at no expense to the Owner, temporary heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

4. Operational Testing

After completion of all installed testing and review by the Engineer that all equipment complies with the requirements of the Specifications, the Contractor shall conduct operational testing. All domestic water, oil, fuel, and chemical systems shall be filled with the specified fluid.

The Contractor shall operate the completed facility for a period of not less than that specified in Part 3.4 of this Section during which all systems shall be operated as a complete facility at various loading conditions, as directed by the Engineer. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

This operation testing shall include the the required 7-day Component and System Test of the Membrane System, as performed by the Membrane System Supplier, with the assistance of the Contractor, as specified in Appendix A, 01800-1.3D.

Record drawings of facilities involved must be accepted and ready for turnover to the Owner at the time of operational testing.

All costs for water, fuel, power, and chemicals required during operational testing, including the Initial Performance Testing of the Membrane System, shall be borne by the Owner.

5. Commissioning

After completion of the operational testing and certifications by the Engineer that the systems meet all performance requirements, commissioning will begin. The commissioning period for all systems shall be 30 days. The Contractor shall remove all temporary piping that may have been in use during the operational testing and shall assist the Owner with the placement of the facility into its fully operational mode handling wastewater. The Owner's operations and maintenance personnel will be responsible for operation of the facility or portion of the facility during this period of time. The facility or portion thereof shall be fully and continuously operational, accepting all normal flow called for in design and performing all functions as designed.

This commissioning period shall include the 7-day Initial Performance Test of the Membrane System, as performed by the Membrane System Supplier, with the assistance of the Contractor, as specified in Appendix A, Section 01800-1.3E.

Contractor shall provide written notice to Owner and Engineer three weeks prior to operational testing of the Phase 1 components and shall allow Owner 3 days prior to beginning commissioning to fill the process tanks with mixed liquor seed from another facility.

The Contractor shall be available, with all appropriate subcontractors and trades, at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested. This assistance shall be available, if needed, on a 24-hour basis. The Engineer will not issue a certificate of Substantial Completion until the end of the commissioning period (including training) and then only when all corrections required by the Engineer and the Membrane System Supplier to assure a reliable and completely operational facility have been complete. Except for the Membrane System, the Contractor shall be responsible for all costs in excess of the Owner's normal expected costs of operations during the commissioning period. Except for the Membrane System, the Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the

portion of the plant being commissioned operational. The Contractor shall only be responsible for the excess operating costs and repair and replacement costs to commission the Membrane System if the Contractor is determined to have caused damage to or improper installation of Membrane System equipment of Contractor-furnished equipment required for Membrane System operation.

The commissioning period will be considered completed when the facility has been continuously operated without major interruption, equipment failure, or system breakdown for the specified commissioning period. A major interruption, failure or breakdown shall be a condition or event that prevents the facility from continuously and adequately handling normal flow, cannot be repaired or corrected immediately by the Contractor, and is not caused by improper operation and maintenance of the facilities by the Owner. An interruption of the commissioning period under these circumstances will require a re-start of commissioning once required repairs and corrections are made by the Contractor. Should the commissioning period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the commissioning shall be repeated until the specified continuous period has been accomplished without interruption.

Final O&M manuals for the facilities must be accepted and ready for turnover to the Owner before the start of commissioning.

C. TRAINING

During the phase of water testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof, except the Membrane System equipment. The time required for this training shall be as covered in the specifications for the specific piece of equipment. The Contractor shall notify the Engineer of the time of the training and submit a detailed outline of training activities to be performed by each manufacturers' representative at least 10 days prior to the start time of the training. The outline shall indicate how the manufacturers' representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

The Membrane System Supplier will be responsible for training the Owner's personnel in the operation and maintenance of Membrane System equipment.

1.4 SUBMITTALS

A. STARTUP AND TESTING PLAN

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer a startup and testing plan with details of the installed tests and inspection procedures he proposes to adopt for testing and startup of all equipment to be operated singly and together.

B. TRAINING OUTLINE

The Contractor shall submit five copies of a detailed outline of training activities to be performed by each manufacturer's representative 10 days prior to the start time of the training. This outline shall indicate how the manufacturer's representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

PART 2 PRODUCTS

2.1 INSTALLATION

Materials employed in the installation shall conform to the requirements of the Contract Documents and the recommendations of the equipment manufacturers, including the Membrane System Supplier.

2.2 TESTING

A. GAUGES, METERS, RECORDERS, AND MONITORS

Gauges, meters, recorders, and monitors shall be provided by the Contractor, except for Membrane System testing, as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Specifications. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to be consistent with the variables to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures

shall be in accordance with applicable standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review by the Engineer.

The Membrane System Supplier will provide the measuring devices required to test the Membrane System.

B. RECORDS

The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract, except Membrane System testing, which will have forms provided by the Membrane System Supplier. Sign-off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preoperation checkout, as well as signatures of representatives of the equipment manufacturers, the Contractor, and the Engineer.

C. TEMPORARY TEST FACLITIES AND MODIFICATIONS

The Contractor shall provide and install all necessary temporary piping, valves, pumps, tanks, controls, and other facilities and modifications to enable the operational testing of the permanent facility components. Operational testing requiring the recirculation of water or process fluids within the facility shall be performed by the Contractor using temporary facilities, if needed, provided and installed by the Contractor. Temporary facilities shall be removed by the Contractor once the required testing is complete.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

3.2 TESTING

Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

During the facility operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable, at conditions, which represent the full range of operating parameters as defined by the Contract Documents.

3.3 TRAINING

Training of the Owner's personnel shall be done by experienced technical manufacturers' representatives. Training shall be provided during a scheduled, dedicated session and shall not be combined with other field services such as equipment testing, startup and check-out. When required by these specifications, the training sessions shall be video and audio-taped by the Contractor and the final DVD delivered to the Owner. These manufacturers' representatives shall follow the outline presented here:

GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS

A. FAMILIARIZATION

1. Overview explaining theory of operation.

2. Show catalog, parts lists, drawings, etc., in the shop drawings and O&M manuals. Clearly identify the model or identification number of the equipment for which training is being provided.

3. Check out the installation of the specific equipment items.

4. Demonstrate the unit and show that all parts of the Specifications are met.

5. Answer questions.

B. SAFETY

1. Point out safety references.

2. Discuss proper precautions around equipment.

C. OPERATION

1. Point out reference literature.

2. Explain all modes of operation (including emergency).

3. Check out Owner's personnel on proper use of the equipment. (Let them do it).

D. PREVENTIVE MAINTENANCE (PM)

1. Pass out PM list including:

a. Reference material.

b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.

2. Show how to perform PM jobs.

3. Show Owner's personnel what to look for as indicators of equipment problems.

E. CORRECTIVE MAINTENANCE

1. List possible problems.

2. Discuss repairs - point out special problems.

3. Open up equipment and demonstrate procedures, where practical.

F. PARTS

1. Show how to use parts list and order parts.

2. Check over spare parts on hand. Make recommendations.

G. LOCAL REPRESENTATIVES

1. Where to order parts: Name, address, telephone, fax, e-mail.

2. Service problems:

a. Who to call.

b. How to get emergency help.

3.4 FACILITY OPERATIONAL TESTING

The systems described below shall be tested to demonstrate the performance of mechanical, electrical, instrumentation and control subsystems together as an integrated system. Where the testing described in this Section conflicts with the testing requirements specified for individual equipment, or the manufacturer's recommended testing procedure, those requirements and procedures shall prevail.

Unless otherwise noted, a time period of 7 days shall be allowed for each facility operational test. Unless otherwise noted, each portion of the facility being operationally tested must perform through its complete design range for a period of 7 consecutive 24-hour days. Facility operational testing shall be sequenced in coordination with the work sequence specified in Section 01110. Temporary facilities necessary for operational testing are specified in Paragraph 2.2 of this Section and in Section 01500. Facility operational testing shall be divided as follows:

A. LIQUID STREAM SYSTEMS

Testing of the liquid stream systems shall include, but not be limited to the influent pump station, equalization basin, influent screens, anoxic basin, aeration basin, membrane basins, membrane system, permeate pumps, return activated sludge (RAS) pump station, UV disinfection system, non-potable water system, outfall, aeration blowers and air diffusion equipment, odor control system, auxiliary generator, and associated electrical control system.

Testing of the Membrane System shall be in accordance with the Initial Performance Test requirements described in Appendix A, Section 01800.

The Contractor shall fill all of the process tanks, RAS pump station, and NPW tank with water prior to operational testing and provide a minimum 2-inch-diameter temporary water supply line and backflow preventer from the existing fire hydrant to the influent pump station and supported above the top of slab elevation to provide a minimum 6" air gap above the wet well top slab. The Contractor shall provide additional influent water as supplied by the NPW pumps via the hose bibs to simulate influent flow rate fluctuations.

B. SOLID STREAM SYSTEMS

Testing of the solid steam system shall include but not be limited to waste activated sludge (WAS) storage tank, WAS pump and associated aeration system and electrical control system.

C. HEATING AND VENTILATING

Testing and balancing of the heating and ventilating systems shall be performed in accordance with Specification Section 15700.

***** END OF SECTION *****

SECTION 01900

SALVAGE AND DEMOLITION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the demolition of existing structures, piping, equipment, and sitework, and the salvage of existing materials and equipment as indicated on the Plans and as specified herein.

All areas and facilities of the existing facility, which are not to be removed, must remain in continuous operation during the work in accordance with Section 01510. Demolition and salvage work shall create a minimum of interference with the operation of the facility.

The Plans show the major items to be demolished and removed. In addition to these items, the Contractor shall remove any other incidental above-grade items which are not to be used in the completed project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01110	Summary of Work
01200	Measurement and Payment
01510	Maintenance of Treatment Facility

1.3 SALVAGE

Salvageable equipment and material shall be removed with care so as not to impair future uses and shall include all equipment and material so indicated on the Plans. Salvaged equipment and material not reused or rejected by the Owner shall be cleaned and protected from corrosion and weather and delivered by the Contractor to the Owner at the wastewater treatment facility.

Reuse of salvageable equipment and material by the Contractor will not be permitted except where specifically indicated on the Plans and in the Specifications or where approved by the Engineer and Owner. Salvageable equipment and materials rejected in writing by the Owner shall become the property of the Contractor and shall be disposed of away from the site without additional cost to the Owner.

The Contractor shall coordinate with the Owner to identify any and all equipment to be salvaged prior to initiating demolition. Among other items that may be selected for salvage by the Owner, the Contractor shall salvage the existing generator, fuel tank, and temporary storage shed. The Contractor shall remove, salvage, load, transport, and offload the existing generator, propane tank, and temporary storage shed at a location determined by the Owner. The delivery location will be within the Taylor Bay Beach Club limits.

1.4 DEMOLITION

The Contractor shall be responsible for compliance with current Owner, County, State, and Federal codes and regulations related to demolition.

The Contractor shall notify all affected utilities and comply with their respective requirements for abandonment of such utilities including power, telephone, natural gas, water, sanitary sewer, and storm sewer utilities.

The Contractor shall maintain access for the Owner's employees during the demolition period and provide barricades, fences, etc., as required for job site safety.

Demolition of concrete, masonry, roofing, asphalt, and other materials shall be done so as to avoid damage to existing structures intended to remain. Demolition or cutting required to add to or modify existing structures shall be done in such a manner that the appearance and utility of the existing structure is not impaired and so that a neat transition from new to old material may occur.

All piping and appurtenances located less than 4 feet below finished grade shall be removed and hauled to an approved disposal site. All piping and appurtenances located four feet or more below finished grade may be abandoned in place, unless shown otherwise on the Plans, as long as Contractor fully seals all pipe and appurtenance openings with grout.

All waste materials from demolition or cutting shall become the property of the Contractor and shall be removed from the site and hauled to an approved waste disposal site, if declared surplus by the Owner. All materials and equipment, however, are property of the Owner unless declared surplus. Some equipment and materials scheduled for salvage and delivery to the Owner are noted on the Plans.

***** END OF SECTION *****

SECTION 01950

TRAFFIC CONTROL

PART 1 GENERAL

1.1 SCOPE

Temporary traffic control refers to the control of all types of traffic, including vehicles, bicyclists and pedestrians (including pedestrians with disabilities). The Contractor, utilizing contractor labor and contractor-provided equipment and materials (except when such labor, equipment, or materials are to be provided by the Owner as specifically identified in the Contract Documents), shall plan, manage, supervise and perform all temporary traffic control activities need to support the work of the Contract.

The Contractor shall provide flaggers, signs, and other traffic control devices not otherwise specified as being furnished by the Owner. The Contractor shall erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices, necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations which may occur on highways, roads or streets. No work shall be done on or adjacent to the roadway until all necessary signs and traffic control devices are in place.

The traffic control resources and activities shall be used for the safety of the public, the Contractor's employees, the Owner's personnel and to facilitate the movement of the traveling public. Traffic control resources and activities may be used for the separation or merging of public and construction traffic when in accordance with a specific approved traffic control plan.

Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices when ordered to do so by the Owner, the Owner may, without further notice to the Contractor or the Surety, perform any of the above and deduct all of the costs from the Contractor's payment.

The Contractor shall be responsible for providing adequate flaggers, signs and other traffic control devices for the protection of the work and the public at all times regardless of whether or not the flaggers, signs, and other traffic control devices are ordered by the Owner, furnished by the Owner, or paid for by the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01160	Regulatory Requirements
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions to the following documents:

Reference	Title
MUTCD	*Manual of Uniform Traffic Control Devices* *Washington State Modifications to the MUTCD* *Quality Guidelines for Temporary Traffic Control Devices*
ANSI 107	*High Visibility Garment Standard*

1.4 TRAFFIC CONTROL MANAGEMENT

A. GENERAL

It is the Contractor's responsibility to plan, conduct, and safely perform the work. The Contractor shall manage temporary traffic control with his or her own staff. Traffic control management responsibilities shall be formally assigned to one or more company supervisors who are actively involved in the planning and management of field Contract activities. The Contractor shall provide the Engineer with a copy of the formal assignment. The duties of traffic control management may not be subcontracted.

The Contractor shall designate an individual or individuals to perform the duties of the primary Traffic Control Supervisor (TCS). The designation shall also identify an alternate TCS who can assume the duties of the primary TCS in the event that person's inability to perform. The TCS shall be responsible for safe implementation of approved Traffic Control Plans provided by the Contractor.

The primary and alternate TCS shall be certified as worksite traffic control supervisors by one of the organizations listed herein. Possession of a current TCS card and flagging card by the primary and alternate TCS is mandatory. A traffic control management assignment and a TCS designation are required on all projects that will utilize traffic control.

The Contractor shall maintain 24-hour telephone numbers at which the Contractor's assigned traffic control management personnel and the TCS can be contacted and be available upon the Engineer's request at other than normal working hours. These persons shall have the resources, ability and authority to expeditiously correct any deficiency in the traffic control system.

B. The duties of the Contractor's traffic control management personnel shall include:

1. Overseeing and approving the actions of the Traffic Control Supervisor (TCS) to ensure that proper safety and traffic control measures are implemented and consistent with the specific requirements created by the Contractor's work zones and the Contract. Some form of oversight shall be in place and effective even when the traffic control management personnel are not present at the jobsite.

2. Providing the Contractor's designated TCS with approved Traffic Control Plans (TCPs), which are compatible with the work operations, and traffic control for which they will be implemented.

3. Discussing proposed traffic control measures and coordinating implementation of the Contractor-adopted traffic control plan(s) with the Owner.

4. Coordinating all traffic control operations, including those of subcontractors, suppliers, and any adjacent construction or maintenance operations.

5. Coordinating the project's activities (road closures and lane closures) with appropriate police, fire control agencies, city or county engineering, medical emergency agencies, school districts, and transit companies.

6. Overseeing all requirements of the Contract, which contribute to the convenience, safety, and orderly movement of vehicular and pedestrian traffic.

7. Having the latest adopted edition of the MUTCD including the Modifications to the MUTCD for Streets and Highways for the State of Washington and applicable standards and specifications available at all times on the Project.

8. Attending all Project meetings where traffic management is discussed.

9. Being present onsite a sufficient amount of time to adequately accomplish the above-listed duties.

C. TRAFFIC CONTROL SUPERVISOR

A Traffic Control Supervisor (TCS) shall be on the Project whenever traffic control labor is required or less frequently, as approved by the Owner.

The TCS shall personally perform all the duties of the TCS. The TCS's duties shall include:

1. Inspecting traffic control devices and nighttime lighting for proper location, installation, message, cleanliness, and effect on the traveling public. Traffic control devices shall be inspected each work shift except that Class A signs and nighttime lighting need to be checked only once a week. Traffic control devices left in place for 24 hours or more should also be inspected once during the nonworking hours when they are initially set up (during daylight or darkness, whichever is opposite of the working hours).

2. Ensuring that corrections are made if traffic control devices are not functioning as required. The TCS may make minor revisions to the approved traffic control plan to accommodate site conditions as long as the original intent of the traffic control plan is maintained and the revision has concurrence of the TCM and/or Owner.

3. Attending traffic control coordinating meetings or coordination activities as authorized by the Owner.

4. Ensuring that all needed traffic control devices are available and in good working condition prior to the need to install those devices.

5. Ensuring that all pedestrian routes or access points, existing or temporary, are kept clear and free of obstructions and that all temporary pedestrian routes or access points are detectable and accessible to persons with disabilities as provided for in the approved plans.

6. Having a current set of approved TCPs and applicable contract provisions as provided by the TCM and the latest adopted edition of the MUTCD including the *Washington State Modifications to the MUTCD* and applicable standards and specifications.

1.5 TCM AND TCS QUALIFICATIONS

The TCM and TCS shall be certified by one of the following:

The Northwest Laborers – Employers Training Trust
27055 Ohio Avenue
Kingston, Washington 98346
(360) 297-3035

Evergreen Safety Council
401 Pontius Avenue N.
Seattle, Washington 98109
(800) 521-0778 or (206) 382-4090

The TCS and all flaggers shall have a current flagging card from the State of Washington, Oregon, or Idaho.

1.6 SUBMITTALS

A. TRAFFIC CONTROL PLAN

The Contractor shall prepare and submit five copies of a Traffic Control Plan(s). All construction signs, flaggers, spotters, and other traffic control devices shall be shown on the traffic control plans. The Contractor shall designate and adopt in writing the specific traffic control plan or plans required for their method of performing the work. The traffic control plan(s) shall be in accordance with the established standards for plan development as shown in the MUTCD, Part VI.

The Traffic Control Plan shall meet the specific requirements of the franchise agreements and right-of-way permits required for this project. In addition, the Traffic Control Plan shall meet the following requirements:

- Maintain two-way traffic.
- Local access and emergency access on local access roads.
- Do not block driveways.

The Contractor, at the end of each day, shall leave the Work area in such condition that it can be traveled without damage to the Work, without danger to traffic, and without one-way traffic control.

Enhancements to improve the effectiveness of the accepted traffic control plans to increase safety of work zones will be discussed between the Contractor and the Contracting Agency as needed. Enhancements shall be mutually agreed upon by the Contractor and the Engineer prior to performing any Work to implement the enhancement. Enhancements do not include the use of Uniformed Police Officers or Washington State Patrol, address changes to allowed work hour restrictions or changes to the staging plans in the Contract (if applicable). If allowed by the Engineer, these items will be addressed in accordance with Section 3.04.6 of the General Conditions. The Contractor shall be responsible for submitting any traffic control plan revision to implement the enhancement.

PART 2 PRODUCTS

2.1 TRAFFIC CONTROL DEVICES

Flagging, signs and all other traffic control devices furnished or provided shall conform to the standards established in the latest WSDOT adopted edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) published by the U.S. Department of Transportation and the *Washington State Modifications to the MUTCD*. Requirements for pedestrian traffic control devices are addressed in the MUTCD.

2.2 CONSTRUCTION SIGNS

All construction signs required by the approved traffic control plan(s) as well as any other appropriate signs prescribed by the Owner shall be furnished by the Contractor. The Contractor shall provide the posts or supports and erect and maintain the signs in a clean, neat, and presentable condition until the necessity for them has ceased. All non-applicable signs shall be removed or completely covered with either metal or plywood during periods when they are not needed. When the need for any of these signs has ceased, the Contractor, upon approval of the Owner, shall take down these signs, post, or supports.

Construction signs will be divided into two classes. Class A construction signs are those signs that remain in service throughout the construction or during a major phase of the work. They are mounted on posts, existing fixed structures, or substantial supports of a semi-permanent nature. Sign and support installation for Class A signs shall be in accordance with the WSDOT Standard Plans. Class A signs shall be designated as such on the Traffic Control Plan. Class B

Construction signs are those signs that are placed and removed daily, or are used for short durations which may extend for 1 to 3 days. They are mounted on portable or temporary mountings.

Tripod-mounted signs in place more than 3 days in any one location, unless approved by the Engineer, shall be required to be post-mounted and shall be classified as Class A construction signs. Where it is necessary to add weight to the signs for stability, sandbags or other similar ballast may be used but the top of the ballast shall not be more than 4 inches above the road surface, and shall not interfere with the breakaway features of the device. The Contractor shall follow the manufacturer's recommendations for sign ballasting.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall provide all labor and equipment to execute the Traffic Control Plan. It is the Contractor's responsibility to plan, conduct, and safely perform the work.

The TCS shall be responsible for safe implementation of approved Traffic Control Plans provided by the TCM.

3.2 TRAFFIC CONTROL LABOR

The Contractor shall furnish all personnel for flagging, spotting, for the execution of all procedures related to temporary traffic control and for setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control traffic during construction operations.

Vests and other high-visibility apparel shall be in conformance with ANSI 107.

Flaggers and spotters shall be posted where shown on the approved Traffic Control Plan. Flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, or Idaho. The flagging card shall be immediately available and shown upon request by the Owner.

During hours of darkness, flagging stations shall be illuminated in a manner that ensures that flaggers can easily be seen but that does not cause glare to the traveling public. Flagger station illumination shall meet the requirements of the MUTCD.

Flaggers shall be equipped with portable two-way radios, with a range suitable for the project. The radios shall be capable of having direct contact wit project management (foreman, superintendents, etc.)

The Contractor shall furnish flagger Stop/Slow paddles conforming to the requirements of the MUTCD, except the minimum width shall be 24 inches.

***** END OF SECTION *****

DIVISION 2

SITEWORK

SECTION 02050

LOCATE EXISTING UTILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the anticipated conflicts, which may exist with existing utilities. A reasonable attempt has been made to locate the existing utilities; however, the exact location, and/or depth are unknown in most instances. Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification. It shall be the responsibility of the Contractor to locate existing utilities and their depth.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
02250	Temporary Shoring and Bracing
02300	Earthwork

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall determine the difficulties to be encountered in constructing the Project and his locate effort based upon the information provided on the Plans, field investigation, and the Contractor's contacts with the existing utility companies. The Contractor shall determine the extent of exploration required to first prevent damage to those existing utilities, and secondly to determine if the proposed improvements are in conflict with existing utilities.

The Contractor shall locate existing utilities sufficiently ahead of construction so that the Engineer can modify the alignment, or grade prior to construction. Where the alignment of the proposed utility cannot be adjusted to miss the existing utility without installation of additional pipe or fittings, the Contractor may be entitled to additional compensation to reroute the proposed utility.

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than 2 nor more than 10 business days before the scheduled date for commencement of excavation that may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project is (800) 424-5555 (or 811). If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of the proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all know facilities in the vicinity of the excavation area have been located and marked.

***** END OF SECTION *****

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the clearing, grubbing, and stripping of the proposed project areas in preparation of foundations, embankment construction, and pipeline installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
02305	Wet Weather Earthwork
02300	Earthwork
02370	Erosion Control

1.3 DEFINITIONS

"Clearing, grubbing, and stripping debris" as hereinafter used shall be considered as all material removed by the clearing, grubbing, and stripping operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Clearing and grubbing debris shall be disposed of by hauling to waste and disposal sites approved by the Owner.

3.2 CLEARING AND GRUBBING

Clearing and grubbing shall be performed as required to complete the work shown on the Plans to a minimum depth of 8 inches in order to remove the root zone of existing vegetation.

This work shall include removal and disposal of all trees, logs, brush, stumps, roots, and minor manmade structures to include but not limited to concrete, asphalt abandoned metal and equipment, rubbish and debris to the limits indicated

on the plans or as required and approved by the owner. This work shall be to a depth necessary to remove stumps, large roots and all other objectionable material. This work shall also include the protection from injury or defacement of trees, bushes, shrubs, and other objects designated to remain.

***** END OF SECTION *****

SECTION 02240

DEWATERING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes dewatering excavations of any kind and location, including but not limited to groundwater, surface water, and precipitation, until backfilling has been completed to finished grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02250	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials

1.3 SUBMITTALS

Prior to the start of construction, the Contractor shall submit a dewatering plan in accordance with Section 01300 containing both a graphical and narrative presentation identifying proposed methods, equipment sizes, and contingency plans should dewatering cause settlement of any adjacent facilities. The dewatering plan shall show specific locations, in plan and section, where dewatering is expected as well as a general discussion of methods to be employed should water be encountered in other locations. The plan shall detail the depth, diameter and anticipated flow for dewatering wells, well points or sumps.

Acceptance by the Owner of the method, installation, and operation and maintenance details submitted by the Contractor shall not in any way be considered to relieve the Contractor from full responsibility for errors therein or from the entire responsibility for complete and adequate design and performance of the system in controlling the water level in the excavated areas, and for control of the hydrostatic pressures to the depths specified herein. The Contractor shall be solely responsible for the proper design, installation, proper operation, maintenance, and any failure of any component of the dewatering system.

1.4 REFERENCES

"Rossum J.R., 1954, *Control of Sand in Water Systems*, Journal American Water Works Association, Volume 46, pp. 123-132"

Construction Stormwater General Permit (GSGP), Washington State Department of Ecology.

Two test borings were drilled on April 12, 2023, as part of the design process for this project. Results from these borings are provided in the Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report, Taylor Bay Sewage Treatment Plant, Associated Earth Sciences, May 20, 2024., in Appendix D. In addition, a 2-inch diameter groundwater monitoring well was installed in the area of the excavation for the process tanks. Results from groundwater monitoring, laboratory testing, slug-testing, and groundwater flow estimations are presented in the technical report in Appendix D.

1.5 QUALITY CONTROL

It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering efforts to avoid all objectionable settlement and subsidence. The Contractor shall comply with local codes and ordinances of governing authorities with regard to disposal of water pumped from dewatering operations.

Proposed discharge points shall be approved by the Owner prior to implementation of dewatering. The Contractor shall be responsible for taking all reasonable precautions necessary to ensure continuous, successful operation of the system.

PART 2 PRODUCTS

Dewatering shall be in accordance with the guidance stated in the Geotechnical Report for this Project.

The Contractor shall have sufficient pumping equipment and/or other machinery available onsite before operations begin to assure that the operation of the dewatering system can be maintained. This shall include providing backup pumps of similar capacity and a standby generator of the capacity required to continuously operate the Contractor's dewatering system.

PART 3 EXECUTION

3.1 INSTALLATION AND APPLICATION

During excavation, the installation of piping, conduits and structures and during the placing of backfill, excavations shall be kept free of water, subsurface or otherwise. The Contractor shall furnish all equipment necessary to dewater the excavations and shall dispose of the water so as not to cause a nuisance or menace to the public. The dewatering system shall be installed and operated by the Contractor so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. The release of groundwater to its static levels shall be performed so as to maintain the undisturbed state of the foundation soils, prevent disturbance of backfill and prevent movement of all structures and pipelines.

Design implementation and maintenance of any dewatering system shall be the responsibility of the Contractor.

The Contractor shall construct all dewatering wells in accordance with WAC 173-160. The dewatering system shall be sufficient to maintain the groundwater level at an elevation to protect the surface of the trench bottoms, the base of the bedding course or other foundation, and shall be accomplished prior to pipe laying and jointing or placement of reinforcing steel for concrete.

If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavations.

The Contractor shall design filters and screen slot sizes for all sumps, wells and well points which prevents the movement of fines during pumping. The Contractor shall develop the wells such that they produce no more than 10-ppm silica as measured with a Rossum Sand Tester (Rossum, 1954) or equivalent.

The Contractor shall discharge all groundwater (as required) and stormwater to Baker Tanks or polyethylene storage tanks with a minimum volume of 5,000 gallons with a gravity overflow or pump overflow of clean water to the existing outfall at all times until the new outfall is complete and operational and all excavation dewatering activities are complete. Per the Construction Stormwater General Permit (GSGP) Section S9.D.10, if wellpoints are used for dewatering, the discharge from the wellpoints can be discharged directly into surface water, and therefore may be directly discharged to the existing outfall. Contractor shall remove sediment from the storage tank when the sediment layer is 1/4 of the tank side water depth. Contractor shall provide and install all

required piping and pumping to discharge clean water to the existing outfall until the permanent systems are operational. The Contractor shall connect the temporary dewatering Baker Tank overflow to a new wye connection to the existing outfall piping, downstream of the existing UV disinfection system. When testing and commissioning of the new effluent piping and outfall are complete, site stormwater can be directed to the new outfall via the new stormwater filter manhole. When site dewatering operations are complete, the contractor shall remove all temporary piping and the connection to the existing outfall. See Specification Section 02370 for stormwater discharge monitoring requirements.

3.2 MONITORING

The Contractor shall install water level observation wells in dewatered areas sufficient to determine whether groundwater levels are maintained as per Part 3.1 of this Section.

3.3 FIELD QUALITY CONTROL

A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. The Contractor shall test all dewatering discharge using a Rossum Sand Tester or equivalent to determine the silica content of the discharge. The Contractor shall notify the Owner at least 24 hours prior to testing. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement that could develop.

Should settlement be observed, the Contractor shall cease dewatering operations and implement contingency plans as outlined in the Contractor's approved dewatering plan. The responsibility for conducting the dewatering operation in a manner that protects adjacent structures and facilities rests solely on the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor. Permanent piping systems, existing or new, shall not be incorporated into the Contractor's dewatering system.

***** END OF SECTION *****

SECTION 02250

TEMPORARY SHORING AND BRACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary shoring and bracing for excavations including the trench excavation safety systems as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02511	Connection to Existing System
02530	Utility Structures
15050	Piping Systems

1.3 SUBSURFACE CONDITIONS

Two test borings were drilled on April 12, 2023, as part of the design process for this project. Results from these borings are provided in the Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report, Taylor Bay Sewage Treatment Plant, Associated Earth Sciences, May 20, 2024., in Appendix D. In addition, a 2-inch diameter groundwater monitoring well was installed in the area of the excavation for the process tanks. Results from groundwater monitoring, laboratory testing, slug-testing, and groundwater flow estimations are presented in the technical report in Appendix D.

1.4 WORK INCLUDED

The extent of temporary shoring and bracing work includes, but is not limited to:

A. Temporary shoring and bracing necessary to protect the following against loss of ground or caving embankments: existing structures, buildings, roads, walkways, utilities, electrical transmission towers and support wiring, other facilities and improvements where required to comply with codes and authorities having jurisdiction.

B. Trench excavation safety systems, pursuant to RCW Chapter 49.17 and WAC 296-155-655.

C. Maintenance of shoring and bracing.

1.5 QUALITY ASSURANCE

A. SHORING CONSULTANT

The Contractor shall engage the services of a qualified geotechnical engineer and qualified structural engineer registered in the State of Washington to design temporary shoring and bracing when required by applicable regulations.

B. REGULATIONS

The Contractor shall design sheeting, shoring and bracing in accordance with the Washington State Safety Code and any local codes and ordinances of governing authorities having jurisdiction. Pile driving will not be allowed on the site; drilling shall be required for all required piles.

1.6 SUBMITTALS

A submittal will be required for temporary shoring and bracing if the trench depth exceeds 4-feet and a certified trench box and/or back sloping/benching is not used.

If required, the Contractor shall submit the following project specific information to the Owner for review in accordance with Section 01300 prior to the start of construction.

A. Shoring and bracing design drawings, calculations, and backup data prepared, stamped, dated, and signed by a Professional Engineer registered in the State of Washington.

B. A shoring and bracing plan including a graphical and narrative presentation identifying the method(s), equipment, and contingency measures proposed to provide temporary shoring and bracing in compliance with applicable regulatory requirements.

1.7 PROJECT CONDITIONS

A. SITE SURVEY

The background survey information provided on the Plans is shown for clarity only. The Contractor shall determine, before commencing work, the exact location of all existing features that may be disrupted by new

construction, including existing underground utilities. The Contractor shall be fully responsible for any and all damages, which might be caused by the Contractor's failure to exactly locate and/or preserve existing site features. Prior to commencing work, the Contractor shall check and verify governing dimensions and elevations.

The Contractor shall survey adjacent structures and facilities, establishing exact elevations at fixed points to act as temporary bench marks to monitor potential settlement from the contractor's ongoing operations. Clearly identify temporary bench marks and record existing elevations from the control points shown on the Plans.

During excavation, the Contractor shall resurvey bench marks weekly. The Contractor shall maintain and make available at the job site an accurate log of surveyed elevations for comparison with original elevations, and promptly notify the Owner if changes in elevations occur or if cracks, sags or other damage is evident.

1.8 EXISTING UTILITIES

The Contractor shall protect existing active sewer, water, gas, electrical, and other utility services and structures that may be present. This shall also include all pipelines, services, and structures that are the property of the Owner.

PART 2 PRODUCTS

The Contractor shall provide suitable shoring and bracing materials, which shall support loads imposed. Materials for shoring systems need not be new, but shall be in serviceable conditions.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

The Contractor shall notify the Owner immediately if, during construction, subsurface conditions are different from those encountered in the exploratory holes.

3.2 INSTALLATION AND APPLICATION

The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The Contractor shall locate required bracing to clear all permanent work. Bracing which must be relocated shall be installed prior to the removal of original bracing. The Contractor shall not place bracing where it will

be cast into or included in permanent concrete work, except as otherwise acceptable to the Owner. The Contractor shall maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.3 REMOVAL

The Contractor shall remove shoring and bracing in stages to avoid disturbances to adjacent and underlying soils and damage to structures, pavements, facilities and utilities. The Contractor shall repair or replace, as acceptable to the Owner, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

3.4 EXCAVATION SAFETY SYSTEMS

All work shall be carried out with due regard for public safety. Open trenches shall have proper barricades and at night they shall be distinctly indicated by adequately placed lights, as provided for elsewhere in the Specifications.

The Contractor is reminded that the Owner has not so delegated, and the Owner's Representative does not purport to be a trench or excavation system safety expert, is not so engaged in that capacity under this Contract, and has neither the authority nor the responsibility to enforce construction, safety laws, rules, regulations, or procedures or to order the stoppage of work for claimed violations of trench or excavation safety.

The furnishing by the Owner of resident representation and inspection personnel shall not make the Owner responsible for the enforcement of such laws, rules, regulations, or procedures, nor shall such make the Owner responsible for construction means, methods, techniques, sequences, procedures, or for the Contractor's failure to properly perform the work necessary for proper trench and excavation safety.

***** END OF SECTION *****

SECTION 02275

GEOTEXTILE FABRIC

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes providing and installing a geotextile fabric to separate two dissimilar aggregate and/or soil materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02250	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials

1.3 SUBMITTALS

The Contractor shall submit a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile in accordance with Section 01300. The Certification shall be attested to by a person having legal authority to bind the Manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

Geotextiles labeling, shipment, and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.

Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.

During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess

temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.

PART 2 PRODUCTS

2.1 GEOTEXTILE FABRIC

The Geotextile fabric shall meet the requirements of section 9-33 of the WSDOT standard specifications.

Underground drainage fabric for drywells and other underground drainage shall be Moderate Survivability and at least Drainage Class C.

Geotextile for soil separation, soil stabilization or reinforced slopes and retaining walls shall be woven.

Permanent erosion control applications shall be High Survivability and Drainage Class C.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The geotextile shall be installed per Section 2-12 of the WSDOT Standard Specifications.

3.2 SITE SPECIFIC REQUIREMENTS

The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of traffic. Adjacent geotextile rolls shall be overlapped, sewn or joined as required. See table below for overlap requirements.

Soil CBR(1)	Method of Joining
Greater than 3	12 - 18 in. overlap
1 – 3	24 - 40 in. overlap
0.5 – 1	40 in. overlap or sewn
Less than 0.5	Sewn
All roll ends	40 in. overlap or sewn

(1) Where CBR is the California Bearing Ratio. A CBR value of 3 is approximately equal to soil shear strength of 90 kPa.

On curves, the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of traffic and held in place by pins, staples, or piles of fill or rock.

Prior to burying, the geotextile shall be inspected by the Owner to ensure that the geotextile has not been damaged during installation. All damaged areas shall be repaired. Damaged areas shall be covered with a geotextile patch which extends an amount equal to the required overlap beyond the damaged area.

The subbase above the fabric shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed subbase aggregate. Construction vehicles shall not be allowed directly on the geotextile. The subbase shall be placed such that at least the minimum specified lift thickness shall be between the geotextile and equipment tires or tracks at all times. Turning of vehicles shall not be permitted on the first lift above the geotextile.

On subgrades having a California Bearing Ratio value of less than 1, the sub base aggregate shall be spread in its full thickness as soon as possible after dumping to minimize the potential of localized subgrade failure due to overloading of the subgrade.

Any ruts occurring during construction shall be filled with additional subbase material, and compacted to the specified density.

If placement of the backfill material causes damage to the geotextile, the damaged area shall be repaired as previously described above. The placement procedure shall then be modified to eliminate further damage from taking place.

***** END OF SECTION *****

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the earthwork, including trench excavation and backfill for piping, excavation and backfill for structures, and finish grading.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
02240	Dewatering
02250	Temporary Shoring and Bracing
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials
02710	Gravel Surfacing
02900	Landscaping

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to Section 02700.

PART 3 EXECUTION

3.1 PREPARATION

Excavation may commence once all erosion control measures are in place in accordance with the Plans and Section 02370 and to the satisfaction of the Owner.

3.2 GENERAL REQUIREMENTS

Excavation, compaction and backfill for structures, pipelines and the final site contours shall be formed by either excavating or compacting fill, as required, to provide the cross-sections as shown on the Plans.

All excavation performed on this Project shall be considered unclassified. Excavation shall consist of the removal of any and all material encountered, including debris, rubble, concrete, metal, topsoil, cutting and removal of existing surfacing, tree stumps, trees, logs, abandoned rail ties, abandoned piping, piling, riprap, etc.

Excavations shall be kept free of water, both surface water and groundwater, during the excavation, installation of pipelines and structures, and the placement of backfill. For additional requirements see Section 02240.

The Contractor's attention is also called to the depth of the structures and piping; for this reason, special shoring and bracing may be required. All shoring and bracing or sheeting required to perform and protect the excavation and to safeguard the employees, shall be furnished by the Contractor. For additional requirements see Section 02250.

No timber bracing, lagging, sheathing or other lumber shall be left in any excavation except with permission of the Engineer and in the event such permission is granted, no separate payment shall be allowed for burying such material.

All stockpiles shall be covered with plastic and no stockpile shall be higher than 6 feet above existing grade.

The size or type of construction equipment shall be selected as required to prevent soil disturbance. In some instances, it may be necessary to limit equipment size or to excavate soils with a backhoe, Gradall, or equivalent type of equipment to minimize subgrade disturbance caused by construction traffic.

3.3 EXCAVATION AND BACKFILL FOR STRUCTURES

Excavation and backfill for structures shall be in conformance with Section 2-09 of the WSDOT Standard Specifications, and as further described herein. All excavation for structures shall be done to the dimensions and levels indicated on the Plans or specified herein. Excavation shall be made to such width outside the lines of the structures to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

Excavation shall consist of the removal of any and all material encountered to the elevations shown on the Plans. Excavations for structures shall be continued down to the subgrade which is defined as 24 inches below concrete mat foundations, concrete footings, and slab on grade floors for the installation of foundation gravel material, unless otherwise noted on the Plans.

Fill material placed under structures, including footings and floor slabs, shall be foundation gravel free from debris and organics, as specified in Section 02700.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be under the unit price bid item entitled "UNSUITABLE EXCAVATION," as described in Section 01200. The Contractor shall then replace the material with compacted crushed surfacing base course, as specified in Section 02700. Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

The Contractor shall notify the Engineer when excavation for compacted fill or structures is complete. No forms, reinforcing steel, or concrete shall be placed until the excavation has been inspected by the Engineer.

Backfill for structures shall be suitable native material, free of organics and particles greater than 4 inches or Gravel Backfill for Walls as specified in Section 02700.

There is no warranty that the native material is suitable for backfill or is suitable, as excavated, for placement and compaction as required by these Specifications. In the event that the Contractor is unable to find onsite, sufficient native material to accomplish the structure backfilling, the select material that he shall furnish and install shall be Structural Fill, as specified in Section 02700.

3.4 PROTECTION OF FOUNDATION SURFACES

Care shall be taken to preserve the foundation surfaces shown on the Plans in an undisturbed condition. If the Contractor unnecessarily over excavates or disturbs the foundation surfaces shown on the Plans or specified herein without written authorization of the Engineer the Contractor shall replace such foundations with concrete fill or other suitable material approved by the Owner in a manner which will show by test an equal bearing capacity with the undisturbed foundation material. No additional payment shall be made for the added quantity of concrete fill or other suitable material used because of unnecessary over excavation caused by the Contractor or their operations.

3.5 EXCAVATION AND BACKFILL FOR TRENCHES

Excavation and backfill for trenches shall be in conformance with Sections 7-08 and 7-09 of the WSDOT Standard Specifications, and as further described herein. The following pipe materials shall be considered flexible:

- PVC

- Polyethylene Tubing
- FRP
- HDPE
- Polyethylene
- Corrugated Polyethylene

All other pipe materials shall be considered rigid.

Upon completion of work each day, all pipeline open trenches shall be completely backfilled, leveled, and temporarily patched or graveled, as herein specified. Under certain conditions, the trench may be left open at the last length of pipe laid during the day to avoid re-excavation the following morning, provided that the opening is adequately plated or covered for vehicle traffic. Special attention shall be given to barricading to keep vehicular traffic away from newly-backfilled trench areas until restored for traffic.

The Engineer reserves the right to restrict the Contractor in the amount of trench for pipeline that can be opened during the working day. Should the Contractor, in the Engineer's opinion, fail to diligently pursue backfilling, an allowable limit of open trench shall be 100 lineal feet and shall be strictly enforced.

The width of the trench at or below a point 12 inches above the top of the outside diameter of the pipe shall be carefully controlled and maintained to ensure the strength of the pipe and prevent pipe failures. Backfilling shall proceed as follows:

A. SUBGRADE PREPARATION

The subgrade for piping is defined as the elevation of the bottom of the pipe bedding material as shown on the Plans.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be paid for under the unit price bid item entitled "UNSUITABLE EXCAVATION," as found in the Proposal. The Contractor shall then replace the material with Gravel Backfill for Pipe Bedding, as specified in Section 02700.

Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

B. BEDDING FOR RIGID PIPE

Above the foundation material, if any, the bedding material shall be suitable native or Gravel Backfill for Pipe Bedding, as specified in Section 02700. This material shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

C. BEDDING FOR FLEXIBLE PIPE

Above the foundation material, if any, Gravel Backfill for pipe bedding, as specified in Section 02700, shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

D. BACKFILL FOR TRENCHES

Partial backfill to protect the pipe will be permitted immediately after the pipe has been properly laid in accordance with the Plans and these Specifications. Complete backfilling of trenches will not be permitted until the section of pipe installed has been inspected by the Engineer.

From the point 12 inches above the top of the pipe barrel, the backfill material to be used in the trench section shall be suitable native material or Structural Fill, as specified in Section 02700, except where required or shown on the Plans to use other material. The Contractor shall place backfill in horizontal lifts not to exceed 8 inches in thickness. All backfill shall be free of large rocks, organic matter, stumps, trees, pieces of pavement, broken concrete and other deleterious substances.

The Contractor shall remedy, at their expense, any defects that appear in the backfill prior to final acceptance of the work. Cleanup operations shall progress immediately behind backfilling to accommodate the return to normal use of the trench area.

During placement of the initial lifts, the backfill material shall not be bulldozed into the trench or dropped directly over the pipe with less than 3 feet of backfill material above the top of the pipe.

3.6 ROCK EXCAVATION

It is not anticipated that solid rock will be encountered. Should such material be encountered, however, it will be paid for change order as directed by the Engineer and approved by the Owner. Boulders or broken rock less than 2 cubic yards in volume as measured in the field by the Engineer, will not be classified as rock,

nor will so-called “hard-pan” or cemented gravel, even though it may be advantageous to use explosives in its removal if blasting were allowed. For the purpose of this contract, rock excavation shall be defined as mineral matter in place and of such hardness and texture that, when it is encountered, cannot be loosened by three passes of a ripper tooth mounted on the larger of a tracked backhoe of at least 25,000 pounds operating weight and 75 horsepower or the largest backhoe being utilized on the job by the Contractor. Where rocks occur as boulders that are smaller than the larger of: (1) 2 cubic yards in volume, or (2) the volume that can be readily handled by the largest backhoe being utilized on the job by the Contractor, they shall be considered incidental to excavation.

Where removal of a boulder results in a void below the desired elevation of the intended excavation, backfilling of the void shall be handled in the same manner as the replacement of unsuitable excavated material.

3.7 REUSE AND DISPOSAL OF EXCAVATED MATERIAL

Excavated materials shall be properly protected and reused where possible. Excavated materials not used for fill shall be hauled to an approved waste site(s), as selected by the Contractor. The Contractor shall submit a list of approved waste haul site(s) to the Owner prior to the commencement of hauling of waste materials. Any permits required for waste haul and disposal shall be the responsibility of the Contractor.

3.8 FINAL SITE GRADING

The site shall be graded consistent with the elevations shown on the Plans. The slopes between elevations shall be uniform or as shown on the Plans. Excavations and backfill shall be to the elevations required for the placement of all surface restorations, such as asphalt, concrete, gravel surfacing, or landscaping. All areas shall be graded to provide proper drainage. The final ground surface shall be smooth, raked free of debris and stones, and prepared for restoration as specified in Section 02900.

3.9 STRUCTURE COMPACTION

The foundation gravel material placed underneath all structures shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers. The thickness of layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand-operated mechanical compactors. Water settlement is not allowed for compaction.

Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Prior to

the placement of fill below structures, any and all groundwater and surface water shall be drained or pumped from areas to be filled.

Wall backfill material shall be compacted to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 within 5 feet of all walls and shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 beyond 5 feet of all walls. Any and all compaction within 5 feet of all walls shall be accomplished by means of hand-operated mechanical equipment rather than heavy equipment compactors.

3.10 TRENCH COMPACTION

Trench backfill materials shall be moisture conditions to within three percent of optimum moisture content. Water settlement is not allowed for compaction.

Pipe bedding materials, for both rigid and flexible pipes, shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in non-structural and non-paved areas shall be performed by using mechanical equipment to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in structural or paved areas shall be performed by using mechanical equipment to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

***** END OF SECTION *****

SECTION 02305

WET WEATHER EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the procedures to be followed if earthwork is to be accomplished in wet weather or in wet conditions where control of soil moisture is difficult.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02370	Erosion Control
02700	Gravel Materials

PART 2 PRODUCTS

The size or type of construction equipment shall be selected as required to prevent soil disturbance. In some instances, it may be necessary to limit equipment size or to excavate soils with a backhoe, Gradall, or equivalent type of equipment to minimize subgrade disturbance caused by construction traffic.

Material used as structural fill during wet weather earthwork shall generally consist of clean granular material containing less than 5 percent fines (material passing the U.S. Standard No. 200 sieve), based on wet sieving the fraction passing the 3/4-inch sieve. The fines shall be non-plastic.

PART 3 EXECUTION

3.1 WET WEATHER EXCAVATION AND FILL PLACEMENT QUALITY CONTROL

Excavation and placement of fill or backfill material will be observed on a full-time basis by the Owner, to determine that all work is being accomplished in accordance with these Specifications.

3.2 WET WEATHER EARTHWORK PROTECTION

The ground surface shall be sloped away from construction areas to promote the rapid runoff of precipitation and prevent ponding of water.

Earthwork shall be accomplished in small sections to minimize exposure to wet weather. Excavation or the removal of unsuitable soil shall be followed immediately by the placement and compaction of a suitable thickness (generally 8 inches or more if approved by the Owner) of clean foundation gravel.

No soil shall be left uncompacted and exposed to moisture. A smooth drum vibratory roller, or equivalent, shall be used to seal the ground surface after placement of fill or backfill materials.

All wet weather work shall meet local, state and federal codes as specified herein and as indicated on the Plans.

***** END OF SECTION *****

SECTION 02370

EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary erosion and sedimentation control (TESC) in and around the site caused by the actions of the Contractor as shown on the Plans and as specified herein.

Work under this Section shall be directed towards site areas disturbed during construction as well as all off-site storage and parking areas maintained by the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02300	Earthwork

1.3 SUBMITTALS

A. A Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP shall be prepared by the CESCL for the Project and submittal in accordance with Section 01300 and paragraph 1.5 of this Section. The SWPPP shall be submitted to the Owner for approval at the preconstruction conference.

1.4 CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)

The Contractor shall designate a Certified Erosion and Sediment Control Lead (CESCL) for this Project. The CESCL shall have, for the life of this Contract, a current Certificate of Training in Construction Site Erosion and Spill Control signed by the WSDOT Water Quality Program Manager.

Duties of the CESCL shall include, but are not limited to:

A. Inspecting temporary erosion and spill control Best Management Practice (BMPs) for proper location, installation, maintenance, and repair. Inspections shall be made as noted on the Plans and after each significant precipitation event, including those that occur during weekends and after working hours. A Temporary Erosion and Spill Control Inspection Report shall be prepared for each inspection and shall be included in the Temporary Erosion and Spill Control file. The inspection report shall include, but not be limited to:

   1. When BMPs are installed, removed or changed;

   2. Repairs needed or made;

   3. Turbidity monitoring results;

   4. Observations of BMP effectiveness and proper placement;

   5. Recommendations for improving performance of BMPs.

B. Prepare and maintain a Temporary Erosion and Spill Control file on site that includes but is not limited to:

   1. Temporary Erosion and Spill Control Inspection Reports;

   2. Contractor's SWPPP;

   3. Spill Prevention, Control, and Countermeasures (SPCC) Plan;

   4. All project permits, including but not limited to grading permits and Hydraulics Project Approval;

   5. Manufacturer instructions for all products used for TESC BMPs;

   6. Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Chapter 4, Volume II, current edition.

1.5 STORMWATER POLLUTION PREVENTION PLAN

The CESCL Contractor shall be responsible for preparing a SWPPP. The intent of the SWPPP is to reflect the Contractor's operations by supplementing the TESC Drawings, details, and notes shown on the Plans to provide comprehensive pollution control at the construction site, staging areas, stockpiles, and borrow

sites. The SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300. The SWPPP shall be submitted to the Owner for approval at the preconstruction conference. **No work shall begin until the Contractor's SWPPP, as approved by the Owner, is implemented.** The SWPPP shall address, at least, the following items:

- Identification of construction haul routes and location of BMPs (e.g., stabilized construction entrance, silt fences, storm drain inlet protection).
- Waste disposal methods and locations.
- Detailed construction sequence and schedule, including identifying dates scheduled for BMP installation, removal, clearing, grading, seeding, and landscaping.
- Details for any temporary flow diversions, dewatering systems, and BMPs (in accordance with the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington) proposed by the Contractor.
- Calculations for temporary sedimentation ponds, if used
- A list of products to be used, including Material Safety Data Sheets.
- Identification of stockpile and staging areas, and BMPs to be implemented at these locations.

The SWPPP shall be prepared in accordance with details shown on the Plans, these Specifications, and Volume II, Chapter 4 – BMPs from the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington, which are hereby referenced and made a part of the Contract Documents. Only those sections of the Stormwater Management Manual for Western Washington that address preparation, implementation, and maintenance of permanent and temporary erosion and sedimentation control BMPs are applicable.

The SWPPP shall include best management practices to control windblown dust.

The Contractor shall discharge all stormwater (and dewatering water not collected via well points) to Baker Tanks or polyethylene storage tanks with a minimum volume of 5,000 gallons prior to gravity overflow or pump overflow of clean water to the existing outfall at all times until the new outfall is complete and operational and all excavation dewatering activities are complete. The CESCL shall conduct monitoring and reporting including turbidity/transparency sampling and testing of the discharge per the Construction Stormwater General Permit

(GSGP). If the discharge from the tanks does not meet the turbidity/transparency standards, the Contractor shall haul the water offsite to an approved facility.

PART 2 PRODUCTS

2.1 SILT FENCES

Silt fences shall conform to the details shown on the Plans and the fabric shall conform meet the requirements of Geotextile for Temporary Silt Fence of Section 9-33 of the WSDOT Standard Specifications.

2.2 STORM DRAIN INLET (CATCH BASIN) PROTECTION

Storm drain inlet protection shall be with a "silt sack," as manufactured by ACF Environmental or equal.

2.3 EROSION CONTROL BLANKET

On all disturbed slopes steeper than 2H:1V, an erosion control blanket shall be placed and secured per manufacturer's recommendation with a biodegradable means.

The erosion control blanket shall be temporary, biodegradable and is to remain in place.

The erosion control blanket shall be "Biomac C" as manufactured by MacCaferri, Inc. or "Curlex II," as manufactured by American Excelsior Co., or Equal.

PART 3 EXECUTION

3.1 PREPARATION

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped.

3.2 BEST MANAGEMENT PRACTICES (BMPS)

Silt fences shall be constructed to control erosion and migration of soils disturbed during construction. The fences and dams shall provide temporary protection and shall be removed only upon approval of the Owner.

All areas or drainage ways downstream of the construction site shall have Best Management Practices (BMPs) installed prior to the beginning of any clearing activities. Runoff from cleared or disturbed area shall be directed through the

BMPs. Disturbed ground shall be stabilized at the end of each work day. Permanent soil stabilization and erosion and sedimentation control shall be implemented upon reaching finish grade. Slope protection shall be immediately implemented upon any soils showing signs of erosion. This shall be done in a manner approved by the Owner.

All BMPs shall be inspected, maintained and kept in a condition sufficient to provide effective erosion and sedimentation control at all times. The site shall be inspected to ensure the BMPs are properly located, constructed and operating as designed during the first storm. Any necessary adjustments or repairs shall be made immediately and be approved by the Owner. The BMPs shall be inspected thereafter as noted on the Plans and after all significant storm events. Turbidity monitoring will be held on a weekly basis at a minimum, or more frequently if necessary as determined by the CESCL.

All BMPs shall be removed no later than 30 consecutive calendar days after final site stabilization has been achieved as determined by the Owner. BMPs such as storm drain inlet protection, straw bales, silt fences and supports and plastic coverings shall be removed and properly disposed of offsite by the Contractor. Areas disturbed by removal of these BMPs shall be immediately stabilized in a manner approved by the Owner.

***** END OF SECTION *****

SECTION 02530

UTILITY STRUCTURES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes precast concrete vaults, manholes, catch basins, castings, and steps for a complete installation as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
08310	Access Hatches

PART 2 PRODUCTS

2.1 GENERAL

The exterior finish of all precast concrete utility structures shall be smooth with no imperfections larger than 1/8 inch in diameter. The interior finish of all precast concrete utility structures shall be smooth and sacked with non-shrink cementitious materials and epoxy bonding agent. No bug holes, fins, projections, or other defects are acceptable.

2.2 PRECAST VAULTS

Precast concrete vaults shall be cast in an established precast yard. Precast vaults shall be designed for H-20 loads. Submit design calculations and shop drawings for review and approval prior to fabrication. Shop drawings shall detail wall thickness, concrete strength, reinforcing requirements, and shall include all appurtenances, such as access hatches, floor drains, and other items called for on the Plans.

All vaults shall be constructed with a minimum of 4-inch-thick solid walls.

The access hatches shall be as specified in Section 08310.

2.3 PRECAST CONCRETE MANHOLES

Precast components shall conform to the requirements of ASTM C478. All Portland cement used in the manufacture of the precast sections shall conform to the requirements of ASTM C150 and shall be Type II or Type V.

Precast base sections shall conform to the requirements for precast riser sections. The base shall be a minimum of 6-inches thick underneath the pipe invert. Openings for pipe shall be circular, tapered toward the inside of the section, and shall be of the minimum size possible to accommodate the size of pipe to be inserted and to effectively seal the joint.

Standard precast riser sections shall consist of circular sections in standard nominal inside diameter as shown on the Plans. Reinforcement shall be in accordance with ASTM C478. Minimum height of a riser section shall be 1 foot. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

The taper section (cone) shall be eccentric, tapering to 24-inches inside diameter and shall be between 18-inches and 36-inches high. Joining to the riser sections shall be similar to joining between riser sections, but the top surface shall be flat and at least 5-inches wide, radially, to receive grade rings.

Grade rings above the taper section shall be 24-inches inside diameter and 4-inches high. Grade ring height shall be a minimum of 8 inches, with a maximum of 20 inches. Otherwise another section of manhole rings shall be installed.

2.4 RINGS AND COVERS

Castings for manhole rings shall be gray-iron conforming to the requirements of ASTM A48/AASHTO M105, Grade 30B. Covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06. All rings and covers shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks, or other defects. Repair of defects shall not be permitted. All mating surfaces shall be machined finished to ensure a nonrocking fit. All covers shall be interchangeable within the dimensions as shown on the Plans and marked "sewer," "drain," or "water" as appropriate. Locking/tamperproof covers shall be secured to the ring with three 5/8-inch stainless steel Allen head cap screws. When watertight covers are required the locking style ring and covers shall be used and include a machined groove in the seat of the ring or underside of the cover and a gasket installed to assure a watertight seal. Covers shall be without pickholes. The manufacturer's identification shall be cast with a minimum of 1/2-inch letters on exposed surfaces. Manhole rings and covers shall have a design wheel load conforming to AASHTO/ASTM A16 design loading HS20-44.

The frames and covers shall be made by Olympic Foundry, Inc., D&L Foundry, East Jordan Iron Works, or Neenah.

2.5 STEPS

Polypropylene manhole steps shall be made of a copolymer polypropylene, superior in its resistance to corrosion, meeting the requirements of ASTM D4101 Type II, Grade 16906, and shall completely encapsulate a deformed 1/2-inch steel reinforcing rod conforming to ASTM A615, Grade 60. Polypropylene steps shall be factory installed in complete accordance with the manufacturer's instructions. This shall be accomplished by predrilling two parallel 1-inch holes, 3-3/4-inch deep, and 13-inches on center in the cured concrete base, riser, and taper sections of the manhole. The insertion ends of the step shall be fully coated with non-shrink epoxy grout then driven into the holes to the prescribed depth. In no case will the predrilled hole be allowed to penetrate through the wall of the manhole section.

Steps shall be Lane International Corporation Manhole Step or equal.

2.6 PRECAST CONCRETE CATCH BASINS

Precast components shall conform to the requirements of ASTM C478. All Portland cement used in the manufacture of the precast sections shall conform to the requirements of ASTM C150 and shall be Type II or Type V.

Thickness of a Type 1 catch basin shall be 4 inches minimum and reinforced with welded wire fabric having a minimum area of 0.12 square inches per foot. Welded wire fabric shall comply with ASTM A497. "Knockouts" shall be free of welded wire fabric and provided on four sides to accommodate the pipe size, invert elevations, and direction as shown on the Plans.

Standard precast riser sections shall consist of rectangular sections to accommodate a Type 1 catch basin. Reinforcement shall be in accordance with ASTM C497. Minimum height of a riser section shall be 6 inches. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

Precast base sections for Type 2 catch basins shall conform to the requirements for precast riser sections. The base shall be a minimum of 6-inches thick underneath the pipe invert. Catch basins Type 2 shall contain steps in accordance with Section 2.5.

Standard precast riser sections shall consist of circular sections in standard nominal inside diameter as shown on the Plans. Reinforcement shall be in accordance with ASTM C478. Minimum height of a riser section shall be 1 foot. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

Openings for pipe shall be circular, tapered toward the inside of the section, and shall be of the minimum size possible to accommodate the size of pipe to be inserted and to effectively seal the joint.

2.7 FRAMES AND GRATES

Castings for catch basin and inlet frames shall be gray-iron conforming to the requirements of ASTM A48/AASHTO M105, Grade 30B. Grates or solid covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06. All frames and grates or covers shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks, or other defects. Repair of defects shall not be permitted. All mating surfaces shall be seated properly to prevent rocking of the grate/cover. The frames, grates, and covers shall have a design wheel load conforming to AASHTO/ASTM A16 design loading HS20-44.

The frames and grates/covers shall be made by East Jordan Iron Works, Olympic Foundry, Inc., D&L Foundry, or Neenah.

2.8 GASKETS AND MANHOLE ADAPTERS

Rubber gaskets shall conform to Section 9-04.4 of the WSDOT Standard Specifications. Pipe connections to existing manholes shall be made using a heavy duty sand collar with gasket, head, or equal. Pipe connections to new manholes or vaults shall utilize an adaptor coupling with gasket or watertight flexible rubber boot, Kor-n-Seal or equal. The Contractor shall provide Kor-n-Seal cavity O-rings to fill the annular spaces between the pipe and the manhole or vault wall.

PART 3 EXECUTION

3.1 MANHOLES

Manhole installation shall be as shown on the Plans. Precast sections with damaged joint surfaces or with cracks or damage that would permit infiltration shall not be installed. Precast base sections shall be set on prepared bedding materials. Before the precast base is set in place, the bedding material shall be carefully leveled to provide full bearing for the entire base section.

Precast riser sections and cones shall be set using the specified joint sealant or gasket. Priming and preparation of surfaces and installation of jointing material shall be in strict conformance with the manufacturer's instructions. Only one 12-inch-high riser section shall be used per manhole and it shall be placed immediately below the cone. Grade rings shall be set in a full bed of cement grout.

All pipe connections to manholes shall be made with manhole adaptors.

Manhole frames shall be set carefully to the established surface grade in a full bed of cement grout. The manhole rim elevation shall be set flush with the existing pavement or grade in paved and improved areas. In unimproved areas, manhole rim elevations shall be set 2 inches above grade unless otherwise shown on the Plans to be set higher.

After placement, channel decks shall be given a light broom finish and shall be sloped to drain into the channels. Patch all lifters after removed picking eyes. Patch all joints inside and outside flush with walls.

Steps shall be installed in base sections, riser sections and tapered sections so that the completed manhole will have a continuous vertical ladder with equally spaced rungs as shown on the Plans. Steps shall be firmly cast or grouted in place. Infiltration from or around steps will not be permitted.

Pipe connections to existing manholes or vaults shall be in accordance with Section 7-05.3(3) of the WSDOT Standard Specifications and as further shown on the Plans.

3.2 CATCH BASINS

Catch basin installation shall be as shown on the Plans. Precast sections with damaged joint surfaces or with cracks or damage that would permit infiltration shall not be installed.

Precast base sections shall be set on a prepared bedding material. Before the precast base is set, the gravel shall be carefully leveled to provide full bearing for the entire base slab.

The frame shall be set carefully to the established surface grade in a full bed of cement grout. The catch basin rim elevation shall be set flush with the pavement or improved areas.

3.3 PRECAST VAULTS

Precast vaults shall be installed as shown on the Plans and in accordance with the manufacturer's recommendations.

3.4 FINAL ADJUSTMENT AND CLEANUP

After installation is complete, the Contractor shall cleanout all precast structures prior to placing the new facilities into service. The adjustment of castings shall be done in a manner satisfactory to the Owner. Adjustment shall be done only with precast grade rings. Bricks are unacceptable. Grouting and final adjustment of castings shall be done with non-shrink grout.

***** END OF SECTION *****

SECTION 02700

GRAVEL MATERIALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of granular materials that are to be used in trenches and other excavations as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02305	Wet Weather Earthwork
02710	Gravel Surfacing

1.3 SUBMITTALS

The Contractor shall provide certificates of laboratory tests in accordance with Section 01300, indicating particle size distribution for review for each type of granular material furnished and proctor test reports for all material to be placed as pipe bedding material, trench backfill, backfill under and around structures and underneath crushed surfacing and asphalt concrete pavements.

The certificates and proctor test reports shall be provided to the Owner at least 5 calendar days prior to placement.

PART 2 PRODUCTS

2.1 FOUNDATION GRAVEL

Foundation gravel shall be Class A Gravel Backfill for Foundations in conformance with Section 9-03.12(1)A of the WSDOT Standard Specifications.

2.2 GRAVEL BACKFILL FOR PIPE BEDDING

Gravel backfill for pipe bedding shall meet the requirements of Section 9-03.12(3) of the WSDOT Standard Specifications.

Native granular material shall not be utilized for gravel backfill for pipe bedding.

2.3 STRUCTURAL FILL

Structural fill shall consist of clean, non-plastic, free-draining sand and gravel free from organic matter or other deleterious materials, in conformance with Section 9-03.14(1) of the WSDOT Standard Specifications. The material shall contain particles less than 4 inches maximum dimension with less than 7-percent passing the U.S. No. 200 size sieve.

During period of wet weather the allowable fines content of the structural fill materials shall be no more than 5 percent passing the U.S. Standard No. 200 size sieve. Alternatively, crushed surfacing base course, in conformance with Section 9-03.9 (3) of the WSDOT Standard Specifications may be used.

2.4 BANK RUN GRAVEL FOR TRENCH BACKFILL

Bank run gravel for trench backfill shall be free from organic matter or other deleterious materials and in conformance with Section 9-03.19 of the WSDOT Standard Specifications.

2.5 GRAVEL BORROW

Gravel Borrow shall be free from organic matter or other deleterious materials and in conformance with Section 9-03.14(1) of the WSDOT Standard Specifications.

2.6 GRAVEL BASE

Provide gravel base in paved areas as backfill material as indicated on the Plans. Gravel base shall be in conformance with Section 9-03.10. The material shall contain particles of less than 4 inches maximum dimension, with less than 7 percent passing the U.S. No. 200 size sieve.

During period of wet weather the allowable fines content of the gravel base materials shall be no more than 5 percent passing the U.S. No. 200 size sieve.

2.7 QUARRY SPALLS

Quarry spalls shall conform to Section 9-13 of the WSDOT Standard Specifications. Materials used for quarry spalls shall meet the requirements of Section 9-13.1(5) of the WSDOT Standard Specifications, except that the size of material shall be revised as follows: 100 percent passing a 4-inch sieve size and 40 percent passing a 2-inch sieve size.

2.8 GRAVEL BACKFILL FOR WALLS

Gravel backfill for walls shall conform to Section 9-03.12(2) of the WSDOT Standard Specifications.

2.9 CRUSHED SURFACING

Crushed surfacing base course and top course shall conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

2.10 PEA GRAVEL

Pea gravel shall be relatively round, processed, washed rock conforming to ASTM C33 with the following sieve analysis.

Sieve Analysis (% Passing by Weight)	
Sieve Size	**Percent Passing**
1/2"	100
3/8"	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.11 MISCELLANEOUS GRAVEL

If the Plans call for a gravel that is not herein specified than the gravel shall conform to the type of gravel called for as per the WSDOT Specifications.

PART 3 EXECUTION

3.1 FOUNDATION GRAVEL

Foundation gravel shall be placed and compacted underneath all structures to a minimum depth of 12 inches unless indicated otherwise on the Plans, and to a greater depth where foundations are unstable and excess suitable excavated material is unavailable to stabilize such foundations.

In the event the Contractor unnecessarily overexcavates the pipe trench or structure foundation, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.2 GRAVEL BACKFILL FOR PIPE BEDDING

Bedding material shall be placed simultaneously on both sides of the pipe for the full width of the trench in lifts not exceeding 6 inches. To assure uniform support, the material shall be carefully worked underneath the pipe haunches with a tool capable of preventing the formation of void spaces around the pipe. In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.3 STRUCTURAL FILL

Provide structural fill as shown on the Plans or where excavated material is unsuitable as directed by the Engineer. Structural fill shall be installed in lifts not to exceed 8 to 10 inches maximum thickness. Structural fill placed under structures shall be compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor, per ASTM D1557.

3.4 BANK RUN GRAVEL FOR TRENCH BACKFILL

Bank run gravel for trench backfill shall be used where excavated material is unsuitable or unavailable for the backfill of trenches as approved by the Owner.

In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.5 GRAVEL BORROW

Gravel borrow shall be used where excavated material is unsuitable or unavailable for the bedding of trenches for rigid pipe as approved by the Owner.

3.6 GRAVEL BASE

Gravel base shall be used where excavated material is unsuitable or unavailable for the backfill of trenches, around manholes, vaults and structures, as approved by the Engineer, as shown on the Plans and as specified herein.

3.7 QUARRY SPALLS

Quarry spalls shall be placed where shown on the Plans, where foundations are unsuitable if approved by the Owner or in other locations where approved by the Owner.

3.8 GRAVEL BACKFILL FOR WALLS

Gravel backfill for walls shall be used where excavated materials are unsuitable for backfilling around the walls of structures, as approved by the Owner, as shown on the Plans and specified in these specifications.

3.9 CRUSHED SURFACING

Crushed surfacing base course and/or top course shall be placed underneath asphalt paving, to the lines and grades shown on the Plans or as required by the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

3.10 PEA GRAVEL

Pea gravel shall be placed underneath concrete slabs for buildings or structures where shown on the Plans. The minimum depth of pea gravel shall be 6 inches.

3.11 MISCELLANEOUS GRAVEL

Miscellaneous gravel shall be installed per the Plans.

***** END OF SECTION *****

SECTION 02710

GRAVEL SURFACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of crushed surfacing materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02700	Gravel Materials
02740	Hot Mix Asphalt

1.3 SUBMITTALS

The Contractor shall provide the Owner with a certificate of laboratory test indicating gradation of each material provided in accordance with Section 01300. The certificate shall be provided to the Owner 5 calendar days prior to placement of any materials.

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to the requirement of Section 02700.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be prepared as per Section 2-06.3 of the WSDOT Standard Specifications. As the rolling of the subgrade proceeds, all soft or spongy areas shall be removed and the resulting holes filled with ballast material or crushed surfacing base course as shown on the Plans. The Contractor shall dispose of excess materials resulting from the preparation of the subgrade. Rollers shall not be operated adjacent to structures where such use may cause damage. Where the subgrade abuts structures and compaction with a roller is not possible for practical

reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.2 GRAVEL MATERIAL

Gravel materials shall be placed in the layers and thickness as shown on the Plans. Gravel materials shall be placed in accordance with Section 4-04.3 of the WSDOT Standard Specifications.

The Contractor shall place gravel materials in a uniform layer over the entire area to receive gravel materials without segregation of sizes, to such depth that when compacted with the power roller, the course shall have the required thickness. The maximum layer thickness for compaction with a roller shall be 6 inches for ballast or base course and 4 inches for crushed surfacing. The gravel material shall be bladed with a grader and rolled while damp with a power roller until the course is thoroughly and uniformly compacted and until its surface is smooth and conforms to grade and crown requirements shown on the Plans. The cross-section of the finished surface shall be subject to reasonable variations as approved by the Owner to meet the varying conditions encountered. The surface shall be maintained in its finished condition until the succeeding layer is placed.

The roller shall not be operated adjacent to structures where such use may cause damage. Where the gravel materials abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.3 COMPACTION

All materials shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

*****END OF SECTION*****

SECTION 02740

HOT MIX ASPHALT PAVING

PART 1 GENERAL

1.1 SCOPE

The work in this section shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, current edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter "Standard Specifications"). Delete section 5-04 of the Standard Specifications, with the exception of 5-04.2(1), and replace it with the following:

The work specified in this Section includes providing and placing one or more layers of plant-mixed hot mix asphalt (HMA) on a prepared foundation or base in accordance with these Specifications and the lines, grades, thicknesses, and typical cross-sections shown in the Plans. The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these Specifications. WMA processes include organic additives, chemical additives, and foaming.

This work also consists of adjusting castings to grade, furnishing and installing temporary HMA per the details in the Contract Plans.

HMA shall be composed of asphalt binder and mineral materials as may be required, mixed in the proportions specified to provide a homogeneous, stable, and workable mixture.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01400	Quality Control
02300	Earthwork
02305	Wet Weather Earthwork
02530	Utility Structures
02700	Gravel Materials
02710	Gravel Surfacing

1.3 SUBMITTALS

A. MIX DESIGN – OBTAINING PROJECT APPROVAL

1. ESALs

The number of ESALs for the design and acceptance of the HMA shall be 0.3 million.

Commercial HMA shall be an HMA Cl. 1/2" PG 58H-22 design mix

No paving shall begin prior to the approval of the mix design by the Engineer.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Project Engineer. Sampling and testing of HMA mixture accepted by commercial evaluation will be at the option of the Project Engineer.

Commercial Evaluation Mix Design Approval of a mix design for "Commercial Evaluation" will be based on a review of a Mix Design from the current WSDOT QPL. At the discretion of the Engineer, agencies may accept verified mix designs older than 12 months from the original verification date with a certification from the Contractor that the materials and sources are the same as those shown on the original mix design. Testing of the HMA by the Owner for mix design approval is not required.

Using Warm Mix Asphalt Processes. The Contractor may elect to use additives that reduce the optimum mixing temperature or serve as a compaction aid for producing HMA. Additives include organic additives, chemical additives and foaming processes. The use of Additives is subject to the following:

- Do not use additives that reduce the mixing temperature more than allowed in subsection 3.3 F. in the production of mixtures.
- Before using additives, obtain the Engineer's approval using WSDOT Form 350-076 to describe the proposed additive and process.

PART 2 PRODUCTS

2.1 HMA PAVEMENT

HMA pavement, Commercial HMA, HMA Cl. 1/2" PG 58H-22

A. MATERIALS

Materials shall meet the requirements of the following sections of the Standard Specifications:

Asphalt Binder	9-02.1(4)
Cationic Emulsified Asphalt	9-02.1(6)
Anti-Stripping Additive	9-02.4
HMA Additive	9-02.5
Aggregates	9-03.8
Recycled Asphalt Pavement	9-03.8(3)B
Mineral Filler	9-03.8(5)
Recycled Material	9-03.21
Portland Cement	9-01
Sand	9-03.1(2).
(As noted in subsection 3.2D.1. for crack sealing)	
Joint Sealant	9-04.2
Foam Backer Rod	9-04.2(3)A

The Contract documents may establish that the various mineral materials required for the manufacture of HMA will be furnished in whole or in part by the Owner. If the documents do not establish the furnishing of any of these mineral materials by the Owner, the Contractor shall be required to furnish such materials in the amounts required for the designated mix. Mineral materials include coarse and fine aggregates, and mineral filler.

The Contractor may choose to utilize recycled asphalt pavement (RAP) in the production of HMA. The RAP may be from pavements removed under the Contract, if any, or pavement material from an existing stockpile.

The Contractor may use up to 20 percent RAP by total weight of HMA. The asphalt content and gradation test data shall be reported to the Owner when submitting the mix design for approval on the QPL. The Contractor shall include the RAP as part of the mix design as defined in these Specifications.

The grade of asphalt binder shall be as required by the Contract. Blending of asphalt binder from different sources is not permitted.

The Contractor may only use warm mix asphalt (WMA) processes in the production of HMA with 20 percent or less RAP by total weight of HMA. The Contractor shall submit to the Engineer for approval the process that is proposed and how it will be used in the manufacture of HMA.

Production of aggregates shall comply with the requirements of Section 3-01 of the Standard Specifications.

Preparation of stockpile site, the stockpiling of aggregates, and the removal of aggregates from stockpiles shall comply with the requirements of Section 3-02 of the Standard Specifications.

B. HMA TOLERANCES AND ADJUSTMENTS

1. Job Mix Formula (JFM) Tolerances

After the JMF is determined as required in subsection 3.6A. The constituents of the mixture at the time of acceptance shall conform to the following tolerances:

Aggregate, percent passing	***Nonstatistical Evaluation***	**Commercial Evaluation**
1", 3/4", 1/2", and 3/8" sieves	*±6%*	±8%
U.S. No. 4 sieve	*±6%*	±8%
U.S. No. 8 sieve	*±6%*	±8%
U.S. No. 200 sieve	*±2.0%*	±3.0%
Asphalt Binder	*±0.5%*	±0.7%

These tolerance limits constitute the allowable limits as described in Standard Specification Section 1-06.2. The tolerance limit for aggregate shall not exceed the limits of the control points section, except the tolerance limits for sieves designated as 100 percent passing will be 99-100. The tolerance limits on sieves shall only apply to sieves with control points.

2.2 TEMPORARY HMA

Temporary HMA material shall meet the requirements for Commercial HMA.

PART 3 EXECUTION

3.1 GENERAL

Where paving occurs on a facility, the Contractor shall maintain access to the facility at all times. The Contractor shall provide 1-week notification to the Owner prior to paving and shall coordinate all work with the Owner to ensure their paving plan does not interfere with the Owner's on-going operations.

When paving occurs on a roadway open to traffic, the requirements of subsection 3.2B. apply.

The Contractor shall provide, place and maintain all temporary markings and signage as required to warn and direct facility traffic as necessary during their paving operations.

3.2 HMA PLACEMENT

A. WEATHER LIMITATIONS

Do not place HMA for wearing course on any Traveled Way beginning October 1st through March 31st of the following year without written concurrence from the Engineer.

Do not place HMA on any wet surface, or when the average surface temperatures are less than those specified below, or when weather conditions otherwise prevent the proper handling or finishing of the HMA.

Minimum Surface Temperature for Paving

Compacted Thickness (Feet)	Wearing Course	Other Courses
Less than 0.10	55 degrees F	45 degrees F
0.10 to .20	45 degrees F	35 degrees F
More than 0.20	35 degrees F	35 degrees F

B. PAVING UNDER TRAFFIC

When the Roadway being paved is open to traffic, the requirements of this Section shall apply.

The Contractor shall keep intersections open to traffic at all times except when paving the intersection or paving across the intersection. During such time, and provided that there has been an advance warning to the public, the intersection may be closed for the minimum time required to

place and compact the mixture. In hot weather, the Engineer may require the application of water to the pavement to accelerate the finish rolling of the pavement and to shorten the time required before reopening to traffic.

Before closing an intersection, advance warning signs shall be placed and signs placed marking the detour or alternate route.

During paving operations, temporary pavement markings shall be maintained throughout the project. Temporary pavement markings shall be installed on the Roadway prior to opening to traffic. Temporary pavement markings shall be in accordance with Standard Specifications Section 8-23.

All costs in connection with performing the Work in accordance with these requirements shall be included in the unit Contract prices for the various Bid items involved in the Contract.

C. EQUIPMENT

1. Mixing Plant

Plants used for the preparation of HMA shall conform to the following requirements:

a. Equipment for Preparation of Asphalt Binder

Tanks for the storage of asphalt binder shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the storage tank. The circulating system for the asphalt binder shall be designed to ensure proper and continuous circulation during the operating period. A valve for the purpose of sampling the asphalt binder shall be placed in either the storage tank or in the supply line to the mixer.

b. Thermometric Equipment

An armored thermometer, capable of detecting temperature ranges expected in the HMA mix, shall be fixed in the asphalt binder feed line at a location near the charging valve at the mixer unit. The thermometer location shall be convenient and safe for access by Inspectors. The plant shall also be equipped with an approved dial-scale

thermometer, a mercury actuated thermometer, an electric pyrometer, or another approved thermometric instrument placed at the discharge chute of the drier to automatically register or indicate the temperature of the heated aggregates. This device shall be in full view of the plant operator.

c. Heating of Asphalt Binder

The temperature of the asphalt binder shall not exceed the maximum recommended by the asphalt binder manufacturer nor shall it be below the minimum temperature required to maintain the asphalt binder in a homogeneous state. The asphalt binder shall be heated in a manner that will avoid local variations in heating. The heating method shall provide a continuous supply of asphalt binder to the mixer at a uniform average temperature with no individual variations exceeding 25 degrees F. Also, when a WMA additive is included in the asphalt binder, the temperature of the asphalt binder shall not exceed the maximum recommended by the manufacturer of the WMA additive.

2. Hauling Equipment

Trucks used for hauling HMA shall have tight, clean, smooth metal beds and shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from adverse weather. Whenever the weather conditions during the work shift include, or are forecast to include, precipitation or an air temperature less than 45 degrees F or when time from loading to unloading exceeds 30 minutes, the cover shall be securely attached to protect the HMA.

The Contractor shall provide an environmentally benign means to prevent the HMA mixture from adhering to the hauling equipment. Excess release agent shall be drained prior to filling hauling equipment with HMA. Petroleum derivatives or other coating material that contaminate or alter the characteristics of the HMA shall not be used. For live bed trucks, the conveyer shall be in operation during the process of applying the release agent.

3. Pavers

HMA pavers shall be self-contained, power-propelled units, provided with an internally heated vibratory screed and shall be capable of spreading and finishing courses of HMA plant mix material in lane widths required by the paving section shown in the Plans.

The HMA paver shall be in good condition and shall have the most current equipment available from the manufacturer for the prevention of segregation of the HMA mixture installed, in good condition, and in working order. The equipment certification shall list the make, model, and year of the paver and any equipment that has been retrofitted.

The screed shall be operated in accordance with the manufacturer's recommendations and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture. A copy of the manufacturer's recommendations shall be provided upon request by the Owner. Extensions will be allowed provided they produce the same results, including ride, density, and surface texture as obtained by the primary screed. Extensions without augers and an internally heated vibratory screed shall not be used in the Traveled Way.

When specified in the Contract, reference lines for vertical control will be required. Lines shall be placed on both outer edges of the Traveled Way of each Roadway. Horizontal control utilizing the reference line will be permitted. The grade and slope for intermediate lanes shall be controlled automatically from reference lines or by means of a mat referencing device and a slope control device. When the finish of the grade prepared for paving is superior to the established tolerances and when, in the opinion of the Engineer, further improvement to the line, grade, cross-section, and smoothness can best be achieved without the use of the reference line, a mat referencing device may be substituted for the reference line. Substitution of the device will be subject to the continued approval of the Engineer. A joint matcher may be used subject to the approval of the Engineer. The reference line may be removed after the completion of the first course of HMA when approved by the Engineer. Whenever the Engineer determines that any of these methods are failing to provide the necessary vertical control, the reference lines will be reinstalled by the Contractor.

The Contractor shall furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for satisfactory operation of the automatic control equipment.

If the paving machine in use is not providing the required finish, the Engineer may suspend Work as allowed by Standard Specification Section 1-08.6. Any cleaning or solvent type liquids spilled on the pavement shall be thoroughly removed before paving proceeds.

4. Rollers

Rollers shall be of the steel wheel, vibratory, oscillatory, or pneumatic tire type, in good condition and capable of reversing without backlash. Operation of the roller shall be in accordance with the manufacturer's recommendations. When ordered by the Engineer for any roller planned for use on the project, the Contractor shall provide a copy of the manufacturer's recommendation for the use of that roller for compaction of HMA. The number and weight of rollers shall be sufficient to compact the mixture in compliance with the requirements of subsection 3.3J. The use of equipment that results in crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of the surface, displacement of the mixture or other undesirable results shall not be used.

D. PREPARATION OF TREATED SURFACES FOR HMA

A treated surface includes cement concrete, asphalt concrete, brick, seal coat, bituminous surface treatment and cement treated base. When the treated surface or old base is irregular, the Contractor shall bring it to a uniform grade and cross-section as shown on the Plans or approved by the Engineer.

Preleveling of uneven or broken treated surfaces over which HMA is to be placed may be accomplished by using an asphalt paver, a motor patrol grader, or by hand raking, as approved by the Engineer.

Compaction of preleveling HMA shall be to the satisfaction of the Engineer and may require the use of small steel wheel rollers, plate compactors, or pneumatic rollers to avoid bridging across preleveled areas by the compaction equipment. Equipment used for the compaction of preleveling HMA shall be approved by the Engineer.

Before construction of HMA on an existing paved surface, the entire surface of the pavement shall be clean. All fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement.

All treated surfaces over which HMA is to be placed shall be thoroughly cleaned of dust, soil, pavement grindings, and other foreign matter. All holes and small depressions shall be filled with an appropriate class of HMA. The surface of the patched area shall be leveled and compacted thoroughly. Prior to the application of tack coat, or paving, the condition of the surface shall be approved by the Engineer.

A tack coat of asphalt shall be applied to all treated surfaces on which any course of HMA is to be placed or abutted. Tack coat shall be uniformly applied to cover the treated surface with a thin film of residual asphalt free of streaks and bare spots at a rate between 0.02 and 0.10 gallons per square yard of retained asphalt. The rate of application shall be approved by the Engineer. A heavy application of tack coat shall be applied to all joints. For Roadways open to traffic, the application of tack coat shall be limited to surfaces that will be paved during the same working shift. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.

Equipment shall not operate on tacked surfaces until the tack has broken and cured. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the HMA.

The tack coat shall be CSS-1, or CSS-1h emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be diluted once with water at a rate not to exceed one part water to one part emulsified asphalt. The tack coat shall have sufficient temperature such that it may be applied uniformly at the specified rate of application and shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

1. Crack Sealing

   When the Proposal includes a pay item for crack sealing, seal all cracks 1/4 inch in width and greater.

   a. Cleaning

      Ensure that cracks are thoroughly clean, dry and free of all loose and foreign material when filling with crack sealant material. Use a hot compressed air lance to dry and warm the pavement surfaces within the crack immediately prior

to filling a crack with the sealant material. Do not overheat pavement. Do not use direct flame dryers. Routing cracks is not required.

b. Sand Slurry

For cracks that are to be filled with sand slurry, thoroughly mix the components and pour the mixture into the cracks until full. Add additional CSS-1 cationic emulsified asphalt to the sand slurry as needed for workability to ensure the mixture will completely fill the cracks. Strike off the sand slurry flush with the existing pavement surface and allow the mixture to cure. Top off cracks that were not completely filled with additional sand slurry. Do not place the HMA overlay until the slurry has fully cured.

The sand slurry shall consist of approximately 20 percent CSS-1 emulsified asphalt, approximately 2 percent portland cement, water (if required), and the remainder clean Class 1 or 2 fine aggregate per Standard Specification Section 9-03.1(2). The components shall be thoroughly mixed and then poured into the cracks and joints until full. The following day, any cracks or joints that are not completely filled shall be topped off with additional sand slurry. After the sand slurry is placed, the filler shall be struck off flush with the existing pavement surface and allowed to cure. The HMA overlay shall not be placed until the slurry has fully cured. The requirements of Standard Specification Section 1-06 will not apply to the portland cement and sand used in the sand slurry.

In areas where HMA will be placed, use sand slurry to fill the cracks.

In areas where HMA will not be placed, fill the cracks as follows:

- Cracks 1/4 inch to 1 inch in width – fill with hot pressure fed sealant.

- Cracks greater than 1 inch in width – fill with sand slurry.

c. Hot Pressure Fed Sealant

For cracks that are to be filled with hot poured sealant, apply the material in accordance with these requirements and the manufacturer's recommendations. Furnish a Type 1 Working Drawing of the manufacturer's product information and recommendations to the Engineer prior to the start of work, including the manufacturer's recommended heating time and temperatures, allowable storage time and temperatures after initial heating, allowable reheating criteria, and application temperature range. Confine hot poured sealant material within the crack. Clean any overflow of sealant from the pavement surface. If, in the opinion of the Engineer, the Contractor's method of sealing the cracks with hot pressure fed sealant results in an excessive amount of material on the pavement surface, stop and correct the operation to eliminate the excess material. Pouring sealant is not an acceptable method.

2. Crack Sealing Areas Prior to Paving

In areas where HMA will be placed, use sand slurry to fill the cracks.

3. Crack Sealing Areas Not to be Paved

In areas where HMA will not be placed, fill the cracks as follows:

a. Cracks 1/4 inch to 1 inch in width - fill with hot pressure fed sealant.

b. Cracks greater than 1 inch in width – fill with sand slurry.

4. Pavement Repair

The Contractor shall excavate pavement repair areas and shall backfill these with HMA in accordance with the details shown in the Plans and as marked in the field. The Contractor shall conduct the excavation operations in a manner that will protect the pavement that is to remain. Pavement not designated to be removed that is damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer at no cost to the Owner. The Contractor shall excavate only within one lane at a time unless approved otherwise by the Engineer. The Contractor shall not excavate more area than can be

completely finished during the same shift, unless approved by the Engineer.

Unless otherwise shown in the Plans or determined by the Engineer, excavate to a depth of 1.0 feet. The Engineer will make the final determination of the excavation depth required. The minimum width of any pavement repair area shall be 40 inches unless shown otherwise in the Plans. Before any excavation, the existing pavement shall be sawcut or shall be removed by a pavement grinder. Excavated materials will become the property of the Contractor and shall be disposed of in a Contractor-provided site off the Right of Way or used in accordance with Standard Specifications Sections 2-02.3(3) or 9-03.21.

Asphalt for tack coat shall be required as specified in subsection D. A heavy application of tack coat shall be applied to all surfaces of existing pavement in the pavement repair area.

Placement of the HMA backfill shall be accomplished in lifts not to exceed 0.35-foot compacted depth. Lifts that exceed 0.35 foot of compacted depth may be accomplished with the approval of the Engineer. Each lift shall be thoroughly compacted by a mechanical tamper or a roller.

E. PRODUCING/STOCKPILING AGGREGATES AND RAP

Aggregates and RAP shall be stockpiled according to the requirements of Standard Specifications Section 3-02. Sufficient storage space shall be provided for each size of aggregate and RAP. Materials shall be removed from stockpile(s) in a manner to ensure minimal segregation when being moved to the HMA plant for processing into the final mixture. Different aggregate sizes shall be kept separated until they have been delivered to the HMA plant.

F. MIXING

After the required amount of mineral materials, asphalt binder, recycling agent and anti-stripping additives have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials is ensured.

When discharged, the temperature of the HMA shall not exceed the optimum mixing temperature by more than 25 degrees F as shown on the reference mix design report or as approved by the Engineer. Also, when a

WMA additive is included in the manufacture of HMA, the discharge temperature of the HMA shall not exceed the maximum recommended by the manufacturer of the WMA additive. A maximum water content of 2 percent in the mix, at discharge, will be allowed providing the water causes no problems with handling, stripping, or flushing. If the water in the HMA causes any of these problems, the moisture content shall be reduced as directed by the Engineer.

Storing or holding of the HMA in approved storage facilities will be permitted with approval of the Engineer, but in no event shall the HMA be held for more than 24 hours. HMA held for more than 24 hours after mixing shall be rejected. Rejected HMA shall be disposed of by the Contractor at no expense to the Owner. The storage facility shall have an accessible device located at the top of the cone or about the third point. The device shall indicate the amount of material in storage. No HMA shall be accepted from the storage facility when the HMA in storage is below the top of the cone of the storage facility, except as the storage facility is being emptied at the end of the working shift.

Recycled asphalt pavement (RAP) utilized in the production of HMA shall be sized prior to entering the mixer so that a uniform and thoroughly mixed HMA is produced. If there is evidence of the RAP not breaking down during the heating and mixing of the HMA, the Contractor shall immediately suspend the use of the RAP until changes have been approved by the Engineer. After the required amount of mineral materials, RAP, new asphalt binder and asphalt rejuvenator have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials, and RAP is ensured.

G. SPREADING AND FINISHING

The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. HMA pavers complying with subsection 3.3C. shall be used to distribute the mixture. Unless otherwise directed by the Engineer, the nominal compacted depth of any layer of any course shall not exceed the following:

HMA Class 1"	0.35 feet
HMA Class 3/4" and HMA Class 1/2" wearing course	0.30 feet
HMA Class 3/4" and HMA Class 1/2" other courses	0.35 feet
HMA Class 3/8" wearing course	0.25 feet
HMA Class 3/8" other courses	0.30 feet

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other equipment or by hand.

When more than one job mix formula (JMF) is being utilized to produce HMA, the material produced for each JMF shall be placed by separate spreading and compacting equipment. The intermingling of HMA produced from more than one JMF is prohibited. Each strip of HMA placed during a work shift shall conform to a single JMF established for the class of HMA specified unless there is a need to make an adjustment in the JMF.

H. AGGREGATE ACCEPTANCE PRIOR TO INCORPORATION IN HMA

Sampling and testing of aggregates for HMA accepted by commercial evaluation will be at the option of the Engineer.

I. SURFACE SMOOTHNESS

The completed surface of all courses shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface of the wearing course of the following sections of Roadway shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline on all Sections of roadway within the project limits that are posted less than 45 mph.

The completed surface of the wearing course of all other sections of Roadway shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline.

The transverse slope of the completed surface of the wearing course shall vary not more than 1/4 inch in 10 feet from the rate of transverse slope shown in the Plans.

When deviations in excess of the above tolerances are found that result from a high place in the HMA, the pavement surface shall be corrected by one of the following methods:

1. Removal of material from high places by grinding with an approved grinding machine; or

2. Removal and replacement of the wearing course of HMA; or

3. By other method approved by the Engineer.

Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

Deviations in excess of the above tolerances that result from a low place in the HMA and deviations resulting from a high place where corrective action, in the opinion of the Engineer, will not produce satisfactory results will be accepted with a price adjustment. The Engineer shall deduct from monies due or that may become due to the Contractor the sum of $500.00 for each and every section of single traffic lane 100 feet in length in which any excessive deviations described above are found.

J. SEALING PAVEMENT SURFACES

Apply a fog seal where shown in the plans. Construct the fog seal in accordance with Standard Specifications Section 5-02.3. Unless otherwise approved by the Engineer, apply the fog seal prior to opening to traffic.

K. HMA ROAD APPROACHES

HMA approaches shall be constructed at the locations shown in the Plans or where staked by the Engineer. The Work shall be performed in accordance with Section 3.3.

Grade transitions, excluding the tie to the roadway, shall be constructed as smooth vertical curves. The maximum change in driveway grade, within the right-of-way, shall be eight percent within any 10 feet of distance on a crest and 12 percent within any 10 feet of distance in a sag vertical curve.

3.3 TEMPORARY PAVEMENT REPAIR

During the course of construction, it may be necessary to provide improved temporary vehicle and/or pedestrian access within the project limits. Such temporary access shall be provided by temporarily patching trench crossings or other areas with temporary HMA until such time as the permanent surface restoration is installed. Locations shall include those areas specifically indicated on the Plans, directed by the Engineer or as further specified herein. This material will be furnished, placed, compacted, and removed and wastehauled at various locations throughout the project. The trenches and/or subgrade shall be thoroughly compacted and brought to a smooth grade prior to placing the material. It shall be placed, maintained (daily), and removed and wastehauled by the Contractor. Typical compacted depth will be 4 inches. Temporary HMA shall also be used around castings, after grinding, to provide a transition until final lift of HMA paving is installed.

3.4 HMA JOINTS

A. TRANSVERSE JOINTS

The Contractor shall conduct operations such that the placing of the top or wearing course is a continuous operation or as close to continuous as possible. Unscheduled transverse joints will be allowed and the roller may pass over the unprotected end of the freshly laid mixture only when the placement of the course must be discontinued for such a length of time that the mixture will cool below compaction temperature. When the Work is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

A temporary wedge of HMA constructed on a 20H:1V shall be constructed where a transverse joint as a result of paving or planing is open to traffic. The HMA in the temporary wedge shall be separated from the permanent HMA by strips of heavy wrapping paper or other methods approved by the Engineer. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The material that is cut away shall be wasted and new mix shall be laid against the cut. Rollers or tamping irons shall be used to seal the joint.

B. LONGITUDINAL JOINTS

The longitudinal joint in any one course shall be offset from the course immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the wearing course shall be located at a lane line or an edge line of the Traveled Way. A notched wedge joint shall be constructed along all longitudinal joints in the wearing surface of new HMA unless otherwise approved by the Engineer. The notched wedge joint shall have a vertical edge of not less than the maximum aggregate size or more than 1/2 of the compacted lift thickness and then taper down on a slope not steeper than 4H:1V. The sloped portion of the HMA notched wedge joint shall be uniformly compacted.

3.5 QUALITY CONTROL

A. HMA MIXTURE ACCEPTANCE

Acceptance of HMA shall be as provided under nonstatistical, or commercial evaluation.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, temporary pavement, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Engineer. Sampling and testing of HMA mix accepted by commercial evaluation will be at the option of the Engineer.

The mix design will be the initial JMF for the class of HMA. The Contractor may request a change in the JMF. Any adjustments to the JMF will require the approval of the Engineer and may be made in accordance with this section.

1. HMA Tolerances and Adjustments

   See Section 2.2 for Job Mix Formula Tolerances.

   a. Job Mix Formula Adjustments – An adjustment to the aggregate gradation or asphalt binder content of the JMF requires approval of the Engineer. Adjustments to the JMF will only be considered if the change produces material of equal or better quality and may require the development of a new mix design if the adjustment exceeds the amounts listed below.

      i. Aggregates – 2 percent for the aggregate passing the 1-1/2", 1", 3/4", 1/2", 3/8", and the No. 4 sieves, 1 percent for aggregate passing the No. 8 sieve, and 0.5 percent for the aggregate passing the No. 200 sieve. The adjusted JMF shall be within the range of the control points in Standard Specifications Section 9-03.8(6).

      ii. Asphalt Binder Content – The Engineer may order or approve changes to asphalt binder content. The maximum adjustment from the approved mix design for the asphalt binder content shall be 0.3 percent.

2. Mixture Acceptance – Commercial Evaluation

   If sampled and tested, HMA mix produced under Commercial Evaluation and having all constituents falling within the tolerance limits of the job mix formula shall be accepted at the unit Contract price with no further evaluation. When one or more constituents fall outside the commercial tolerance limits in the Job Mix

Formula shown in Section 2.2, the lot may be subject to rejection. When less than three sublots exist, backup samples of the existing sublots or samples from the street shall be tested to provide a minimum of three sets of results for evaluation.

B. HMA COMPACTION ACCEPTANCE

HMA mixture accepted by commercial evaluation and HMA constructed under conditions other than those listed above shall be compacted on the basis of a test point evaluation of the compaction train or by testing of roadway cores. Compaction of the HMA mixture to a minimum of 92 percent of the reference maximum density is required for acceptance.

1. HMA Compaction – General Compaction Requirements

Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. Areas inaccessible to large compaction equipment shall be compacted by other mechanical means. Any HMA that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced with new hot mix that shall be immediately compacted to conform to the surrounding area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided the specified densities are attained. Unless the Engineer has approved otherwise, rollers shall only be operated in the static mode when the internal temperature of the mix is less than 175 degrees F. Regardless of mix temperature, a roller shall not be operated in a mode that results in checking or cracking of the mat. Rollers shall only be operated in static mode on bridge decks.

2. HMA Commercial Evaluation Compaction

The location of the HMA compaction tests will be randomly selected by the Engineer.

Tests for the determination of the pavement density will be taken by the Contractor, in accordance with the required procedures for measurement by a nuclear density gauge or roadway cores, after completion of the finish rolling.

HMA mixture accepted by commercial evaluation shall be compacted on the basis of a test point evaluation of the compaction train. The Contractor shall provide the RICE density test results for

the HMA mixture, identifying the reference maximum density of the mix, prior to the first day of paving. The test point evaluation shall be performed by the Contractor, in accordance with instructions from the Engineer. The number of passes with an approved compaction train, required to attain a minimum of 92 percent of the reference maximum density, shall be used on all subsequent paving.

If the Owner
uses a nuclear density gauge to determine density the test procedures FOP for WAQTC TM 8 and WSDOT SOP T 729 will be used on the day the mix is placed and prior to opening to traffic.

Alternatively, the HMA mixture accepted by commercial evaluation may be evaluated by testing of roadway cores taken after completion of the finish rolling, resulting in a minimum of 92 percent of the reference maximum density. Roadway cores for density shall be obtained by the Contractor in accordance with WSDOT SOP 734. The core diameter shall be 4-inches minimum, unless otherwise approved by the Engineer. Roadway cores will be tested by the Contractor in accordance with WSDOT FOP for AASHTO T 166. Core locations shall be outside of wheel paths and as determined by the Engineer

If the Contract includes the Bid item "Roadway Core" the cores shall be obtained by the Contractor in the presence of the Engineer on the same day the mix is placed and at locations designated by the Engineer.

C. REJECT WORK

1. Reject Work General

Work that is defective or does not conform to Contract requirements shall be rejected. The Contractor may propose, in writing, alternatives to removal and replacement of rejected material. Acceptability of such alternative proposals will be determined at the sole discretion of the Engineer.

2. Rejection by Contractor

The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material. Any such new material will be sampled, tested, and evaluated for acceptance.

3. Rejection Without Testing (Mixture or Compaction)

The Engineer may, without sampling, reject any batch, load, or section of Roadway that appears defective. Material rejected before placement shall not be incorporated into the pavement. Any rejected section of Roadway shall be removed.

No payment will be made for the rejected materials or the removal of the materials unless the Contractor requests that the rejected material be tested.

Commercial Evaluation: If the Contractor elects to have the rejected material tested, a minimum of three representative samples shall be obtained and tested by the Contractor. Acceptance of rejected material will be based on conformance with the commercial evaluation tolerances in Section 2.2. If one or more of the mixture components are out of tolerance then, no payment will be made for the rejected material; in addition, the cost of sampling and testing shall be borne by the Contractor. If the material is rejected before placement and all of the mixture components are within the commercial evaluation tolerances, then compensation for the rejected material will be at the unit Contract price, with an addition of 25 percent of the unit Contract price added for the cost of testing, removal and disposal.

3.6 SAWCUTTING

Where shown on the Plans or where directed in the field by the Owner, the Contractor shall make a neat vertical sawcut at the boundaries of the area to be removed. Care shall be taken during sawcutting so as to prevent damage to the existing HMA or cement concrete pavement, to remain in place. Any pavement or cement concrete surface that is damaged by the Contractor outside the area scheduled for removal due to the Contractor's operations or negligence shall be repaired or replaced to the Owner's satisfaction by the Contractor at no additional cost to the Owner.

All cuts shall be continuous, full depth, and shall be made with saws specifically equipped for this purpose. No skip cutting, wheel cutting or jack hammering will be allowed unless specifically approved otherwise in writing by the Owner. However, even if preapproved as a method of cutting, no payment will be made for this type of work, and it shall be considered incidental and included in the various unit contract and lump sum prices listed in the Proposal.

The location of all pavement cuts shall be preapproved by the Owner in the field before cutting commences.

All water and slurry material resulting from sawcutting operations shall not be allowed to enter the storm drainage or sanitary sewer system and shall be removed from the site and disposed of in accordance with the Washington State Department of Ecology regulations.

All existing pavement edges shall be saw cut back to sound material, in uniform lines immediately prior to paving operations. Any edges broken between the time of cutting and placement of new paving shall be recut to the satisfaction of the Owner at no additional cost to the Owner. All excess excavated materials shall be hauled to waste.

3.7 HMA TRENCH PATCH

This work shall consist of the preparation, placing and compaction of HMA above trench sections, in accordance with the details included on the plans and the requirements outlined herein. The work shall be in conformance with Section 3.3 herein unless specifically directed otherwise by the Owner.

The Contractor shall restore all paved surfaces excavated or disturbed to a condition acceptable to the Owner or the municipality having control of the road. The trench section shall be patched as indicated on the plans and in accordance with the following steps:

A. Crushed rock/ temporary HMA shall be installed to the top of the existing pavement. Crushed rock shall be installed in the trench section on a daily basis as required to maintain the existing pavement surface elevation. For areas that will be open to traffic, the Contractor shall inspect the condition of the temporary trench patch daily and maintain as directed by the Owner. Use of steel sheets to provide temporary trench protection for traffic is subject to Owner approval.

B. Crushed rock/temporary HMA shall be removed to the depth of existing pavement or to the depth of the pavement section specified on the plans, whichever is thicker. The trench shall be paved to match the existing pavement surface. HMA trench patching shall be constructed by the Friday following pipe installation. All trench areas shall be patched and cleaned by close of work that day.

Before any HMA material is placed, all pavement cuts shall be trued so that marginal lines of the patch will form a rectangle with straight edges and vertical faces a minimum of 1 foot back from the maximum trench width.

The HMA shall be placed per subsection 3.3G., Spreading and Finishing. The HMA trench patch thickness shall match existing pavement thickness or the minimum pavement repair section indicated on the plans whichever is thicker.

Seal all joints per Section 3.5, HMA Joints.

3.8 PAVEMENT MARKINGS

In those areas where the proposed work causes existing pavement with striping and/or pavement markings to be removed, the Contractor shall not only replace the pavement, as noted herein, and as shown on the Plans, but shall also remark and restripe the new pavement so as to restore the new pavement to its former condition.

Pavement markings shall conform to Standard Specification Section 8-22.2 and 8-22.3, and the latest edition and amendments thereto of the Manual on Uniform Traffic Control Devices (MUTCD) as adopted by the State of Washington, and shall be constructed as shown in the Plans except as modified herein.

Raised pavement markers shall conform to Standard Specifications Section 8-09.2 and 8-09.3.

3.9 ADJUSTING STRUCTURES TO GRADE

All utility castings and monuments within the existing and/or new pavement area shall be referenced by the Contractor prior to any pavement removal or planing. The Contractor shall keep a record of such references and submit a copy to the Owner.

Existing structures and new structures shall be adjusted to the finished grade as shown on the Plans and as further specified herein. Existing boxes, rings, grates, covers, and lids shall be reset in a careful and workmanlike manner to conform to the required grades.

The new and existing utility castings and monuments shall be adjusted to grade in the following manner:

As soon as the street has been paved past each structure or casting, the HMA mat shall be scored around the location of the structure or casting. After rolling has been completed and the mat has cooled, it shall be cut along the scored lines. The structure or casting shall then be raised to finished pavement grade and the annular spaces filled as indicated on the Plans. The Contractor shall install the pavement to give a smooth finished appearance. All covers, lids, frames, and grates shall be thoroughly cleaned.

After pavement is in place, all new pavement joints shall be sealed with a 6-inch-wide strip of hot asphalt sealer. A sand blanket shall be applied to the surface of the hot asphalt sealer immediately after the placement of the sealer to help alleviate the tracking of the asphalt. The sealer shall meet the requirements of the Standard Specifications Section 9-04.2(1).

***** END OF SECTION *****

SECTION 02810

IRRIGATION SYSTEM

PART 1 GENERAL

1.1 SCOPE

This section includes furnishing and installing irrigation equipment as shown on the Plans and as specified herein. The irrigation system shall include all necessary accessories, appurtenances, and hardware required for a complete and workable system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
15050	Piping Systems
15100	Valves
Division 16	Electrical

1.3 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A MATERIALS

Submit manufacturer's data sheets for all materials in accordance with Section 01300. Provide sufficient descriptive literature/information as to all operating characteristics, including operating pressures, pressure losses, materials used in product, test certificates, special features, etc., for those products not specified by manufacturer or those submitted for approval as equal.

B RECORD IRRIGATION DRAWINGS

Contractor shall furnish record drawings of the complete irrigation system in accordance with these specifications. The Engineer shall provide two sets of full-size prints showing all irrigation work required under this Contract. The prints are to be on site at all times during the construction so that Contractor can make a daily record of all work installed.

Actual location of hidden items including valves, stub cuts, manual drains, and shut-off valves shall be shown on the prints by dimensions from easily

identified permanent features such as buildings, curbs, fences, walks or property lines. Drawings shall show approved manufacturer's name and catalog number. The Drawings shall be to scale and all indications shall be neat. These prints will be observed by the Engineer throughout the course of work. All information noted on the prints shall be transferred to the final as-built with all indications recorded in a neat orderly way by Contractor.

C OPERATIONS MANUAL

One manual, bound in a hardback cover, shall be submitted to the Engineer for approval at the time of mainline testing. It shall include as a minimum the following information for all items used on the system:

List of authorized distributors and service representatives for each piece of irrigation equipment, including names, addresses, and phone numbers.

- Manufacturer's contact information
- Factory trained representative contact information
- Guarantee/warranty certificates.
- Instruction manuals.
- Parts lists for each item with exploded views of each item showing part numbers.
- Complete trouble-shooting guide to common irrigation problems.
- Winterization and spring startup procedures.

At the time of final review of the completed installation, the Contractor shall have completed revisions to the Engineer's satisfaction of the record drawings and operations manual (indicating all changes) ready to turn over to the Owner for recording purposes; this shall be accomplished prior to acceptance.

1.4 JOB CONDITIONS

A WATER SOURCE

Refer to the Plans.

B MECHANICAL/ELECTRICAL

Provide conduit for control wiring from the controller location to outside planting area(s) as shown on the Plans. 120 VAC power shall be supplied at the controller location.

C SLEEVING

Sleeve under all paved areas, size and material as shown on Plans.

D OTHER TRADES

Coordinate all work with that of other trades.

E AVAILABLE WATER PRESSURE

Verify available water pressure at point of connection and report this value to the Engineer prior to beginning work.

1.5 PROTECTION

The Contractor shall protect all work and adjacent property as well as the general public, and be responsible for any damage or injury arising from this contract.

Confine work to areas designated. Do not disturb natural vegetation outside of project limit lines. Protect all trees and shrubs within project limits not designated to be removed. Repair or replace vegetation damaged as a result of Contractor's operation to satisfaction of Owner at Contractor's expense.

Be cognizant of all utility lines and underground obstruction. Be familiar with all utility, irrigation, mechanical, and electrical plans, so that digging/drilling operations do not damage lines. Replace or repair at Contractor's expense any existing buildings, equipment, underground utilities, walks, stairs, and/or forms damaged as a result of Contractor's operations in a manner satisfactory to the Owner before final payment is made.

PART 2 PRODUCTS

2.1 GENERAL

All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified, and meeting the requirements of the system. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejections. All materials shall be color coded and/or labeled "Caution Non-Potable Water – Do Not Drink."

No substitutions of smaller pipe sizes will be permitted. However, substitutions of larger sizes of the same type, with prior approval from the Engineer, are acceptable.

2.2 PIPE AND FITTINGS

A PVC PIPE AND FITTINGS

Shall meet the requirements of Section 15050.

B DRIPLINE TUBING AND FITTINGS

Tubing shall be flexible, dual-layered, pressure-compensating polyethylene dripline tubing with integrally welded emitters at the spacing as indicated on Plans. Tubing emitters shall be protected from root intrusion by an integral piece of metallic copper.

Insert or compression fitting shall be provided by the manufacturer to be compatible with inline emitter tubing.

Dripline tubing and fittings shall be the XFCV(TM) Dripline by Rainbird, or equal.

2.3 EXCAVATION

All earthwork, excavation, bedding, backfill and compaction shall meet the requirements of Section 02300.

2.4 VALVES

Master Control Valve:	Rainbird Wide Flow Commercial Control Zone Kit with PESB Series Scrubber Valve and Pressure Regulating Basket Filter, or equal.
Zone Control Valves:	Rainbird XCZ-PRB-100-COM Series, or equal.
Air Relief Valves:	Rainbird ARV050, or equal.
Operation Indicator Pop-Up:	Rainbird OPERIND Series, or equal.
Manual Drain Valves:	Bronze angle globe valve.
Manual Flush Valves:	PVC ball valve.

2.5 VALVE BOXES AND PROTECTIVE SLEEVES

A GENERAL

Enclose all valves in valve boxes, at depth of pipe provide extensions to finish grade as required.

B VALVE BOXES

Valve boxes shall be sized to accommodate the components within and as indicated on the Plans. Boxes shall be heavy-duty, commercial boxes of black plastic with locking, black lids and an extra wide base flange. Boxes shall be the Rainbird VB Series, or equal.

C VALVE KEYS AND VALVE BOX COVER KEYS

Provide two complete sets of all keys for valve box lids.

2.6 CONTROLLER

Rainbird ESP-LX Series, or equal. Install new controller in location shown on the Plans.

2.7 MISCELLANEOUS ELECTRICAL EQUIPMENT

A CONTROL WIRE

Insulated single-strand copper, minimum AWG No. 14, 600 V UL-approved as Type UF. Copper conductor must meet or exceed ASTM B-3. Red, white, orange, and black colors must be available. Sufficient quantities must be supplied to meet splice and extra-wire requirements listed under control wire installation. Control wire size must meet or exceed Rainbird irrigation control wire specifications including length of run/size ratio.

B SPLICE

Make watertight electrical wire splices with either 3-M, Scott's Lock Seal tack 3576-78 or Pen-Tite PVC socket and sealing plug or Rainbird PT-100 series.

C ELECTRICAL TAPE

Black plastic, 3/4-inch-wide, minimum of 0.007-inches thick, and all-weather type.

D TRACE WIRE

Bare #10 solid copper.

PART 3 EXECUTION

3.1 REVIEW

A DISCREPANCIES

Upon initiation of work or at earliest time discovered, report to the Engineer any deviations between the irrigation Plans and the site. Failure to do so prior to the installing of equipment, and resulting in replacing, and/or relocating, or additional equipment, shall be done at Contractor's expense.

Installation of piping prior to establishment of correct subgrade elevations is strongly discouraged. Contractor must attain specified bury depths.

B AVAILABLE PRESSURE VERIFICATION

Prior to the start of any work, verify the assumed static pressure at point of connection. Notify Engineer in writing of pressure available for approval to proceed.

C PLANT MATERIALS

Locate irrigation lines to avoid proposed plant material locations and any existing trees. Minor field adjustments may be made by the Engineer to shrubs to avoid equipment. If conflict occurs with tree pit, relocate irrigation line at no additional cost.

3.2 PERFORMANCE

Stake the irrigation system locations following the shop drawing design for approval before the construction begins. Alterations and changes in the layout may be expected in order to conform to the ground conditions and to obtain full and adequate coverage of water. It is understood that corrective measures may become necessary but no changes or alteration in the system as planned shall be made without the prior authorization of the Engineer.

Where connections to existing stub-outs are required, make necessary adjustments in layout to connect should stubs not be located exactly as shown. Adjust layout as necessary to install around existing work. Do not install directly over another line in same trench.

Non-potable water service connections shall conform to the requirements set forth by the supplying agency, and all codes and ordinance.

A TRENCHING

Trenches shall be excavated for all pipe to provide a minimum depth of cover below finish grade as follows:

1. All mainlines: 18 inches

2. Laterals: 18 inches

3. Maximum bury depth for all pipe: 30 inches

Provide a minimum of 4-inches clear horizontally and vertically between pipes in a common trench.

Excavate no wider at any point than is necessary to lay the pipe or install equipment. Excavate with vertical sides and provide bracing and shoring as required.

Excavate to depth required in any material encountered with no extra compensation. Materials unsuitable for bedding of pipe to be removed to depth 4 inches below pipe depth.

Exercise care when excavating trenches near existing trees. Where roots are 2 inches and greater in diameter, except in the direct path of the pipe, hand-excavate and tunnel. When large roots are exposed, wrap with heavy burlap for protection and to prevent excessive drying. Trenches dug by machines shall have the sides hand-trimmed, making a clean cut of the roots. All roots 1/2 inch and greater in diameter that are cut and trimmed shall be treated with an approved tree wound dressing. Trenches having exposed tree roots shall be backfilled within 24 hours unless adequately protected by moist burlap or canvas.

B PIPING

1. Drain Valves

Installed at Point of Connection and elsewhere as shown on the Plans. Each drain to have 1/2 cu. yd. drain rock sump. Install valves as per detail. Locate sumps outside of paved areas, use offsets, if necessary. System will be winterized by compressed air blowdown. Locate all manual drains on as-built Plans.

2. Pipe Placement

Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer. Provide bare copper trace wire at mainlines only, attached to pipe 5-feet o.c.

3.3 PIPE JOINING

A GENERAL

All threaded joints (PVC or galv.) shall be sealed with Teflon tape or Rectorseal "Heavy Duty" #100 virgin Teflon thread sealing paste only (no substitutes).

Care shall be taken to not over-tighten fittings.

Keep interior of pipes clean and free from dirt, debris, excess solvent, pipe cuttings or burrs, and ream to full diameter. When pipe laying is not in progress, close ends of pipe.

B PVC PIPE

Use two-step solvent weld process only, apply as per manufacturer's recommendations.

No water shall be permitted in pipe until a period of at least 10 hours has elapsed for solvent weld-setting and curing. The joints shall be allowed to cure at least 24 hours before pressure is applied to the system.

Only factory-threaded schedule 80 PVC pipe may be connected to a threaded fitting without an adapter.

No male PVC adapters permitted. Use only female PVC adapters with galvanized steel pipe nipples (3 inch min. length). Street ells permitted

only for triple swing joints, and only “Marlex” Schedule 40 high-density polyethylene (no substitutes).

C INSTALLATION

1. General

See details for general installation requirements. Provide sufficient clearance for materials requiring maintenance. Install all materials as per manufacturer’s recommendations.

2. Valves

Enclose all valves (including automatic control valves and PRVs) in valve boxes. Valve box extension may be required. Install as per detail and locate precisely by dimensions to two fixes objects on as-built Plans.

Valve bonnet packings and bolts shall be checked and tightened before backfill.

3. Control Wiring Installation

Wiring between irrigation controller and automatic control valves shall conform with National Electrical Code, latest edition, and shall have a common neutral, white; and separate control conductor for each valve. Label wires at both ends in a permanent fashion.

Splices will be permitted only at junction boxes, valve boxes, or at control equipment. A minimum of 2 feet of excess conductor shall be left at all splices, terminal, and control valves to facilitate review and future splicing. Encapsulate all splices with approved sealants. Run a bare copper trace wire along all mainlines and wide bundles to the furthest zones.

Control wires are to be taped together at 5-foot intervals with electrical tape, then this bundle is to be taped to the bottom of the main (supply) line at 10-foot intervals with at least one full wrap of duct tape. Tie a loose 20-inch loop in all wiring at changes of direction greater than 30 degrees. Untie all loops after all connections have been made. At Contractor’s option, the control wire may be placed to the side of the main rather than below as indicated above, provided that the wire is not installed above the top of the main nor more than 8 inches from the side of the main.

The bundle of control wires shall be taped together at 5'-0" intervals. Sleeve all control wires which do not run with main line in PVC Cl. 200 pipe.

Run four unconnected continuous spare control wires (orange color) through each intermediate valve box (with loop) between each controller and furthest automatic control valve. When backfilling around valve box, make sure that spare wires, splices and excess conductor are visible in box.

4. Cleanup

Keep the premises free from rubbish and debris at all times, and arrange materials so as not to interfere with other operations on the job site. Remove all unused material, rubbish, and debris from the site.

3.4 REVIEWS AND TESTING

A GENERAL

To be valid, the pressure tests must be performed under the direction of the Engineer. The Contractor must give 48-hours notice to the Engineer when review is required. The location, review and testing provisions for these specifications shall be strictly adhered to.

If, for any reason, any part of the sprinkler system is backfilled before location, testing, or review, it must be completely uncovered and exposed until approved for backfilling by Engineer.

The Engineer reserves the right to direct the removal and replacement of any items that, in their opinion, do not present an orderly, reasonably neat, or skillful appearance, provided such items can be properly installed in such orderly way by the usual methods in such work. Such removal and replacement shall be done, when directed in writing, at the Contractor's expense without additional cost to the Owner.

B PRELIMINARY REVIEW/PRESSURE TESTING

Prior to request for preliminary review of arrival of Engineer, the Contractor shall:

- Install all pipe and valves (including drain valves and quick couplers) and all other equipment;

- Cap all risers except first riser from valve on each lateral (one uncapped riser per lateral), typical; and

- Purge all air from main lines.

C TEST OF MAINS AND VALVES

With all valves in place and closed, test at 150 psi minimum for 30 minutes without introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line where directed by Engineer. Lines which show loss of pressure exceeding 5 psi at the end of specified test periods shall be rejected. The Contractor shall correct installations rejects, and retesting will be performed as specified herein.

D TEST OF LATERALS

Purge all air from laterals and cap all risers. Open valves and bring system to line pressure. Lateral lines will be inspected visually. Lines which evidence visible leakage shall be rejected.

E REJECTED SYSTEMS

Rejected systems or portions of systems require repair and retesting in the manner specified.

F FINAL REVIEW/OPERATIONS AND COVERAGE CHECK

Prior to request for final review or arrival of Engineer accomplish the following:

Complete all work, including balancing, adjusting the system (pressure reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging. Backfill all except valve boxes.

G COVERAGE CHECK

Operate each zone of the system for the Engineer's review.

3.5 MAINTENANCE

Maintain entire system until final acceptance including balancing of system, repair of damage, raising settled heads, adjustments to spray and other updates as needed.

3.6 SYSTEMS OPERATION ORIENTATION

At time of and as part of the final review, conduct a training and orientation session for the Owner covering the operation, adjustment and maintenance of the irrigation system. The services of a factory-trained representative of the irrigation system manufacturer shall be provided. Services shall include 2 days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the irrigation system is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price. The record drawings and operations manual shall be reviewed and all features explained.

*****END OF SECTION*****

SECTION 02820

CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing and installing of chain link fencing and gates conforming to the lines, grades, and details and at the locations as shown on the Plans.

The furnishing, installing, maintaining, and removing of temporary fencing and gates shall be provided to provide site safety, security, and protection at the project site. The temporary fencing is required to stay in place until the permanent fence is installed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
03300	Cast-in-Place Concrete

1.3 QUALITY ASSURANCE

A. EMERGENCY ACCESS REQUIREMENTS

According to requirements of authorities having jurisdiction for gates serving as a required means of fire department access or emergency.

PART 2 PRODUCTS

2.1 FENCING

Chain link fencing shall conform to Section 9-16 of the WSDOT Standard Specifications, and shall be a Type 1 fence per WSDOT Standard Plan, with the following exceptions. The fence shall have continuous chain link wire, tension wire and three strands of barbed wire supported on angled extension arms. The chain link shall have a 2-inch diamond mesh and 9-gauge wire, meeting ASTM 668, Class 2b. The total height of the fence shall be as shown on the Plans. The fence shall be heavy steel guard fence with top rail and bottom tension wire. Top and bottom selvages of chain link fabric are to have a twisted and barbed finish.

The posts shall be equipped with extension arms, designed to carry three strands of barbed wire at an angle of 45 degrees. The topmost barbed wire shall be located approximately 12 inches above the fabric, and approximately 12 inches out from the fence line. Extension arms for line posts shall be of 14-gauge (minimum) pressed steel, provided with slots for securely fastening the barbed wires. Corner and fence post arms are to be of similar construction, and shall be constructed from a minimum of 12-gauge strip steel or heavy malleable iron, and shall be designed to provide sufficient strength to support the barbed wire.

The barbed wire shall be of the 4-point pattern, each wire to be composed of two strands of No. 12 1/2-gauge wire, galvanized after weaving.

2.2 CANTILEVERED ROLLING GATES

Gate shall be installed for the full opening shown on the Plans as per the manufacturer's recommendations. Gate shall be of heavy duty construction and shall be made to withstand repetitive daily use. The gate shall be constructed to restrict access of vehicles and pedestrians or other unauthorized personnel to the WWTF.

The gate must be designed to provide positive latching at full closure, even during periods of high wind. The gate shall be designed with a minimum stiffness to ensure positive closure during periods of high wind, or may be provided with ultra-high molecular weight guides at the latch post to ensure positive latching at full closure. If used, guides shall minimize gate chatter and vibration.

Gate shall open in the direction shown on the Plans.

2.3 EMERGENCY ACCESS CONTROL DEVICES

Emergency access control for manual cantilevered rolling gate shall be via the facility pedestal mounted lock box as shown on Plans.

PART 3 EXECUTION

3.1 TEMPORARY FENCING

The Contractor shall furnish and install temporary fencing around the site so as to protect the site and prevent unauthorized entry into the site. The Contractor shall also maintain the temporary fencing throughout the course of the construction and provide any and all security necessary for site safety and protection during periods when sections of the fence may be down or open. Temporary fencing shall be removed by the Contractor only after receiving written authorization from the Owner for its removal.

3.2 FENCING INSTALLATION

The chain link fencing shall be erected in straight lines between angle points by skilled workmen experienced in this type of construction, in accordance with the manufacturer's recommendations and these Specifications. The new fence installation shall not commence until final grading is complete and finish grade elevations are established. The new fence shall be constructed to provide security for the site. There shall not be any gaps between finish elevations and the bottom links of the fence, which would allow entrance into the site.

The site fence shall be constructed in conformance with Section 8-12 of the WSDOT Standard Specifications. The maximum spacing for line posts shall be 10-feet on center. Post holes shall be a minimum depth of 3 feet below finished grade; holes for line posts shall be 10 inches in diameter; holes for gate, corner, and pull posts shall be four times the diameter of the post. Posts shall be set plumb in true line and to the depth of 3 feet and the remainder of the hole filled with concrete that must extend around the posts to a point 2 inches above finished grade. The top surface shall have a crowned watershed finish.

Concrete shall be proportioned to provide at least 2,500 psi strength at 28 days. Materials, methods of proportioning, mixing, transporting and placing shall conform to Section 03300. After the concrete has set, accessories shall be installed; chain link fabric shall be fastened to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately 14-inch centers and 24-inch centers, respectively. Three lines of barbed wire shall be installed on the extension arms and drawn taut and secured at each bracket.

3.3 GATE INSTALLATION

Install gateposts in accordance with manufacturer's instructions.

Gate posts shall be diagonally braced to adjacent line posts to ensure stability. Gates shall be hung and all hardware adjusted so that gates operate satisfactorily from open or closed position.

Concrete set gateposts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times greater than outside dimension of post, and depths approximately 6-inches deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36 inches below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

Install gates plumb, level, and secure for full opening without interference.

Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

*****END OF SECTION*****

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of all landscaping work as shown on the Plans and as specified herein. Landscaping activities shall include work both at the project location as well as any residential properties that are affected by construction activities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02230	Clearing and Grubbing
02300	Earthwork

1.3 SUBMITTALS

A. WATERING SCHEDULE

Prior to Final Acceptance of the Landscaping, the Contractor shall submit a written "watering schedule" to the Owner to ensure adequate watering (summer, fall, winter, and spring) of all plant materials during the Guarantee Period of this Contract. Watering shall be by hand and watering truck, unless otherwise directed by the Owner.

B. PLANT PROCUREMENT

The Contractor shall provide all plants of the size, species, variety and quality noted and specified. Submit written documentation to the Owner that all specified plant materials have been ordered. If unavailable, the Contractor shall notify the Owner in writing immediately and provide the names, addresses, and telephone numbers of five nursery suppliers that have been contacted. If substitution should be permitted, it can be made only with the prior written acceptance of the Owner.

C. SOIL ANALYSIS REPORTS

See Section 2.1 and 2.2 of this Specification.

D. SUBGRADE PERCOLATION TEST RESULTS

See Section 3.1 of this Specification.

E. SEED MIX

See Section 2.4 of this Specification.

F. WEED AND PEST CONTROL PLAN

See Section 1.5 of this Specification.

1.4 QUALITY ASSURANCE

A. CONTRACTOR QUALIFICATIONS

All landscaping work shall be performed by a licensed Landscape Contractor registered in the State of Washington and shall be qualified for landscaping work through certification by the Washington Association of Landscape Professionals (WALP).

B. PLANT MATERIAL

Quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

C. FERTILIZER

Conform to Washington State Department of Agriculture Laws and Federal Specification O-F-241D pertaining to commercial fertilizers.

D. SEED

Conform to the minimum standards for "certified" grade seed.

Furnished in standard container on which the following information is shown: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

Furnish to the Owner duplicate copies of a statement signed by the vendor, certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the Project.

Seed that is wet, moldy, or otherwise damaged in transit or storage will not be accepted.

1.5 WEED AND PEST CONTROL PLAN

The Weed and Pest Control Plan (WPCP) shall be submitted and approved by the Owner prior to starting any landscape work.

The WPCP shall include scheduling and methods of all control measures described in this Section, including soil preparation methods to meet the required soil surface conditions in the planting areas. The weed control plan shall show general weed control including:

- Hand, mechanical, and chemical methods;
- Timing and frequency;
- Application of herbicides including type, rate, use, and timing; and
- Noxious weed control.

Target weeds and unwanted vegetation to be removed shall be identified and listed in the weed control plan.

The plan shall be prepared and signed by a licensed commercial operator with a Washington State Department of Agriculture (WSDA) Commercial Applicator pesticide license. The plan shall include methods of weed control, dates of weed control operations, and the name, application rate, and Material Safety Data Sheets (MSDS) of all proposed herbicides. In addition, the Contractor shall furnish the Owner with a copy of the current product label for each herbicide/pesticide and spray adjuvant to be used. These product labels shall be submitted with the weed control plan for approval.

All herbicides and/or pesticides must be carefully selected and applied in accordance with U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), WSDA, and local sensitive area ordinances and regulations.

1.6 GUARANTEE

A. GUARANTEE PERIOD

Guarantee work within this Specification for 2 years against all defects of materials and workmanship. The guarantee period begins after the date of Final Acceptance. Replace plants and seed areas not in normal healthy growing condition at the end of guarantee period. Replace with plants with identical species, size, and seed mix. Final Acceptance will be certified in writing by the Owner.

B. DEAD AND DISFIGURED PLANT MATERIAL

Any plant material that is 25 percent or more dead or disfigured shall be considered dead and must be replaced at no charge. A tree shall be considered dead when the main leader has died back or there is 25 percent of the crown dead. Plants shall be considered disfigured when excessive dead wood has been removed or when the symmetry, typical habit of growth, or sculptured form has been impaired by the removal of dead wood.

During the 2-year guarantee period, should any seed areas showing signs of failure such as dead or dying areas of grass or bare spots larger than 6-inch square, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

C. SEED PLANT REPLACEMENT

All plants are subject to one replacement only per item, and the Contractor shall submit, after each replacement period, a marked planting plan showing the exact location of each item replaced at that time. The owner may require the contractor to replace dead plants prior to the end of the guarantee period at no additional cost. This applies only after Final Acceptance.

Replacements made by the Contractor shall be made in the same manner as specified for the original planting, and shall be done at no extra cost to the Owner.

Replace all trees, shrubs, and groundcovers and seed areas when plants are no longer in a satisfactory growing condition as determined by the Owner for the duration of the guarantee period. Make replacements within 10 working days of notification from the Owner.

D. ACCESS TO PROJECT SITE

Contractor has the right to enter upon the property for inspection and curative treatment of any materials needing such which are still under warranty during the entire guarantee period. The Owner must be notified at least 48 hours in advance of any corrective or curative treatment measures so as to arrange for convenient access to the area.

E. APPLICABLE CONDITIONS

The guarantee shall be applicable to any growing conditions through which plants of like kind could be expected to survive, and any deformity or cause of death which could be attributed to, or affected by, the physiological condition of the plant shall be deemed replaceable cause; however, this would not apply to plant losses due to abnormal weather conditions such as floods, excessive wind damage, drought, severe freezing or abnormal rains, as determined by the National Weather Service.

F. MAINTENANCE DURING GUARANTEE

It is expressly understood that the Contractor will be responsible, during the Guarantee Period, for normal landscape maintenance of the project. Maintenance of the landscape shall include, but not be limited to hand watering, mowing, weeding, monitoring and treating any disease and/or pest-problems, cultivating and any other maintenance requirements, per standard trade practices, to keep the plant materials in a normal healthy growing condition.

PART 2 MATERIALS

2.1 TOPSOIL

The topsoil shall consist of 67 percent sandy loam and 33 percent composted organic material by volume.

The soil shall meet the following requirements:

Soil shall be sandy loam or loamy sand consisting largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall fall apart when the pressure is released; on squeezing when moist, it shall form a cast that does not only hold its shape when the pressure is released, but shall withstand careful handling without breaking.

The mixed soil shall meet the following gradation:

Screen Size	**Percent Passing**
1/2 inch	100
1/4 inch	95 – 100
#10	85 – 95
#30	60 – 75
#60	50 – 60

#100	20 – 30
#200	5 – 15

Shall have a pH range of 5.5 to 7.5. Soils indicated having a pH below 5.5 shall be treated with dolomitic limestone as necessary to attain this pH range. Soils having a pH greater than 7.5 shall be treated with sulfur as necessary to attain this pH range. The pH shall be determined by soil test.

Organic material shall consist of composted yard debris or organic waste material composted for a minimum of 3 months. Compost shall consist of 100 percent recycled content. In addition, the organic material shall have the following physical characteristics:

1. Shall pass a standard cress test for seed germination (90 percent germination compared to standard).

2. Shall have a pH from 5.5 to 7.5.

3. Shall have a maximum electrical conductivity of 3.0 ohms/cm.

4. Shall have a maximum carbon to nitrogen ratio of 40:1.

5. Shall be certified by the "Process to Further Reduce Pathogens" (PFRP) guideline for hot composting as established by the United States Environmental Protection Agency.

Submit a certified laboratory analysis from an accredited soils testing laboratory indicating the Material source and compliance with all planting soil Specifications to the Engineer for approval before delivery to the Project Site. The analysis shall be with a sample size of no less than 1 pound.

2.2 COMPOST

Composted material shall be derived from a Type 1 feedstock and produced by a facility in compliance with WAC 173-350-220. The compost shall meet Grade AA Compost as defined by Ecology's Interim Guidelines for Compost Quality (Publication #94-38, Revised November 1994). Compost material shall have 100 percent passing a 1/2-inch screen. The carbon to nitrogen ratio (C:N) of the compost shall be in the range of 20:1 to 35:1. Organic matter of the composted material shall be between 4 percent and 10 percent, and the moisture content shall be between 35 percent to 50 percent as determined by ASTM D 2974. The pH of the compost shall be within the range of 5.5 to 7.0 as determined by ASTM D 2976. The maximum electrical conductivity of composted material shall be 6 ohms/cm. Decomposed Organic Compost shall be mature as determined by US

Composting Council stability test ratings referred to in the Ch 173-350 WAC. The product shall be tested within 6 months of proposed use.

2.3 ARBORIST WOOD CHIP MULCH

Clean recycled wood chip from tree-trimming, composting operations or wood reclamation operations and shall not contain elements in quantities that would be detrimental to plant life. The product shall be certified free of all plant parasitic organisms, viable weed seeds, heavy metals or parasitic residues.

2.4 SEEDING, FERTILIZING, AND MULCHING

All areas that have been cleared and grubbed, graded, and where restoration is required, shall receive seeding, fertilizing and mulching. These areas shall be leveled, acceptable to the Owner, existing topsoil broken up to a depth of 6 inches and hydroseeded. Graded areas shall receive 6 inches of Class A topsoil prior to hydroseeding. Native materials selected by the Engineer from material excavated for foundations and stockpiled on site shall be used for topsoil.

For those areas in which hydroseeding would be difficult, the Contractor may request approval from the Owner to hand-apply the hydroseeding mix. Approval shall be granted for hand-application only after reviewing and approving the procedure that the Contractor recommends.

Seeding, fertilizing and mulching shall be installed using an approved-type hydroseeder.

The seed mixture shall have the following composition, proportion and quality:

Kind and Variety of Seed in Mixture	Percent By Weight	Minimum Percent of Pure Seed	Minimum Percent of Germination
Colonial Bent Grass (Highland or Astoria)	10%	9.8%	85%
Creeping Red Fescus (Illahee Rainier or Pennlawn)	40%	39.2%	90%
Perennial Rye Grass	30%	29.4%	90%
White Clover (Pre-inoculated)	20%	19.6%	90%
Maximum Percentage of Weed Seed	1.0%		
Maximum Inert and Other Crops	1.0%		

The seed shall be applied at a minimum rate of 120 pounds per acre.

A commercial fertilizer of the following formulation shall be furnished as specified, and all fertilizer shall be premixed prior to use on the job. The fertilizer shall be applied at the rate of 500 lbs. per acre.

Nitrogen (Inorganic) as N_2	**Nitrogen (Organic) Ureaformaldehyde**	**Phosphorous as P_20_5**	**as K_20**	**Potassium lbs/Acre**
10%	38%	20%	20%	500

Wood cellulose fiber mulch shall be applied at the rate of 2,000 pounds per acre.

2.5 SOD

Should sod not be available on the project site the sod shall be of grass sod that is a premium quality, which closely matches existing grass sod in the immediate area. The sod shall be purchased locally and, as such, accustomed to the existing climate and soil conditions of the local area.

2.6 PLANT MATERIALS

A. QUALITY

Genera, species, and variety; quantity, size, and conditions as shown on the Plans.

B. TREES, SHRUBS, AND GROUNDCOVER

All plants shall be nursery grown, or normal habit of growth, healthy, vigorous and free of disease, insect eggs and larvae. Plants shall not be pruned prior to delivery. Plants shall have all leaders and buds intact. Grading of plant material and root ball/container sizes shall be in accordance with the code of standards of the American Landscape and Nursery Association. Names shall conform to accepted nomenclature in the nursery trade.

Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged or crooked leader, bark abrasions, sunscald, disfiguring knots, insect damage, or cuts of limbs over 3/4 inch in diameter that are not completely closed will be rejected.

No less than 10 percent of each variety and/or species of plant delivered to the project shall be accurately labeled. Whether or not labeled, any plants, which do not conform to the Plant Schedule and/or the Plans shall be

replaced immediately with appropriate plant type. Plant material labels shall be durable, legible labels stating the correct plant name.

Provide the number of plants shown on the Plans. Collected plant material is not acceptable. Plant material with weeds in the top of the rootballs or containers will be rejected.

Trees grown in fabric bags shall have a well-established root system reaching the sides of the fabric bag to maintain a firm ball when the fabric is removed, but shall not have excessive root growth encircling the fabric bag. Fabric bags shall be entirely removed prior to planting.

PART 3 EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. DELIVERY

Deliver fertilizer and soil additives to the site in original unopened containers bearing manufacturer's guaranteed chemical analysis, weight, manufacturer's name, trademark, and conformance with state law.

Protect plant material during delivery to prevent damage to root ball, trunks, stems, or desiccation of leaves.

Transport plants in enclosed trucks. Large trees shall be totally wrapped to prevent damage and windburn. Provide adequate protection so that trunks are not scarred in transport and branches are not broken. Tree trunks shall be wrapped with protective covering prior to handling and loading. Covering shall be removed at the time of plant materials inspection at the job site.

B. HANDLING

Exercise care in handling, loading, unloading, and storing of plant materials. Plant materials damaged in any way shall be discarded and replaced with undamaged materials.

C. STORAGE

Protect plant materials from mechanical damage, wind, excessive sun, and drying out. If planting is delayed more than 4 hours after delivery, set plants in shade and keep roots moist by covering with mulch, soil or other acceptable means of retaining moisture.

Protect packaged materials from deterioration during storage.

3.2 PERCOLATION TEST

Prior to soil preparation, a percolation test shall be performed. This shall be accomplished by excavating a pit 2 feet in depth within the landscape area. Fill the pit with water and allow to drain for 24 hours. After 24 hours, refill the pit with water. If the time required for the pit to drain completely after being filled the second time is greater than 24 hours, the Contractor shall notify the Owner. The Contractor shall be paid for work required to solve the drainage problem, such as installation drainage sumps at a unit price basis and agreed upon by a Change Order prior to commencement of work.

3.3 SEED INSTALLATION

Seeding, fertilizing and mulching shall be installed in conformance with Sections 8-01 and 9-14 of the WSDOT Standard Specifications.

The seed materials will be applied in two applications. The first application shall consist of seed and a non-toxic tracer. The second application shall consist of a homogenous mixture of fertilizer and wood cellulose fiber mulch, and shall be uniformly applied over the seed within 48 hours of the seed application unless otherwise directed by the Owner.

When weather conditions are not conducive to satisfactory results from seeding operations, the Owner may order the work suspended and it shall be resumed only when the desired results are likely to be obtained.

Inspection is required for each area when seeding and fertilizing is complete, and again after mulching is complete.

Areas not receiving a uniform application of seeding at the specified rate as determined by the Engineer shall be reseeded at the Contractor's expense prior to mulching or payment.

3.4 SEEDED AREA SOIL PREPARATION

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 inches of compost over existing soil, mix and till to a depth of 6 inches. This material shall be suitable topsoil from the site or imported material.

3.5 LANDSCAPE AREA SOIL PREPARATION

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 inches of compost over existing soil, mix and till to a depth of 6 inches. Place additional 6 inches of topsoil on top of this throughout all buffer planting areas.

3.6 INSTALLATION OF PLANTS

Planting should occur in spring or fall of the year and when weather conditions are consistent with good horticultural practice. If container stock looks to be rootbound, slash roots vertically with a sharp knife along outside of ball in three places minimum before planting. Finish grade at plants, after planting and settling, shall afford positive drainage away from crown.

Set all trees, shrubs and groundcovers according to the Plans. Plant trees upright and face to give best appearance or relationship to adjacent public right-of-way or properties.

Excavate all planting holes twice the spread of the tree, shrub, or groundcover root ball or root system. Place 3 inches minimum lightly compacted layer of prepared topsoil under root system of each tree and shrub. Loosen planting hole subsurface to a depth of 4 to 6 inches prior to placement.

Loosen and remove from container as shown on the Plans. Pulling burlap from under balls will not be permitted on large and loose root balls. Cut off cleanly all broken or frayed roots.

Place and compact backfill soil consisting of topsoil carefully to avoid injury to roots, then fill all voids. When hole is nearly filled, completely fill with water and allow water to soak away. Fill holes to finish grade and prepare for other work indicated.

Provide all planting areas with uniform 2-inch layer of mulch over a properly cleaned and graded surface unless otherwise noted on the Plans.

All groundcover plant materials shall be installed continuous under all trees and shrubs as indicated on the Plans.

Fertilize all trees, shrubs and groundcover with Triple 14 slow-release fertilizer. Place fertilizer on surface of mulch around plant. Apply in quantities per manufacturer's specifications.

3.7 PROTECTION

All planting materials shall be properly protected against harm from normal weather conditions and the public by the Contractor until Final Acceptance. Maintenance of all the planted areas until Final Acceptance, shall include, but not be limited to, watering, mowing, weeding, and pruning as well as replacement of any plants that appear to be in distress. Tree stakes shall be kept secure at all times. Although planting should occur in spring or fall and when weather conditions are favorable, special planting techniques, defoliating, wilt proofing or spray misting may be required should unseasonable planting conditions occur. No work shall be performed in, over or adjacent to planting areas without approved protection and safeguards.

Plant losses due to abnormal weather conditions such as, floods, excessive wind, drought, severe freezing or abnormal rains; as determined by the National Weather Service shall not be the responsibility of the Contractor.

3.8 WEED CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of chemical herbicides shall require the use of anti-drift and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

All applications of post-emergent herbicides shall be made while green and growing tissue is present. Should unwanted vegetation reach the seed stage in violation of these Specifications, the Contractor shall physically remove and bag the seed heads. All physically removed vegetation and seed heads shall be disposed of offsite at no cost to the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair and pay for all damages caused by their negligence to the satisfaction of the Owner prior to final payment.

3.9 PEST CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of spray chemical pesticides shall require the use of anti-drift and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair and pay for all damages caused by their negligence to the satisfaction of the Owner prior to final payment.

3.10 CONSTRUCTION ACCEPTANCE

Construction acceptance shall be subject to well-established trees, shrubs, groundcover, and seeded areas that fulfills the requirement of the approved Plans. The Contractor shall protect and care for all plantings until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

Final Acceptance of all landscaping work described in this Specification, with the exclusion of possible replacements of plant materials under the Guarantee, shall be made by the Owner to determine 100 percent completion of the Contract work. This review shall be made upon written request to the Owner no less than 48 hours prior to the anticipated date of inspection.

***** END OF SECTION *****

SECTION 02950

SITE RESTORATION AND REHABILITATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes areas requiring restoration or rehabilitation as shown on the Plans or specified herein, including those areas that shall be graded, restored with hydroseeding or sod, areas restored with concrete sidewalk and driveway, and areas containing certain improvements and landscaping on and along the right-of-way including the adjacent private properties. The work also includes repair and replacement of fencing and other property features impacted construction.

Particular care shall be taken to minimize damage to landscaped areas within and adjacent to construction areas. In the event that construction is to be carried out in landscaped areas, appropriate measures shall be taken to restore such areas to conditions existing prior to construction.

Surface restoration type and location are shown on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
02230	Clearing and Grubbing
02300	Earthwork
02710	Gravel Surfacing
02740	Hot Mix Asphalt Paving
02900	Landscaping
03300	Cast-In-Place Concrete

1.3 QUALITY ASSURANCE

A. PLANT MATERIAL

Quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

See Specification Section 02900 for more information.

B. FERTILIZER

Conform to Washington State Department of Agriculture Laws and Federal Specification O-F-241D pertaining to commercial fertilizers.

See Specification Section 02900 for more information.

C. SEED

Conform to the standards for "certified"-grade seed or better.

Furnished in standard container on which the following information is shown: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

Furnish to the Owner duplicate copies of a statement signed by the vendor, certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the Project.

Seed that is wet, moldy, or otherwise damaged in transit or storage will not be accepted.

PART 2 PRODUCTS

2.1 HYDROSEEDING

See Specification Section 02900 for more information.

The seed mixture for easement and property restoration shall have the composition, proportion, and quality as specified in 02900-2.4.

2.2 TOPSOIL

See Specification Section 02900 for more information.

Topsoil shall have a pH value between 6 and 8, shall be fertile, friable, natural loam, containing 5 to 8 percent of humus, and shall be capable of sustaining vigorous lawn growth. Topsoil shall be free of any admixtures of subsoil, stones 2 inches in diameter or larger, clods of earth, plants or their roots, sticks, or other extraneous material. All topsoil shall be furnished as necessary and approved by the Owner to complete the required restoration and seeding.

2.3 PLANT MATERIALS

See Specification Section 02900 for more information.

A. QUALITY

Genera, species, and variety; quantity, size, and conditions as indicated on the Plans and Plant Schedule.

B. TREES AND SHRUBS

Provide straight, single-leader trees except for multiple-stem (clump) trees. Deciduous trees and shrubs shall have full, bushy tops with healthy branches and buds.

Trees and shrubs shall be fertilized with Triple 14 (14-14-14) slow-release fertilizer granules.

2.4 CONCRETE

Concrete for concrete curb and gutter shall meet the requirements of Section 8-04 of the WSDOT Standard Specifications. Concrete for driveway entrances shall meet the requirement of Section 8-06 of the WSDOT Standard Specification. Concrete for sidewalks shall be the requirements of Section 8-14 of the WSDOT Standard Specification.

2.5 FENCING REPAIR

Certain individual site locations will require temporary removal of fencing for site access and construction. The Contractor shall be required to remove and replace existing barbwire, wood, and chain link fences. The Contractor is urged to inspect the construction site so as to ascertain the condition of existing fences. The fences shall be replaced as soon as practicable with matching materials. If existing fence posts are cast in concrete the contractor shall install new fence posts and cast them in place to match the original installation methodology.

2.6 LANDSCAPE BARK

Bark shall be derived from Douglas fir, pine or hemlock species. The bark shall not contain resin, tannin or compounds in quantities that would be hazardous plant life. Bark shall be large size with greater than 50 percent larger than 4 inches in size.

2.7 LANDSCAPE FABRIC

Landscape fabric shall be heavy duty fabric 4 to 6 ounce per square yard. This material shall be warranted to withstand full sun for 5 years and be able to pass water at $3x10^{-2}$ cm/sec.

PART 3 EXECUTION

3.1 HYDROSEEDING

See Specification Section 02900 for more information.

Areas that have been cleared and grubbed and graded within the public right-of-way, which are not covered by gravel, concrete, or pavement, shall receive hydroseeding, fertilizing, and mulching. These areas shall be leveled, acceptable to Owner, existing topsoil broken up to a depth of 6 inches and hydroseeded. Graded areas shall receive 6 inches of topsoil prior to hydroseeding. Native materials selected by the Owner from material excavated for foundations and stockpiled onsite may be used for topsoil.

For those areas in which hydroseeding would be difficult, the Contractor may request approval from the Owner to hand-apply the hydroseeding mix. Approval shall be granted for hand-application only after reviewing and approving the procedure that the Contractor recommends.

Seeding, fertilizing, and mulching shall be installed in conformance with Sections 8-01 and 9-14 of the WSDOT Standard Specification.

Seeding, fertilizing, and mulching shall be installed using an approved type hydroseeder.

When weather conditions are not conducive to satisfactory results from seeding operations, the Owner may order the work suspended and it shall be resumed only when the desired results are likely to be obtained.

Areas that have received an application of mulching shall be inspected upon completion of the work and again on the completion of the application of seed and fertilizer.

3.2 SOIL PREPARATION

See Specification Section 02900 for more information.

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 to 3 inches of topsoil over existing soil, mix and till to a depth of 6 inches. This material shall be suitable topsoil from the site or imported material.

3.3 TREE PLANTING

See Specification Section 02900 for more information.

Plant trees and shrubs upright and face to give best appearance or relationship to adjacent plants.

Excavate all planting holes twice the spread of the tree, shrub, or groundcover root ball or root system. Place 3 inches minimum of topsoil lightly compacted layer of prepared topsoil under root system of each tree and shrub. Loosen planting hole subsurface to a depth of 4 to 6 inches prior to placement.

Loosen and remove burlap from around at least upper 1/2 of root ball and remove excess burlap. Pulling burlap from under root balls will not be permitted on large and loose root balls. Cut off cleanly all broken or frayed roots.

Place and compact backfill soil consisting of two way topsoil carefully to fill all voids and avoid injury to roots. Mix moisture-retention agent into backfill per manufacturer's specifications. When hole is nearly filled, completely fill with water and allow water to soak away. Fill holes to finish grade and prepare for other work indicated.

Fertilize all trees, shrubs and groundcover with Triple 14 slow-release fertilizer. Place fertilizer on surface of mulch around plant. Apply in quantities per manufacturer's specifications.

3.4 TOPSOIL

See Specification Section 02900 for more information.

Those areas to receive topsoil shall have the trenched backfilled to within 6 inches of the finished grade. A compacted 6-inch depth of topsoil shall then be applied to the subgrade. The Contractor may elect to utilize and stockpile existing and excavated topsoil material; however, no separate payment will be made for its use.

3.5 CONCRETE

Concrete Curbs and Gutters shall be constructed per WSDOT Standard Specifications Section 8-04. Sidewalks shall be constructed per WSDOT Standard Specifications Section 8-14. Driveway entrances shall be constructed per WSDOT Standard Specification Section 8-06.

Any curb, gutter, sidewalk or driveway entrance damaged, defaced, cracked, chipped, or determined to be of poor workmanship, in the opinion of the Owner, shall be removed, wastehauled and replaced by the Contractor, at the Contractor's expense. Sacking and grinding shall not be considered an acceptable means for repairing unacceptable sections. The Contractor shall further provide verbal and written notice (door hanger) to property owners identifying restricted use of their driveways, sidewalks, etc. This notice must be provided twice: at 1 week prior and again 1 day prior to the work being performed.

At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2 inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

Place preformed asphalt expansion joints in the adjacent curb, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk.

Provide contraction joints transversely to the walks at locations opposite the contraction joints in the curb. These joints shall be 3/16-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the surface of the walk. Walk areas wider than 20 feet shall have longitudinal contraction joints at spacings not to exceed 15 feet.

Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher requirement shall govern.

Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a joining tool. Upon completion of the finishing, apply an

approved curing compound to exposed surfaces. Protect the sidewalk from damage for a period of 7 days.

Driveway access shall be maintained at all times. The Contractor shall use steel plates to bridge entrances or construct entrances in sections in order to protect new driveway entrances and allow access during the curing period.

The driveway entrance, curb and gutter and sidewalk shall be protected against damage or defacement of any kind until acceptance by the Owner. Any driveway entrance not acceptable, in the opinion of the Engineer, because of damage or defacement shall be removed, wastehauled, and replaced by the Contractor at the Contractor's expense. Sacking, grinding, or spot repair shall not be considered an acceptable means for repairing unacceptable sections.

3.6 LANDSCAPE FABRIC AND BARK

Landscape fabric shall be spread smoothly across the final grade and the fabric shall be overlapped by 1 foot. The fabric shall be pinned by jute net pins on a approximate 10-foot grid and along the edge of the fabric.

The bark shall be placed to a depth of 4 inches.

3.7 LANDSCAPED AND IMPROVED AREAS

Certain improvements and landscaping have been placed on and along the rights-of-way including the adjacent private properties. Wherever such property is damaged, destroyed, or the use thereof is interfered with due to the operation of the Contractor, it shall be immediately restored to its former condition by the Contractor. Notice should be given to the property owner along the route of construction by the Contractor advising them of the methods he will use to preserve and restore the improvements.

3.8 HYDROSEEDING, LANDSCAPING, WATERING MAINTENANCE AND PROTECTION

The Contractor shall water, protect and care for all seeded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient watering of all planted areas until final acceptance. See Specification Section 02900 for more information.

Watering of hydroseeded, grass sod, and landscaped areas shall be at the Contractor's expense until new plantings are fully established.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any planted areas show signs of failure, such as dead or dying areas of grass or bare spots, or any shrubs or trees planted as part of the site restoration fail, the Contractor shall repair or replace all deficient seeded areas and replace all dead shrubs and trees to the satisfaction of the Owner. If any seeded areas or plants require replacement, the Contractor's maintenance and guarantee period applicable to the replaced plants shall extend for an additional 1-year period after the time of the replacement.

The Contractor shall mow all newly established lawn areas a minimum of two mowings. The first mowing shall be performed only after an established and healthy stand of grass is judged to have grown. The second mowing shall occur upon establishment of second healthy stand of grass (4 inches in height).

3.9 FINISHING AND CLEANUP

Before acceptance of the Project, all pipes, manholes, catch basins, and other appurtenances shall be cleaned of all debris and foreign material. After all other work on the Project is completed and before final acceptance, the entire roadway, including the roadbed, planting, sidewalk areas, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades and cross-sections shown on the Drawings and as hereinafter specified.

In undeveloped areas, the entire area which has been disturbed by the construction shall be shaped so that, upon completion, the area will present a uniform appearance, blending into the contour of the adjacent properties. All other requirements outlined previously shall be met. Slopes, sidewalk areas, planting areas and roadway shall be smoothed and finished to the required cross-section and grade.

Upon completion of the cleaning and dressing, the Project shall appear uniform in all respects. All graded areas shall be true to line and grade as shown on the typical sections and as required by the Owner.

All rocks in excess of 1-inch diameter shall be removed from the entire construction area and shall be disposed of the same as required for other waste material. In no instance, shall the rock be thrown onto private property. Overhang on slopes shall be removed and slopes dressed neatly so as to present a uniform, well sloped surface.

All excess excavated material within the limits of the Project shall be removed entirely. All debris resulting from clearing and grubbing or grading operations shall be removed and disposed.

Drainage facilities, such as inlets, catch basins, culverts, and open ditches, shall be cleaned of all debris resulting from the Contractor's operations.

All pavements and oil mat surfaces, whether new or old, shall be thoroughly cleaned. Existing improvements, such as Portland cement concrete curbs, curb and gutters, walls, sidewalks, and other facilities which have been sprayed by the asphalt cement shall be cleaned to the satisfaction of the Owner.

Castings for manholes, monuments, water valves, lamp poles, vaults, and other similar installations which have been covered with the asphalt material shall be cleaned to the satisfaction of the Owner.

3.10 CONSTRUCTION ACCEPTANCE

The Contractor shall protect and care for all seeded and sodded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any seed areas show signs of failure such as dead or dying areas of grass or bare spots, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

3.11 PERMANENT SIGNING AND APPURTENANCES

During the life of the Contract all existing signs, mailboxes and other appurtenances that are damaged or removed shall be replaced by the Contractor at no additional expense to the Owner.

Existing signs may be temporarily relocated to portable sign stands for convenience of construction, subject to the approval of the Owner. When temporarily installed on posts, the signs shall be located as near as practical to their permanent locations and shall have a minimum vertical clearance above the pavement in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). Private signs and appurtenances shall be removed and provided to the Owner.

All portable sign stands shall be designed to rigidly support the sign in position without creating a hazard to the motorist. Portable sign stands shall be furnished by the Contractor and upon completion of the work shall remain the property of the Contractor and shall be removed from the Project.

All signs, unless specified herein, shall be mounted at a height of 7 feet as measured vertically from the ground (finished grade) to the bottom of the sign.

3.12 ADJUSTMENT OF NEW AND EXISTING STRUCTURES TO GRADE

This work consists of constructing and/or adjusting all new and existing utility structures encountered on the Project to finished grade.

Prior to commencing manhole adjustments, a plywood and visqueen cover, as approved by the Owner, shall be placed over the manhole base and channel to protect them from debris.

The castings shall not be adjusted until the contactor has completed his paving operations. The asphalt concrete pavement around the casting shall be cut and removed to a neat circle, the diameter of which shall not exceed 6 inches from the outside diameter of the casting frame. The casting frame shall be brought up to the desired grade. Adjustment of manholes, catch basins and precast concrete vaults shall be made with the use of concrete adjustment rings or bricks. No iron adjustment rings will be allowed. An approved class of mortar (one part cement to two parts of plaster sand) shall be placed between adjustment rings or bricks and casting frame to completely fill all voids and to provide a watertight seal. No rough or uneven surfaces will be permitted inside or out. Adjustment rings or brick shall be placed and aligned so as to provide vertical sides and vertical alignment of ladder steps (if steps are necessary).

***** END OF SECTION *****

DIVISION 3

CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes reinforcement and associated items for all concrete, including, but not necessarily limited to: reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payment
01300	Submittals
03300	Cast-in-Place Concrete

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ACI 301	Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	American Concrete Institute - Detailing Manual
ANSI/ASTM A82	Cold Drawn Steel Wire for Concrete Reinforcement
ANSI/ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/AWS D1.4	Structural Welding Code for Reinforcing Steel
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement

1.4 SUBMITTALS

Submit in accordance with provisions of Section 01300.

A. SHOP DRAWINGS

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

B. MANUFACTURER'S CERTIFICATE

Certify that reinforcing bar and welded wire fabric meet or exceed specified requirements.

Submit certified copies of mill test reports of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

Perform Work in accordance with ACI 301.

1.6 COORDINATION

Coordinate with placement of formwork, formed openings, and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. REINFORCING STEEL

ASTM A615, deformed bars: Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, unless noted otherwise on the Plans.

B. WELDED STEEL WIRE FABRIC

ASTM A185 Plain Type; in flat sheets; plain.

2.2 ACCESSORY MATERIALS

A. TIE WIRE

Minimum 16-gauge annealed type.

B. CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS

Sized and shaped for strength and support of reinforcement during concrete placement conditions including load-bearing pad on bottom where required to prevent vapor barrier puncture.

C. SPECIAL CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS ADJACENT TO WEATHER EXPOSED CONCRETE SURFACES

Plastic-coated steel type; size and shape as required.

D. MECHANICAL BAR SPLICES

Comply with ACI 318 requirement of minimum tensile strength of 125 percent of specified yield for reinforcement.

Subject to compliance with the requirements and approval of the Engineer, products, which may be incorporated into the work include, but are not limited to, the following:

BAR-LOCK (MBT) Coupler Systems
"ERICO" REBAR SPLICING

E. ADHESIVE ANCHORS

Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

1. Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:

   a. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

   b. SET-3G, Simpson Strong Tie, Inc.

   c. PE1000+, Powers Fasteners, Inc.

2.3 FABRICATION

Fabricate concrete reinforcing in accordance with ACI SP-66. Obtain written approval from the Engineer prior to welding reinforcing steel. Weld reinforcement in accordance with ANSI/AWS D1.4.

PART 3 EXECUTION

3.1 PLACEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal/plastic chairs, runners, bolsters, spacers, and hangers, as required.

Install reinforcing bars with clearance indicated on the Plans. Provide laps as shown and stagger locations to minimize the concentration of multiple reinforcing at joints. Bar lap splicing shall have full contact. Where full contact cannot be achieved, the maximum space between the spliced bars shall not exceed 2 inches. Unless noted otherwise on the Plans, provide two #5 minimum trim bars around all openings and penetrations. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

***** END OF SECTION *****

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes schedules, notes, and details for the construction of cast-in-place concrete structures, landings, equipment piers, housekeeping pads and slabs on grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
03200	Concrete Reinforcement
Division 7	Thermal and Moisture Protection

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ACI 117	Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 212.3	Chemical Admixtures for Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Tightness Testing of Reinforced Engineering Concrete Structures and Commentary
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

1.4 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. GENERAL

The submittal for each included concrete mix shall include, as a complete package, the following as defined below:

1. Concrete Mix Design

2. Certified Test Results

3. Sieve Analysis

4. Product Data

An incomplete concrete mix submittal package may render a rejection of the mix or could delay the review process.

B. CONCRETE MIX DESIGN

Submit mix design for the proposed mix to be used on the Project, indicating components, and proportions by weight, including any admixtures. Mix design shall state chloride content. Mix designs to be provided are:

1. Unspecified Concrete

2. Lean Concrete

3. Cement Grout

C. CERTIFIED TEST RESULTS

Submit laboratory test results indicating compressive strength of concrete in compliance with requirements specified herein and in accordance with ACI 301.

D. SIEVE ANALYSIS

Submit sieve analysis for proposed coarse and fine aggregates indicating components, source, gradation, and WSDOT aggregate source approval report, including WSDOT Aggregate Source ID.

E. PRODUCT DATA

Provide product data on all proposed admixtures, accessories, and embedded items to be used on the Project, including, but not limited to:

1. Cement; source and type

2. Air Entraining Agent

3. Water Reducing Admixtures

4. Pozzolans

5. Bonding Agents

6. Curing Compounds/Floor Hardeners

7. Non-Shrink Grout; Non-metallic and Metallic

8. Waterstops

9. Plastic Joint Formers

10. Vapor Barriers

11. Stair Nosings

For admixtures other than those proposed for air entrainment, submit a letter from the manufacturer describing the benefits of its use for the project and effect of its use on the properties of the concrete. Product data shall expressly state admixtures are chloride free, or the manufacturer shall submit a letter certification stating the same.

F. MATERIAL DELIVERY TICKETS

Provide copies of all concrete and grout material delivery tickets for the Project to the Engineer.

1.5 QUALITY ASSURANCE

Perform work in accordance with ACI 301. Acquire cement and aggregates from same source for all work performed on the Project. Conform to ACI 305 when concreting during hot weather. Conform to ACI 306 when concreting during cold weather. Provide or coordinate field and laboratory testing as described later in this Section and under provisions of Section 01400.

1.6 COORDINATION

Coordinate work in accordance with provisions of Section 01310. Coordinate the placement of embedded items with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 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 the Plans.

B. 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.

C. FORMS FOR CYLINDRICAL COLUMNS AND SUPPORTS

Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

D. FORM COATINGS

Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

E. FORM TIES

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units, which will leave no metal closer than 1-1/2 inches to surface. Unless noted otherwise on Plans, provide ties with plastic cone devices which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. CEMENT

ASTM C150, Type II – Moderate or Type I - II. Use one brand of cement throughout the project, unless otherwise approved by the Engineer. Provide low alkali cement where Alkali-Silica Reaction (ASR) mitigation measures are required by WSDOT Aggregate Source Approval.

B. FINE AND COARSE AGGREGATES

Comply with ASTM C33. Provide aggregates from a single source. Coarse aggregate shall be size designation 467 (Nominal size 1-1/2 inch to No. 4 sieve) for all liquid containing structures, and size designation 67 (Nominal size 3/4-inch to No. 4 sieve) for all other concrete. Aggregates shall show a loss of weight not exceeding 35 percent after 500 revolutions

in a Los Angeles wear machine, when tested in accordance with ASTM C131 or ASTM C535. Aggregates shall be from a WSDOT approved source.

C. WATER

Clean, potable, and not detrimental to concrete, in compliance with ASTM C94.

2.3 ADMIXTURES

Except for air entrainment, use of all other admixtures used shall be subject to approval of the Engineer and at no additional cost to the Owner. Only admixtures expressly stated by the manufacturer as being chloride-free shall be used. Subject to compliance with requirements, products, which may be incorporated into the work include, but are not limited to, the following:

A. AIR ENTRAINMENT

ASTM C260 certified by manufacturer to be compatible with other proposed admixtures.

Master Builders MB AE 90 or MICRO-AIR
Sika AER
W.R. Grace Daravair or Darex Series

B. WATER REDUCING ADMIXTURE

ASTM C494 Type A.

Master Builders PolyHeed
Sika Plastocrete 161
W.R. Grace WRDA Series

C. ACCELERATING ADMIXTURE

ASTM C494 Type C.

Master Builders Pozzolith NC534
Sika Plastocrete 161 FL
W.R. Grace Polarset or DCI

D. WATER REDUCING, RETARDING ADMIXTURE

ASTM C494, Type D.

Master Builders Pozzolith 100XR
Sika Plastiment
W.R. Grace Daratard Series

E. WATER REDUCING, ACCELERATING ADMIXTURE

ASTM C494, Type E.

Euclid Chemical Co. Accelguard 80
Master Builders Pozzutec 20
W.R. Grace Daraccel

F. HIGH RANGE WATER REDUCER (HRWR)

ASTM C494, Type F.

Master Builders Rheobuild 1000/3000 FC
Sika Sikament 10 ESL
W.R. Grace ADVA 100

G. HIGH RANGE WATER REDUCER AND RETARDER

ASTM C494, Type G.

Master Builders Pozzolith 440N
W.R. Grace Daracem-100

H. POZZOLAN

ASTM C618 - CLASS F, with a CaO maximum content of 10 percent.

2.4 ACCESSORIES

A. BONDING AGENT

ASTM C881, Type I and II, Grade 2, Class C, Epoxy Resin. Subject to Contract requirements, provide one of the following or equal:

Sika Armatec 110
Conspec SpecBond 100

W.R. Meadows Sealtight Rezi Weld 1000

B. CURING COMPOUND/CHEMICAL FLOOR HARDENER

ASTM C309, Type I, Class A and B. Subject to Contract requirements, provide one of the following or equal:

W.R. Meadows Sealtight 1100-Clear
Conspec RX cure
Chemrex, Inc. Masterkure
Burke Spartan-Cote WB

C. GENERAL PURPOSE NON-SHRINK NON-METALLIC GROUT

Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 Mpa) in 48 hours and 7,000 psi (48 Mpa) in 28 days. Subject to Contract requirements, provide one of the following or equal:

Sika SikaGrout 212
Conspec 100 Non Metallic
Chemrex, Inc. Masterflow 928 Grout
W.R. Meadows Sealtight 588

D. WATERSTOPS

Provide waterstop of type and size at construction joints and other joints as indicated on the Plans.

1. PVC (Polyvinyl Chloride)

Serrated (ribbed), 3/8 of an inch minimum thickness for 6 inches and larger and 3/16 of an inch minimum thickness for 4 inches. Comply with Corps of Engineers CRD-C-572. No reclaimed PVC will be allowed in waterstop.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation

W.R. Meadows

2. Cold Joint Waterstop

Install where shown on the Plans or at locations approved by the Engineer. Cold joint waterstop shall be certified by the manufacturer to be compatible for use in wastewater (sewage) containment structures. Unless otherwise shown in the Plans, size shall be 1-inch thick and 1-inch wide.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Hydrotite, Greenstreak

E. PLASTIC JOINT FORMER

Provide and install, per manufacturer's recommendations, where shown on the Plans or at locations approved by the Engineer. Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

F. STAIR NOSINGS

American Safety Tread Co., Inc., Style 816 with steel wing anchors with nuts and anchor bolts or equal.

G. VAPOR BARRIER

Six-mil fabric reinforced plastic film.

2.5 CONCRETE MIX

A. GENERAL

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 the Engineer for preparing and reporting proposed mix designs. The

testing facility shall not be the same as that used for field quality control testing.

The maximum water soluble chloride ion content, expressed as a percent of the cement, contributed from all ingredients of the concrete mix, including water, aggregates, cementitious materials, and admixtures, shall not exceed 0.10 percent. Pozzolans may be counted as part of the total cementitious material in the concrete mix design. The cementitious material is the "minimum cement content" specified in the mix design for each type of concrete. When pozzolans are used as part of this "cement content," the minimum content shall be 15 percent by weight of the total cementitious materials (Portland cement and pozzolans) and not more than 20 percent.

Where ASR mitigation measures are required by WSDOT, provide a minimum of 15 percent pozzolan included in the cementitious material in the design mix.

B. MIX DESIGNS

Provide normal weight concrete with the following properties, unless noted otherwise on the Plans.

1. Unspecified Concrete

Structural concrete of general use in structures, sidewalks, and where no specific class of concrete is designated.

Minimum compressive strength @ 28 days:	4,000 psi
Minimum cement content:	6 sacks per cubic yard
Maximum water cement ratio by weight:	0.45
Nominal coarse aggregate size:	1-1/2" to No. 4 (size designation 467)

2. Lean Concrete

Concrete for pipe thrust blocks or for use as noted as "Concrete Fill" on the Plans.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	5 sacks per cubic yard

3. Cement Grout

Material for filling guard posts, grouting of clarifier bottoms or for other uses as shown on the Plans. Cement grout shall be sand and cement only and shall not contain coarse aggregate.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	6.5 sacks per cubic yard
Maximum water cement ratio by weight:	0.54

C. ADMIXTURES

1. Air Entrainment

Use air-entraining admixture complying with ASTM C260 in all exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement in accordance with ASTM C173 or C231 having total air content with a tolerance of plus or minus 1 percent within the following limits:

5.5 percent for 1.5 inch max. coarse aggregate size
6.0 percent for 1.0 inch max. coarse aggregate size
7.0 percent 0.50 inch or less max. coarse aggregate size

2. Other Admixtures

Use of all other admixtures shall be subject to the approval of the Engineer, and shall be in accordance with ACI 212.3 and Manufacturer's recommendations. Only admixtures stated by the manufacturer to be chloride free shall be used.

D. SLUMP LIMITS

Proportion and design mixes to result in concrete slump (1 inch ± of the maximum) at the point of placement in accordance with ASTM C143 as follows:

Ramps, slabs, and sloping surfaces: 3 inches.

Reinforced foundation systems: 3 inches.

Other concrete: 4 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2- to 3-inch slump concrete.

E. CONCRETE MIXING

Comply with requirements of ASTM C94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required.

PART 3 EXECUTION

3.1 GENERAL

Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

3.2 FORMS

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back up at all joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast-in-place concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Provide Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer all exposed corners and edges and other areas shown on the Plans, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

3.3 JOINTS AND WATERSTOPS

A. CONSTRUCTION JOINTS

Locate and install construction joints where indicated, or locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise shown on the Plans.

B. WATERSTOPS

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

C. ISOLATION JOINTS IN SLABS-ON-GRADE

Unless otherwise noted, construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as shown on the Plans.

Joint filler and sealant materials are specified in Division 7.

D. SLAB (CONTROL) JOINTS

Construct joints in slabs-on-grade as shown on the Plans. Use saw cuts 1/8 of an inch wide x 1/4 of the slab depth or inserts 1/4-inch wide x 1/4 of the slab depth.

E. PREMOLDED (CONTROL) JOINTS

Insert premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

F. EDGE FORMS AND SCREED STRIPS FOR SLABS

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. GENERAL

Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use installation drawings, diagrams, instructions, and directions provided by suppliers of items to be embedded.

B. CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

C. REGLETS

Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing as shown at lintels, relieving angles, and other conditions.

3.5 VAPOR BARRIER INSTALLATION

Following leveling and tamping of granular base material for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of concrete placement.

Lap joints a minimum of 6 inches and seal with appropriate approved tape. After placement of vapor barrier, cover with sand material and compact to depth as shown on the Plans.

3.6 PLACING REINFORCEMENT

See Section 03200.

3.7 PREPARATION OF FORM SURFACES

Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.8 PREPARATION OF EXISTING CONCRETE SURFACES

The Contractor shall bush hammer all existing concrete surfaces that are to have new concrete cast against them. Apply epoxy bonding agent prior to placing concrete.

3.9 CONCRETE PLACEMENT

A. GENERAL

Comply with ACI 304 and as herein specified.

Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during concrete placement.

B. PLACING CONCRETE IN FORMS

Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators 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 set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

C. PLACING CONCRETE SLABS

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Maintain reinforcing in proper position during concrete placement operations.

D. COLD WEATHER PLACING

Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

E. HOT WEATHER PLACING

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is at Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed. Upon approval, water-reducing retarding admixture (Type D) may be used when required by high temperatures, low humidity, or other adverse placing conditions.

3.10 FINISH OF FORMED SURFACES

Provide smooth form finish for all formed concrete surfaces exposed-to-view including all surfaces exposed to water or wastewater, or that are to be covered with a coating material applied directly to the concrete, or a covering material

applied directly to concrete, such as veneer plaster, painting, or other similar type of system.

Provide smooth form finish for surfaces to be waterproofed or dampproofed. Surfaces must comply with recommendations of the manufacturer of the product being utilized.

Provide rough form finish for formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.

A. SMOOTH FORM FINISH

This is to be the as-cast concrete surface obtained utilizing selected form facing material, arranged orderly and symmetrically with a minimum of seams, and as specified herein.

Repair and patch tie holes and defective areas, with all fins or other projections completely removed and smoothed, by one of the following methods:

1. Provide smooth rubbed finish to concrete surfaces after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

2. Provide grout "sacked" cleaned finish. The sacking grout shall be one part Portland cement to 1-1/2 parts fine sand by volume, and mixed with water to consistency of thick paint. Proprietary additives such as epoxy bonding agents or adhesives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts to be determined by trial patches, so that final color of dry grout matches adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep sacked surfaces damp by fog spray or other acceptable method so surfaces do not dry out.

B. ROUGH FORM FINISH

This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/8 of an inch in height rubbed down

or chipped off. All "bug holes" exceeding 1/2 inch in diameter and exceeding 1/4-inch depth shall be repaired or filled in.

C. RELATED UNFORMED SURFACES

At tops of walls, horizontal offsets, and similar unformed surfaces occurring at adjacent formed surfaces, continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

D. TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:

a.	In the lines and surfaces of columns, pier, walls and in arises	In any 10 feet of length – 1/4 inch. Maximum for entire length – 1 inch
b.	For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch

2. Variations from level or from the grades indicated on the Plans:

a.	In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores	In any 10 feet of length – 1/4 inch. In any bay or opening, or in any 20 feet of length – 3/8 of an inch. Maximum for entire length – 3/4 inch
b.	In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or opening, or in any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch

3. Variations in the linear building lines from the established position in plan view — In 20 feet of length – 1/2 inch. Maximum for entire length – 1 inch

4.	Variations in distance between walls, columns and partitions		In any 10 feet of distance – 1/4 inch. In any bay or opening – 1/2 inch. Maximum total variation – 1-inch.
5.	Variations in the sizes and locations of sleeves, floor openings and wall openings		Minus – 1/4 inch Plus – 1/2 inch
6.	Variations in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls		Minus – 1/4 inch Plus – 1/2 inch
7.	Variations in footings:		
	a.	Variation from dimensions on Plans when formed or plus 3-inches when placed against unformed excavations	Minus – 1/2 inch Plus – 2 inches
	b.	Misplacement of eccentricity	2 percent of the footing width in the direction of the misplacement, but not more than 2 inches
	c.	Reduction in thickness of specified thickness	Minus – 5 percent
8.	Variations in steps:		
	a.	In a flight of stairs	Riser – 1/8 of an inch Tread – 1/4 inch
	b.	In consecutive steps	Riser – 1/16 of an inch Tread – 1/8 of an inch

3.11 MONOLITHIC SLAB FINISHES:

A. SCRATCH FINISH

Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping, including grout finishes where indicated on plans, or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. Slope surfaces uniformly to floor drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. FLOAT FINISH

Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. TROWEL FINISH

Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth surface defects that would telegraph up through applied floor covering system.

D. TROWEL AND FINE BROOM FINISH

Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. NON-SLIP BROOM FINISH

Apply non-slip broom finish to exterior concrete platforms, landings, steps, and ramps, sidewalks and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner before application.

F. CHEMICAL-HARDENER FINISH

Apply chemical-hardener finish to interior exposed concrete floors and steps, unless noted otherwise. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

G. TOLERANCES FOR MONOLITHIC SLAB FINISHES

The flatness of the concrete shall be carefully controlled and the tolerances shall be measured by the straight edge system as specified in paragraph 4.5.7 of ACI 117, using a 10-foot straight edge, within 72 hours after floor slab installation and before shores and/or forms are removed. The tolerances listed below shall be met at any and every location at which the straight edge can be placed.

Bullfloated	1/2 inch
Float Finish	3/16 inch
Trowel Finish	1/8 inch
Straightedges	5/16 inch

3.12 CONCRETE CURING AND PROTECTION

A. GENERAL

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep concrete continuously wet for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried out. Continue final curing for at least 7 days in accordance with ACI 301 curing methods. Avoid rapid drying of concrete at the end of final curing period.

B. CURING METHODS

Perform curing of concrete by use of curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

Provide moisture curing by the following methods. Keep concrete surface continuously wet by covering with water, or provide continuous water-fog spray.

Covering concrete surface with absorptive cover, thoroughly saturating cover with water and keeping continuously thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in wide as practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walls, sidewalks, and curbs, as follows:

Apply curing and sealing compound to concrete slabs and walls as soon as initial curing operations are complete or immediately after the forms have been stripped (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Completely cover the concrete surfaces with curing and sealing compound. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair any damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

C. CURING FORMED SURFACES

Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period and until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.

D. CURING UNFORMED SURFACES

Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of an appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover.

3.13 SHORES AND SUPPORTS

A. GENERAL

Comply with ACI 347 for shoring, and as herein specified. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until all concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete, such as beam soffits, joints, suspended slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained 70 percent of the design minimum compressive strength at 28 days. Determine potential

compressive strength of in-place concrete by testing field-cured specimens, representative of concrete location or members.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.14 REUSE OF FORMS

Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Provide new form facing material. Apply new form coating compound as specified for new formwork prior to reuse of forms.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, unless approved by the Engineer and acceptable to the Owner.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. FILLING-IN

Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work. Fill-in all form tie holes and other forming system holes with non-shrink grout.

B. CURBS

Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. BASE PLATE, EQUIPMENT BASES AND FOUNDATIONS

Provide machine and equipment bases (housekeeping pad/pier) and foundations, as shown on the Plans. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturers furnishing machines and equipment.

Provide 4-inch-high, square or rectangular concrete pad around all conduits and small diameter pipes that penetrate through floor slabs.

Provide leveling grout under base plates and equipment frames using non-metallic, non-shrink grout. Minimum thickness for leveling grout shall be 1/2 inches unless noted otherwise on the Plans or specified by equipment manufacturer.

D. STAIR NOSINGS

Provide stair nosings at all exterior cast-in-place concrete stairs or steps. The stair nosings shall be installed in accordance with the manufacturer's written instructions.

3.16 CONCRETE SURFACE REPAIRS

A. PATCHING DEFECTIVE AREAS

Repair and patch defective areas immediately after removal of forms. Cut out honeycomb, rock pockets, voids or bugholes over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. For water and wastewater containment structures, utilize an epoxy resin bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. REPAIR OF FORMED SURFACES

Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, bug holes, honeycomb, rock pockets; fins and other discolorations that cannot be removed by cleaning. Flush out form tie holes and form bolt holes, fill with non-shrink grout, or precast concrete cone plugs or rubber plugs secured in place with bonding agent or epoxy adhesive.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. All repairs shall be approved by the Engineer. If defects cannot be repaired, the Contractor shall remove and replace the concrete.

C. REPAIR OF UNFORMED SURFACES

Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inches wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3 inches of clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding agent has dried. Compact dry-pack mixture

in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to approval of the Engineer. If acceptable repairs cannot be made, the Contractor shall remove and replace the concrete at no cost to the Owner.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. GENERAL

Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete

   ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump

   ASTM C143: one test at point of discharge for each day's placement of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content

   ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's placement of each type of air-entrained concrete.

4. Concrete Temperature

   Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens is made.

5. Compression Test Specimen

ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests

ASTM C39; one set for each day's placement exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any 1 day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When total quantity of a given class of concrete is less than 50 cubic yards, Engineer may waive strength test if, in their judgment, adequate evidence of satisfactory strength is provided.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported via email to Engineer and Contractor within 24 hours after testing. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

7. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection of concrete.

8. Additional Tests

The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in a structure, as directed by the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for cost of such tests when unacceptable concrete is verified.

3.18 WATERTIGHTNESS

All water and wastewater holding tanks, basins and structures listed on the Structural Plans shall be tested for watertightness. Each tank, structure or basin shall be tested independently.

Watertightness tests shall be made after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placement. Watertightness shall conform to the requirements of ACI 350.1.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan. Suitable evaporation pan shall be approved by Owner and shall be provided by Contractor.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks shall be required. All costs associated with location (re-excavation and backfilling) and repair of leaks shall be borne by the Contractor.

***** END OF SECTION *****

SECTION 03350

CONTROLLED DENSITY FILL (CDF)

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section provides all materials, labor, and equipment for installation of Controlled Density Fill (CDF) as shown on Plans and/or in lieu of imported backfill material and compacted structural fill where approved by the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payment
01300	Submittals
03300	Cast-in-Place Concrete

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	**Title**
ASTM C94	Specification for Ready-Mixed Concrete
WSDOT	Standard Specifications for Road, Bridge, and Municipal Construction
ASTM C33	Concrete Aggregate
ASTM C150	Portland Cement
ASTM C618	Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

1.4 SUBMITTALS

Comply with provisions of Section 01300.

A. CERTIFICATE OF COMPLIANCE

Certificate shall verify that the delivered material is in compliance with mix design and shall include: Project Contract No., Date, Truck No., and Batched Weights of each ingredient. The certification shall be signed by a representative of the CDF producer, and shall be someone other than the truck driver.

B. DELIVERY TICKETS

Provide copies of delivery tickets to the Owner.

1.5 DELIVERY AND HANDLING

Comply with requirements of ASTM C94.

PART 2 PRODUCTS

2.1 MATERIALS

A. PORTLAND CEMENT

Type I, II, or III comply with ASTM C150 or State of Washington, Standard Specifications for Road, Bridge, and Municipal Construction Article 9-01, Current Edition.

B. FLY ASH (POZZOLAN)

ASTM C618, Class F or Class C.

C. AGGREGATES

ASTM C33 or State of Washington, Standard Specifications for Road, Bridge and Municipal Construction, Current Edition, Articles 9-03.1 or 9-03.14.

D. WATER

Clean, potable and free from oil or other contaminants.

E. ADMIXTURES

State of Washington, Standard Specifications for Road, Bridge and Municipal Construction, Current Edition, Article 9-23.6.

2.2 CDF MIX DESIGN AND PROPORTIONING

Controlled Density Fill (CDF) shall be a mixture of Portland cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating self-consolidating, free-flowing and excavatable material which will result in a hardened, dense non-settling fill.

Unconfined compressive strength:	100 psi minimum 300 psi maximum
Gallons of water per cubic yard:	35 gallons
Pounds of cement per cubic yard:	50 lbs.
Pounds of fly ash per cubic yard:	250 lbs.
Pounds of aggregate per cubic yard:	3,200 lbs.

Flowability	Slump
Low	6 inches or less
Normal	6 to 8 inches
High	8 inches +

Total water and aggregate quantities may be adjusted for yield if air entraining or water-reducing admixtures are used for flowability. Use 3/8 inch minus aggregates or sand for flowable or excavatable CDF materials.

PART 3 EXECUTION

Verify site and excavations for conditions acceptable to receive CDF. Ensure all inspections and approvals for substrate surfaces and utilities have been made and are complete before CDF placement. Trench sections to be filled with CDF shall be contained at either end of the trench section by use of a bulkhead or earth fill prior to CDF placement.

CDF placement may be started if weather conditions are favorable, and when the temperature is at least 34 degrees F and rising. At the time of placement, the CDF shall have a temperature of at least 40 degrees F. Mixing and placing shall stop when the temperature is 38 degrees F or less, and falling. CDF shall not be placed on frozen ground. Each filling stage shall be as continuous of an operation as is practicable.

Remove displaced groundwater by either dewatering or pumping. Provide for proper disposal of displaced or dewatered groundwater in compliance with local regulations. Provide steel plates to span utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF has compacted or hardened enough to prevent rutting by construction equipment or traffic.

***** END OF SECTION *****

DIVISION 4

MASONRY

SECTION 04200

MASONRY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes masonry construction as indicated on the Plans and schedules. The types of masonry work include but are not limited to the following: Concrete masonry units (CMU) and brick masonry, notes and details to show size and location of units and typical connections for installation and construction of units.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ACI SP-66	ACI Detailing Manual
ASTM A82	Steel Wire, Plain, for Concrete Reinforcement
ASTM C67	Sampling and Testing Brick and Structural Clay Tile
ASTM C90	Load-Bearing Concrete Masonry Units
ASTM C140	Sampling and Testing Concrete Masonry Units and Related Units
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C404	Aggregates for Masonry Grout
ASTM C476	Grout for Masonry
ASTM C578	Rigid, Cellular Polystyrene Thermal Insulation
ASTM C780	Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C1363	Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus

IMIAC	International Masonry Industry All-Weather Council: Recommended Practiced and Guide Specifications for Cold Weather Masonry Construction

1.4 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. SHOP DRAWINGS

Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI SP-66.

B. PRODUCT DATA

Submit manufacturer's product data for each type of masonry unit, accessory, and other types of manufactured products. Unless noted otherwise on the plans, provide a color palette of at least six colors for color selection by Owner.

C. CERTIFICATES

Submit manufacturer's certificate certifying that each product meets or exceeds specified requirements.

1.5 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Installer

Company specializing in performing the work specified in this Section shall have minimum 5 years of documented experience.

B. SINGLE SOURCE RESPONSIBILITY

Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Obtain mortar ingredients of uniform quality, including color for exposed masonry, from manufacturer for each cementitious component and from one source and producer for each aggregate.

C. TESTING

Test the following materials by the methods indicated:

1. Concrete Masonry Units (CMU)

   Test each type, class, and grade of concrete masonry unit per ASTM C140.

2. Mortar

   Test each mortar type per ASTM C780.

For structures constructed of CMU, provide masonry prism tests per ASTM C1314. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days. Masonry prisms shall be fabricated with height-to-thickness ratio of not less than 1.33 nor more than 3.0.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver masonry materials to project in undamaged condition. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, or other causes.

Store cementitious materials off ground, under cover and in dry location. Store aggregates where grading and other required characteristics can be maintained. Store masonry accessories including metal items to prevent deterioration and accumulation of dirt.

1.7 PROJECT CONDITIONS

A. PROTECTION OF WORK

During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

B. STAINING

Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.

Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from droppings of mortar.

C. COLD WEATHER PROTECTION

Do not lay masonry units that are wet or frozen. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch. Remove masonry damaged by freezing conditions.

Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout.

For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F (6 degrees C).

Range: 40 degrees F (4 degrees C) to 32 degrees F (0 degrees C)

Mortar:	Heat mixing water to produce mortar temperature between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C).
Grout:	Follow normal masonry procedures.

Range 32 degrees F (0 degrees C) to 25 degrees F (-4 degrees C)

Mortar:	Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.

Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Range: 25 degrees F (-4 degrees C) to 20 degrees F (-7 degrees C)

Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.

Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Heat both sides of walls under construction using salamanders or other heat sources.

Use windbreaks or enclosures when wind is in excess of 15 mph.

20 degrees F (-7 degrees C) and below:

Mortar: Heat mixing water and sand to produce mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (49 degrees C); maintain temperature of mortar on boards above freezing.

Grout: Heat grout materials to 90 degrees F (32 degrees C) to produce in-place grout temperature of 70 degrees F (21 degrees C) at end of workday.

Masonry Units: Heat masonry units so that they are above 20 degrees F (-7 degrees C) at time of laying.

Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F (4 degrees C) for 24 hours after laying units.

Do not heat water for mortar and grout above 160 degrees F (71 degrees C).

Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.

Range: 40 degrees F (4 degrees C) to 32 degrees F (0 degrees C)

Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

Range: 32 degrees F (0 degrees C) to 25 degrees F (-4 degrees C)

Completely cover masonry with weather-resistant membrane for at least 24 hours.

Range: 25 degrees F (0 degrees C) to 20 degrees F (-7 degrees C)

Completely cover masonry with weather-resistant insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

20 degrees F (-7 degrees C) and below:

Except as otherwise indicated, maintain masonry temperature above 32 degrees F (0 degrees C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry, maintain heated enclosure to 40 degrees F (4 degrees C) for 48 hours.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. GENERAL

Comply with referenced standards and other requirements indicated, applicable to each form of concrete masonry unit required. Provide special shapes where required for lintels, corners, jambs, sash control joints, headers, bonding and other special conditions. Provide square-edged units for outside corner, except where indicated as bullnose.

All material for exterior block walls shall contain the manufacturer's recommended amount of the Dry Block System Admixture for water repellency.

All mortar for exterior block walls shall contain the recommended amount of the Dry Block Mortar Admixture for water repellency and to assure proper bond strength.

Provide units complying with characteristics indicated for grade, type, face size, exposed face, and weight classification.

B. HOLLOW LOAD-BEARING BLOCK UNITS

ASTM C90, Grade N, Type I, moisture controlled, medium weight (density shall exceed 110 pcf).

1. Size

Unless noted otherwise on the Plans, provide manufactured standard units with nominal face dimensions 16 inches long by 8 inches tall (15-5/8 inches x 7-5/8 inches actual) by thickness shown on the Plans.

2. Color and Pattern

Interior Wall Units: Smooth faced, natural color.

Exterior Wall Units: Split faced, color selection by owner.

Provide color palette of at least six colors for Owner selection.

2.2 MORTAR AND GROUT MATERIALS

A. PORTLAND CEMENT

ASTM C150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color. Mortar color shall coordinate with block color. Provide mortar color options to the Owner for selection.

B. HYDRATED LIME

ASTM C207, Type S.

C. AGGREGATE FOR MORTAR

ASTM C144.

D. AGGREGATE FOR GROUT

ASTM C404.

E. ADMIXTURES

Comply with Section 03300.

Dry Block Mortar Admixture.

F. WATER

Clean, potable and free of oils.

2.3 REINFORCEMENT AND ANCHORAGE

A. REINFORCING BARS

Comply with Section 03200.

B. SINGLE WYTHE JOINT REINFORCEMENT

Truss or Ladder type; hot dip galvanized after fabrication cold-drawn steel conforming to ASTM A82, 3/16 of an inch (4.8 mm) side rods with 3/16 of an inch (4.8 mm) cross ties; manufactured by National Wire, or equal.

2.4 FLASHINGS

A. COPPER/KRAFT PAPER FLASHINGS

3-oz/sq. ft. (915-g/sq. m) sheet copper bonded to fiber-reinforced asphalt treated Kraft paper; manufactured by York Manufacturing, or equal.

2.5 ACCESSORIES

A. PREFORMED CONTROL JOINTS

Synthetic Rubber material. Provide with corner and tee accessories, cement fused joints, manufactured by Williams Products, Inc., or equal.

B. CLEANING SOLUTION

Not harmful to masonry work or adjacent materials.

Do not use Muriatic Acid.

Subject to compliance with requirements, product(s), which may be incorporated into the work include, but are not limited to, the following:

Fabrikleen Masonry Cleaner, by Fabrikem Chemicals, International.

NMD 80 Masonry Detergen, EaCo Chem, Inc.

C. DAMPPROOFING

Apply a clear siloxane sealer with an active solids content of 6.5 percent on the exterior of all CMU (follow manufacturer's recommended coverage rate and application instructions).

Provide one coat of Chemprobe Corporation Prime-A-Pell Plus and then one finish coat of Chemprobe Corporation Conformel clear. Apply coating at a maximum rate of 150 square feet/gallon.

D. INSULATED CMU WALLS

Provide insulated CMU walls as shown on the Plans.

The expanded polystryene insulation shall be individually molded to have a minimum density of 1.0 lb/ft^3, and shall conform to ASTM C578 Standard Type 1.

Thermal capabilities of insulated CMU walls when tested in accordance with ASTM C1363:

Nominal CMU Wall Thickness	U, Value for 2 Core Insulated CMU Wall System
8-Inch	0.19
10-Inch	0.17
12-Inch	0.15

Subject to compliance with requirements, the products, which may be incorporated in the work, include, but are not limited to, the following:

Korfil Block Insulation by Concrete Block Insulating Systems, Inc. (CBIS, Inc.)

PART 3 EXECUTION

3.1 INSTALLATION

For Insulated CMU Walls install insulation in block cores at the block manufacturer's plant in conformance with Korfil installation requirements.

Thickness: Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

Build chases and recesses as shown or required for the work of other trades. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.

Use dry cutting saws to cut concrete masonry units.

Match masonry coursing, bonding, color, and texture of new masonry work with existing masonry work.

Provide smooth exterior face CMU where the masonry is to receive attachments such as light fixtures, water faucets, electrical boxes, etc.

3.2 CONSTRUCTION TOLERANCES

A. VARIATION FROM PLUMB

For vertical lines and surfaces of columns, walls and arises do not exceed 1/4 inch in 10 feet, corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4 inch in any story. For vertical alignment of head joints, do not exceed plus or minus 1/8 inch in 10 feet.

B. VARIATION FROM LEVEL

For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 foot maximum. For top surface of bearing walls, do not exceed 1/8 of an inch between adjacent floor elements in 10 feet or 1/16 of an inch within width of a single unit.

C. VARIATION OF LINEAR BUILDING LINE

For position shown on the Plans and related portion of columns, walls and partitions, do not exceed 3/8 of an inch in any bay or 20 feet maximum.

D. VARIATION IN CROSS-SECTIONAL DIMENSIONS

For columns and thickness of walls, do not exceed minus 3/8 of an inch nor plus 3/8 of an inch from dimensions shown on the Plans.

E. VARIATION IN MORTAR JOINT THICKNESS

Do not exceed bed joint thickness indicated by more than plus or minus 1/8 of an inch or do not exceed head joint thickness by more than plus or minus 1/8 of an inch from dimensions shown on the Plans.

3.3 TEMPORARY FORMWORK

Provide temporary formwork and shoring as required for support of masonry construction. Construct formwork to conform to shape, line and dimensions shown on the Plans. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

Allow at least then the following minimum time to elapse after completion of members before removing shoring or forms, provided suitable curing conditions have been obtained during the curing period.

Girders and Beams	10 calendar days
Slabs	7 calendar days
Reinforced Masonry Soffits	7 calendar days

3.4 PLACING REINFORCEMENT

A. GENERAL

Clean reinforcement of loose rust, mill scale, earth, ice or other materials that will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Plans or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or one inch (whichever is greater).

For columns, piers and pilasters, provide a clear distance between vertical bars as shown on the Plans, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties as shown on the Plans.

Splice reinforcement bars where shown. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie. Provide not less than minimum lap shown on the Plans.

Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8 of an inch on exterior face of walls and 1/2 inch at other locations. Lap units not less than six inches at ends. Use prefabricated “L” and “T” units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fire-proofing, pipe enclosures and other special conditions.

B. ANCHORING

Anchor reinforced masonry work to supporting structure as shown on the Plans.

3.5 INSTALLATION OF CONCRETE MASONRY UNITS

A. GENERAL

Do not wet concrete masonry units (CMU).

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work. As the work progresses, build-in items specified under this and other sections of these Specifications. Fill in solidly with masonry around build-in items.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise shown on the Plans.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and road mortar or grout into core to completely fill the masonry unit.

Fill cores in hollow concrete masonry units with grout three courses (24 inches) under bearing plates, beams, lintels, posts and similar items, unless otherwise shown on the Plans.

Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8-inch joints.

Cut joints flush for masonry walls, which are to be concealed or to be covered by other materials, unless otherwise shown on the Plans.

Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise shown on the Plans.

Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units, which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

Use special blocks as required to provide solid CMU face at all surfaces including, but not limited to, jambs, headers and sills. Exposed ends of CMU cores are not allowed.

B. FLASHING OF MASONRY WORK

Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetration in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

Extend flashing the full length of lintels and shelf angles and minimum of 4 inches into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches and through the inner wythe to within 1 inch of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches. At heads and sills turn up ends not less than 2 inches to form a pan. Install flashing to comply with manufacturer's instructions. Provide weep holes in the head joints where shown on the Plans.

C. WALLS

1. Pattern Bond

Lay CMU wall units in half-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise shown on the Plans. Bond and interlock each course at corners and intersections. Use special shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond

beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

2. Option

Where all vertical cores are not shown to be grouted, Contractor may elect to fill all vertical cores with grout, in which case requirements for mortar bedding of cross-webs and closing of core spaces below bond beams do not apply.

D. LINTELS

Install steel lintels where shown on the Plans. Provide masonry lintels where shown and wherever openings of more than 1 foot for brick size units and 2 feet for block size units are shown without structural steel or other supporting lintels. Provide minimum bearing of 8 inches at each jamb, unless otherwise shown on the Plans.

E. CONTROL AND EXPANSION JOINTS

Provide vertical and horizontal expansion, control and isolation joints in masonry where shown on the Plans. Build in related items as the masonry work progresses.

Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.

Build flanges of factory-fabricated expansion joint units into masonry.

Build in non-metallic joint fillers where shown on the Plans.

F. COLUMNS, PIERS, AND PILASTERS

Use CMU units of the size, shape and number of vertical core spaces shown. If not shown on the Plans, use units that provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown on the Plans. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

G. GROUTING

Use “Fine Grout” per ASTM C476 for filling spaces less than 4 inches in one or both horizontal directions.

Use “Coarse Grout” per ASTM C476 for filling 4-inch spaces or larger in both horizontal directions.

Use “Concrete Mix” for filling spaces 10 inches or larger.

H. GROUTING TECHNIQUE

1. General

At the Contractor’s option, use either low-lift or high-lift grouting techniques subject to requirements that follow.

2. Low-Lift Grouting

Provide minimum clear dimension of 2 inches and clear area of 8 square inches in vertical cores to be grouted.

Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.

Lay CMU to maximum pour height. Do not exceed 5-foot height, or if bond beam occurs below 5-foot height, stop pour at course below bond beam.

Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than 1 hour. Terminate grout pours 1-1/2 inches below top course of pour.

Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3. High-Lift Grouting

Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3 inches and 10 square inches, respectively.

Provide cleanout holes in first course at all vertical cells, which are to be filled with grout. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.

Construct masonry to full height of maximum grout pour specified, prior to placing grout.

Limit grout lifts to a maximum height of 5 feet and grout pour to a maximum height of 24 feet for single wythe hollow concrete masonry walls, unless otherwise shown on the Plans.

Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10 feet.

Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.

Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing shown on the Plans.

Place horizontal beam reinforcement as the masonry units are laid. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.

Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8-gauge wire ties spaced 16 inches on center for

members with 20 inches or less side dimensions, and 8 inches on center for members with side dimensions exceeding 20 inches.

I. PREPARATION OF GROUT SPACES

Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Owner.

Limit grout pours to sections, which can be completed in 1 working day with not more than one hour interruption of pouring operation. Place grout in lifts that do not exceed 5 feet. Allow not less than 30 minutes, nor more than 1 hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

Place grout in lintels or beams over openings in one continuous pour.

Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1 inch of vertically reinforced cavities, during construction of masonry.

When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2 inches of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

J. FIELD QUALITY CONTROL

1. General

Contractor shall employ, a testing laboratory experienced in performing types of masonry field quality control tests for masonry as specified in Section 01400.

2. Unit Test Method

a. Brick Tests

For each type and grade of brick indicated, test units by methods of sampling and testing of ASTM C67 except select five bricks at random for each 10,000 units or fraction thereof installed.

b. Concrete Masonry Unit Tests

For each type, class and grade of concrete masonry unit indicated, test units by method of sampling and testing of ASTM C140.

c. Mortar Tests

For each type indicated, test mortar by ASTM C780 methods for sampling and testing. Conduct tests no less frequently than that required to evaluate mortar used to install each increment of masonry units indicated above from which samples are taken for testing.

K. REPAIR, POINTING, AND CLEANING

1. General

Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

2. Pointing

During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

3. Final Cleaning

After mortar is thoroughly set and cured, clean masonry as follows:

Remove large mortar particles by hand with wooden paddles and non-metallic scrape, hoes or chisels.

Test cleaning methods on sample wall panel; leave panel uncleaned for comparison purposes. Obtain Owner's approval of sample wall cleaning before proceeding with cleaning of masonry.

Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.

Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

For masonry made of clay or shale, clean masonry with cleaning solution in accordance with manufacturer's recommendations. Muriatic acid shall not be used. Apply acidic cleaner in compliance with directions of cleaner manufacturer.

Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

Provide final protection of masonry work and maintain conditions in a manner acceptable to the Owner that ensures unit masonry work to be without damage and deterioration at time of substantial completion.

***** END OF SECTION *****

DIVISION 5

METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes structural steel work as shown on the Plans, including schedules, notes, and details to show size and location of members, typical connections, and type of steel required. Miscellaneous metal fabrications are specified elsewhere in Division 5.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
03300	Cast-In-Place Concrete
06520	Fiberglass Reinforced Plastic (FRP) Grating

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ASTM A36	Structural Steel
ASTM A53	Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe
ASTM A123	Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A276	Stainless Steel Bars and Shapes
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A325	High Strength Bolts for Structural Steel Joints
ASTM A490	Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A572	High-Strength Structural Steel
ASTM A992	High-Strength Structural Steel
AWS A2.4	Standard Welding Symbols
AWS D1.1	Structural Welding Code

AISC	Specification for Structural Steel Buildings
SSPC	Steel Structures Painting Council

1.4 SUBMITTALS

Submit under provisions of Section 01300.

A. SHOP DRAWINGS

Indicate profiles, sizes, spacing, locations, and complete details of structural members, to include openings, cuts, camber, fasteners, connections, and other pertinent data. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

B. MANUFACTURER'S MILL CERTIFICATE

Submit under provisions of Section 01300 certifying that products meet or exceed specified requirements.

C. MILL TEST REPORTS

Submit under provisions of Section 01300 Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.

D. WELDERS' CERTIFICATES

Submit under provisions of Section 01300 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

1.5 QUALITY ASSURANCE

Codes and Standards: Comply with the provisions of the following, except otherwise indicated:

Standard	**Title**
AISC	"Code of Standard Practice for Steel Buildings and Bridges"
AISC	"Specifications for Structural Steel Buildings," including "Commentary" and Supplements thereto as issued

AISC	"Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
American Welding Society (AWS)	D1.1 "Structural Welding Code – Steel"
ASTM A6	"General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use"

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver material to site at such intervals to ensure uninterrupted progress of work.

Deliver anchor bolts and anchorage devices that are to be embedded in cast-in-place concrete or masonry in ample time as to not delay work.

Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 MATERIALS

A. STRUCTURAL STEEL SHAPES

ASTM A992, High-Strength Structural Steel.

B. STRUCTURAL STEEL PLATES AND BARS

ASTM A36, unless noted otherwise.

C. STRUCTURAL TUBING

Cold-Formed:	ASTM A500, Grade B, Fy=46KSI
Hot-Formed:	ASTM A501, Fy=36KSI

D. STEEL PIPE

ASTM A53, Type E or S Grade B.

E. HEADED STUD-TYPE CONNECTORS

ASTM A108, Grade 1015, forged steel, uncoated.

F. HIGH-STRENGTH THREADED FASTENERS

Heavy hexagon structural bolts, as follows:

Quenched and tempered medium carbon steel bolts, nuts and washers complying with ASTM A325.

Quenched and tempered alloy steel bolts, nuts and washers complying with ASTM A490 where indicated.

Heavy hexagon nuts complying with ASTM A563.

Hardened washers complying with ASTM F436.

Provide and install bolts with load indicator devices (load indicator washers or snap-off heads).

G. ANCHOR BOLTS AND THREADED RODS

ASTM F1554, Grade 36, unless noted otherwise. Heavy hexagon nuts complying with ASTM A563 and hardened washers complying with ASTM F436.

ASTM A193 Grade B8, where stainless steel is noted in the plans. Heavy hexagon nuts complying with ASTM A194 Grade 8 and type 304 stainless steel washers.

H. UNFINISHED THREADED FASTENERS

ASTM A307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

I. EXPANSION ANCHORS

Provide size and type indicated. Expansion anchors shall be one piece stud type, wedge-style anchor.

Carbon steel expansion anchors shall meet the following:

- Stud: ASTM A108 and zinc plated in accordance with ASTM B633
- Wedge: AISI 1010 carbon steel
- Nut: ASTM A563 Grade A
- Washer: SAE 1005-1020

Stainless steel expansion anchors shall meet the following:

- Stud: ASTM F593, AISI 304 or 316
- Wedge: AISI 304 or 316
- Nut: ASTM F594
- Washer: AISI 304 or 316 conforming to ASTM A240

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:

KWIK Bolt 3, Hilti, Inc.
Strong-Bolt 2, Simpson Strong Tie, Inc.
Power-Stud+ SD1, Powers Fasteners, Inc.

J. FLUSH TYPE EXPANSION ANCHORS

Provide size to match fastener indicated, conforming to AISI 12L14, meeting ASTM A108, and zinc plated in accordance with ASTM B633, SC1, Type III.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

HDI Anchor, Hilti, Inc.
Drop-In Anchor, Powers Fasteners, Inc.

K. ADHESIVE ANCHORS

1. Adhesive capsules shall be self-contained two-part component consisting of a vinyl urethane resin with a Dibenzoyl Peroxide Hardener.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to the following:

HVU Adhesive capsule, Hilti, Inc.
Chem-Stud Capsule, Powers Fasteners, Inc.

2. Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

   Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

   HIT RE 500 V3 Injection Adhesive Anchor, Hilti, Inc.
   SET-XP, Simpson Strong Tie, Inc.
   PE1000+, Powers Fasteners, Inc.

3. For hollow-base materials such as concrete masonry units (CMU), provide galvanized screen tubes as required by the manufacturer.

   Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

   HIT HY 70 Adhesive Anchor System for Unreinforced Masonry, Hilti, Inc.
   Pure 110+, Powers Fasteners, Inc.

L. WELDING MATERIALS

AWS A5.1 or A5.5, E70XX; AWS A5.17, E70S-X; AWS A5.20, E70XT-X. Comply with AWS code.

M. GROUTING MATERIALS

Shall comply with Section 03300 “Cast-in-Place Concrete.”

N. STRUCTURAL STEEL PRIMER PAINT

Epoxy Primer per Section 09900, SSPC SP-10.

2.2 FABRICATION

A. SHOP FABRICATION AND ASSEMBLY

Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. CONNECTIONS

Weld or bolt shop connections, as indicated on the Plans or as specified.

Bolt field connections, except where welded connections or other connections are indicated.

Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.

C. HIGH-STRENGTH BOLTED CONSTRUCTION

Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts."

D. WELDED CONSTRUCTION

Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections where indicated by methods which will produce true alignment of axes without warp.

E. SHEAR CONNECTORS

Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.3 SHOP PAINTING

A. GENERAL

Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed, or the exposed portions and initial two inches of embedded areas only. Do not paint surfaces that are to be welded or are high-strength bolted with friction-type connections. Apply two coats of paint complying with Section 09900 to surfaces that are inaccessible after assembly or erection.

B. SURFACE PREPARATION

After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows: SP-10 "Near-White Blast Cleaning."

C. PAINTING

Immediately after surface preparation, apply structural steel primer paint in accordance with Section 09900 and manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils DFT. Use painting methods, which result in full coverage of joints, corners, edges and exposed surfaces.

D. ZINC COATING

Unless noted otherwise, where structural steel (ferrous metal) is exposed to weather, it shall be zinc coated or galvanized by the "hot-dip" method in accordance with ASTM A123. Provide the following minimum coating weight per square foot of actual surface.

(a)	Steel 1/8 inch	2.0 Ounces Average
	and 3/16 inch	1.8 Ounces Minimum

(b)	Steel 1/4 inch and heavier	2.3 Ounces Average 2.0 Ounces Minimum

Provide galvanized fasteners with zinc-coated items.

2.4 SOURCE QUALITY CONTROL AND TESTS

Testing and analysis of components will be performed under provisions of Section 01400.

PART 3 EXECUTION

3.1 ERECTION

A. GENERAL

Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. SETTING BASES AND BEARING PLATES

Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

C. FIELD ASSEMBLY

Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances.

Splice members only where indicated and accepted on shop drawings.

D. ERECTION BOLTS

On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

Comply with AISC Specification for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing member. Ream holes that must be enlarged to admit bolts.

E. GAS CUTTING

Do not use gas-cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to the Engineer.

F. TOUCHUP PAINTING

Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils. Painting shall conform to the requirements of Section 09900.

Cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on structural steel is included in Section 09900.

G. REPAIR OF GALVANIZED WORK

Galvanized work damaged during installation shall be repaired with a “hot stick method” using “galv-bar.”

3.2 QUALITY CONTROL

A. GENERAL

Comply with Section 01400 for independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

Provide testing agency access to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

Testing agency may inspect structural steel at plant before shipment; however, the Engineer reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

Correct deficiencies in structural steel work that inspections and laboratory test reports indicate as not in compliance with requirements. The performance of additional tests, at the Contractor’s expense, may be necessary to reconfirm any non-compliance of original work, as well as to show compliance of corrected work.

B. SHOP-BOLTED CONNECTIONS

Inspect or test in accordance with AISC specifications.

C. SHOP WELDING

Inspect and test during fabrication of structural steel assemblies, as follows:

Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

Perform visual inspection of all welds.

Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.

CONTRACTOR'S OPTION

Liquid Pentrant Inspection:	ASTM E165
Magnetic Particle Inspection:	ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
Radiographic Inspection:	ASTM E94
Ultrasonic Inspection:	ASTM E164

D. FIELD-BOLTED CONNECTIONS

Inspect in accordance with AISC specifications.

E. FIELD WELDING

Inspect and test during erection of structural steel as follows:

Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

Perform visual inspection of all welds.

Perform tests of welds as follows:

Liquid Pentrant Inspection:	ASTM E165
Magnetic Particle Inspection:	ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

Radiographic Inspection:	ASTM E94
Ultrasonic Inspection:	ASTM E164

***** END OF SECTION *****

SECTION 05500

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the miscellaneous metal fabrication work including, but is not limited to, the following: preassembled stairs, ladders, handrails, railings, grating, including stair treads and nosings; floor plates and covers, custom fabricated pipe brackets, supports, and pipe sleeves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
03300	Cast In Place Concrete
05120	Structural Steel

1.3 REFERENCES

This section references the latest revisions of the following documents:

Reference	Title
ASTM A36	Structural Steel
ASTM A53	Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe
ASTM A123	Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A283	Carbon Steel Plates, Shapes, and Bars
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A325	High Strength Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B241	Aluminum-Alloy Seamless Pipe and Seamless Extruded Steel Tube
NAAMM	National Association of Architectural Metal Manufacturers, "Metal Bar Grating Manual"
AISC	American Institute of Steel Construction
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
SSPC	Steel Structures Painting Council

1.4 SUBMITTALS

Submit under provisions of Section 01300.

Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. STRUCTURAL STEEL

Structural steel members and sections as defined in the AISC "Code of Standard Practice" are specified in Section 05120.

B. STEEL CASTINGS

Comply with ASTM A27. Grade 65-35, medium strength carbon steel.

C. CAST IRON

Comply with ASTM A48, Class 20.

D. STAINLESS STEEL

Comply with ASTM A276, Type 316.

E. ALUMINUM ALLOY EXTRUDED BARS, RODS, WIRE, SHAPES AND TUBES

Comply with ASTM B221, Alloy 6061-6.

F. WELDING MATERIALS

As specified in Section 05120.

G. ZINC COATING

Comply with ASTM A123 or ASTM A153.

H. FASTENERS, ANCHORS, AND ANCHOR BOLTS

As specified in Section 05120.

I. PAINTING

Comply with Section 09900.

J. GROUT MATERIALS

As specified in Section 03300.

2.2 PRODUCTS

A. HANDRAILS AND RAILINGS

Handrails and railings shall be clear satin finish, anodized 1-1/2-inch nominal diameter Schedule 40 extruded aluminum tubing conforming to ASTM B241, Alloy 6063 with concealed aluminum spigot splice connectors and fasteners countersunk and flush. Fasteners shall be 316 stainless steel. Maximum post spacing shall be 6'-0" on center.

Post connections shall be cast aluminum R&B Wagner Interna-Rail or approved equal. Mounting shall be cast aluminum R&B Wagner-Interna-Rail drive on flange or approved equal; other acceptable manufacturers are Golden Railings, Inc., or Alumaguard Corporation.

B. GRATING AND STAIR TREADS

Stair treads shall be serrated, aluminum alloy 6063, rectangular bar grating complying with the requirements of NAAMM “Metal Bar Grating Manual”; in addition, stair treads shall be provided with 1-1/4" corratred nosings.

Unless noted otherwise on the Plans, minimum size of aluminum grating shall be 1-1/2" x 3/16" bearing bars at 1-3/16-inch on center with cross bars at 4-inches on center for a maximum span of 4'-6". For spans greater than 4'-6", grating shall be designed for 100 psf uniform load and 250 pounds concentrated load and 1/2-inch maximum deflection.

Stair treads shall be designed for 300-pound concentrated load with 33 1/3 percent impact.

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to the following:

AMICO Bar Grating
IKG Borden
McNichols Co.
Seidlehuber Metal Products

2.3 FABRICATION

Fit and shop assemble components in the largest practical size for delivery and installation at site.

A. STRUCTURAL STEEL MEMBERS AND SECTIONS

Fabrication of structural steel members and sections shall comply with Section 05120.

Provide galvanized fasteners with zinc coated items except as noted below. For all items installed in submerged, intermittently submerged, or areas subject to splash and spill, or corrosive atmospheres, fasteners shall be 316 stainless steel. The term fasteners includes nut, bolts, washers, leveling nuts, and U-bolts.

B. HANDRAIL AND RAILINGS

Unless noted otherwise, handrail and railing assemblies shall include a minimum 1/4" x 4" aluminum kick plate. Fabricate components with joints tightly fitted and secured. Fabricate anchors and related components of the same material and finish unless noted otherwise. Coordinate and accurately form components to suit stairs, landings and building structure. All stair stringers shall have handrail installed on them, unless noted otherwise.

C. GRATING AND STAIR TREADS

Fabricate with bearing bars placed edgewise and joined by straight cross bars. Do not notch, slot or cut bearing bars to receive cross bars. Cross bars shall be secured to the main bearing bars to prevent turning, twisting, or coming loose. Each of the cross bars shall be trimmed flush with outside face of bearing bars. Grating shall be fully banded at ends and at all openings. Provide anchorage as indicated on the Drawings.

D. ACCESSORIES

Provide necessary accessories as required for complete installation of products. Provide anchors, anchor bolts, plates, angles, hangers, struts, and other items required for connecting stairs to structure.

E. ANCHORAGE TO SUPPORTING STRUCTURES

For anchorage to supporting structures, provide 316 stainless steel fasteners for all aluminum items. Provide tapered washers where required to avoid point loading of structural members.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that field conditions are acceptable and are ready to receive the work.

3.2 PREPARATION

Clean and strip primed steel items to bare metal where site welding is required. Supply items required to be cast into concrete or embedded in masonry with setting templates.

Paint embedded aluminum items in accordance with Section 09900.

3.3 INSTALLATION

A. TOLERANCES

Install items plumb and level, accurately fitted, free from distortion or defects. Comply with the following tolerances:

Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-accumulative.

Maximum Offset From True Alignment: 1/4 inch (6 mm).

Allow for erection loads, and provide sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments. Handrail installation shall be sturdy and without play.

B. BOLTING AND WELDING

Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Field weld components as indicated on the Drawings. Perform field welding in accordance with AWS D1.1 or AWS D1.2.

Obtain Owner's approval prior to field cutting or making adjustments not scheduled on the shop drawings.

C. COATINGS

After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete complying with Section 09900. Field galvanizing shall be done by the hot-stick method utilizing Galv-bar, or equal. Spray-on zinc paint is not acceptable.

D. DISSIMILAR MATERIALS

Avoid direct fastening of dissimilar metals to one another. Connections shall include means as required to isolate dissimilar metals from one another. Possible methods of isolation include, but are not limited to, non-metallic bushings/washers at bolts, and epoxy paint coating of contact surfaces. Intended means of isolation shall be noted on the submitted shop drawings. See Section 09900 for epoxy paint requirements.

E. ANCHORING GRATING

All grating shall be mechanically fastened into place. Provide plate fasteners or F-9 fasteners as recommended by the manufacturer. Where removable grating is specified on the Plans, fasteners shall be provided and installed to allow for easy removal of the grating.

***** END OF SECTION *****

DIVISION 6

WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shows the extent of rough carpentry work on the Plans, including, but not limited to, the following: wood framing, timber posts and beams, rooftop equipment bases and support curbs, wood nailers and blocking, wood furring, fascia, soffits, and sheathing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
06190	Prefabricated Wood Trusses

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ALSC PS 20	American Lumber Standards Committee (ALSC): American Softwood Lumber Standard
APA PRP-108	American Plywood Association (APA): Performance Standards and Qualification Policy for Structural-Use Panels
APA PS 1	American Plywood Association (APA): Product Standard for Construction and Industrial Plywood
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
AWC NDS	American Wood Council (AWC): National Design Specification for Wood Construction
AWC WFCM	American Wood Council (AWC): Wood Frame Construction Manual for one- and two-family dwellings
AWPA U1	American Wood-Preservers' Association (AWPA) Standard
WCLIB 17	West Coast Lumber Inspection Bureau (WCLIB): Standard Grading and Dressing Rules for Douglas Fir, Western

Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber

1.4 SUBMITTALS

Comply with provisions of Section 01300.

Submit a certificate of compliance from the supplier certifying that the materials provided meet or exceed specified requirements. Certificate shall itemize materials provided on the Project and refer to pertinent specifications.

1.5 DELIVERY, STORAGE AND HANDLING

Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and underneath temporary coverings including polyethylene and similar materials. For lumber and plywood that is pressure treated with waterborne chemicals, provide a sticker between each course to provide air circulation.

PART 2 PRODUCTS

2.1 GENERAL

Lumber shall comply with ALSC PS 20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Each piece of lumber shall be factory marked with Grade Stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill that produced the product.

Nominal sizes are indicated on the Drawings, except as shown by detailed dimensions. Provide actual sizes as required by ALSC PS 20, with moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 FRAMING LUMBER AND FASCIA BOARDS

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

2.3 TRIM BOARDS

Unless noted otherwise, provide No. 2 Common Boards or better complying with WWPA rules. Where boards are exposed to finish work, provide 19 percent maximum moisture content. Exterior trim shall be cedar, Grade A or better.

2.4 MISCELLANEOUS LUMBER

Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, wood trim, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown or required. Provide Standard Grade Hem-Fir or better. Provide 19 percent maximum moisture content for lumber items not specified to receive wood preservative treatment.

2.5 SHEATHING

Provide APA-rated Exposure 1 unless noted otherwise, span rating and thickness as noted on the Plans.

Comply with PS 1 “Product Standard for Construction and Industrial Plywood” for plywood panels and for products not manufactured under PS 1 provisions, comply with APA PRP-108. Factory-mark each panel with APA trademark evidencing compliance with grade requirements.

2.6 PLYWOOD OTHER THAN SHEATHING

A. BACKING PANELS

For Plywood Backing Panels (or Boards) used for mounting electrical, telephone or communications system equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated on the Drawings. If not otherwise indicated, provide minimum thickness of 15/32 of an inch.

B. MARINE

APA, A-A exterior thickness as indicated on the Plans. HDO (High Density Overlay) faces are acceptable.

2.7 MISCELLANEOUS MATERIALS

A. FASTENERS AND ANCHORAGES

Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable federal specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended fasteners.

Where rough carpentry work is exposed to the weather, in ground contact, or in an area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating per ASTM A153.

B. BUILDING PAPER

ASTM D226, Type I; asphalt saturated felt, non-perforated, 30-lb. type.

C. SILL SEALER GASKETS

Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1-inch nominal thickness compressible to 1/32 of an inch; selected from manufacturer's standard width to suit width of sill members.

2.8 WOOD TREATMENT BY PRESSURE PROCESS

Where lumber or plywood is indicated as "P.T." or "Treated," or is specified herein to be treated, comply with applicable requirements of American Wood Preserver's Association (AWPA) Standard U1.

Pressure-treat above-ground items with waterborne preservatives to comply with AWPA Standard U1. After treatment, kiln dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Pressure treat items indicated on the Plans and all of the following: wood cants, nailer, curbs, top plates, equipment support bases, equipment curbs, plywood, blocking, stripping, and similar members utilized in connection with roofing, flashing, vapor barriers and waterproofing. All wood items including plywood used for or around roof penetrations shall be pressure treated.

PART 3 EXECUTION

3.1 GENERAL

Discard units of material with defects that could impair the quality of the work or with units too small to use in fabricating work with minimum joints or optimum joint arrangement. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, and similar supports to allow attachment of other work.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD NAILERS AND BLOCKING

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING

Install plumb and level with closure strips at edges and openings. Shim with wood as required to obtain specified tolerance for finished work.

A. FURRING FOR PLYWOOD PANELING

Unless otherwise indicated, provide 1-inch x 3-inch furring at 2-feet on center, horizontally and vertically. Select furring for freedom from knots capable of producing bent over nails and resulting damage to paneling.

B. FURRING FOR GYPSUM DRYWALL

Unless otherwise indicated, provide 1-inch x 2-inch furring at 16-inch on center, vertically.

C. SUSPENDED FURRING

Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet.

3.4 WOOD FRAMING, GENERAL

Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of the AWC WFCM. Do not splice structural members between supports. Anchor and nail as shown, and to comply with the AWC NDS.

Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2-inch-thick lumber of the same width as framing members.

3.5 INSTALLATION OF SHEATHING

A. GENERAL

Comply with applicable recommendations contained in the APA "Engineered Wood Construction Guide," for types of construction panels and applications indicated.

B. FASTENING METHODS

Fasten panels as indicated on the Plans. Include metal H clips between sheathing panels.

C. PLYWOOD BACKING PANELS

Nail to supports with minimum 10d at 6-inches on center edge nailing and 12-inches on center at intermediate framing.

***** END OF SECTION *****

SECTION 06190

PREFABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SCOPE

The extent of Prefabricated Wood Trusses work is shown on the drawings and shall include all labor and materials for the fabrication and installation of the type and configuration of prefabricated wood trusses shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payments
01300	Submittals
06100	Rough Carpentry

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879	Steel Sheet, Zinc-Coated by the Electrolytic Process
ASTM A924	General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
TPI	Truss Plate Institute
ANSI/TPI 1	National Design Standard for Metal Plate Connected Wood Trusses Construction
WCLIB	West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber
WWPA	Western Wood Products Association

1.4 SUBMITTALS

Comply with provisions of Section 01300.

A. PRODUCT DATA

Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling, and erection.

Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

B. SHOP DRAWINGS

Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design values, location of metal connector plates; and bearing and anchorage details.

Provide calculations, which have been signed and stamped by a Structural Engineer licensed in the State of Washington.

C. SINGLE SOURCE RESPONSIBILITY FOR CONNECTOR PLATES

Provide metal connector plates from a single manufacturer.

1.5 QUALITY ASSURANCE

A. TPI STANDARDS

Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:

"National Design Standard for Metal Plate Connected Wood Truss Construction."

"BCSI B1 – Guide for Handling, Installing, Restraining and Bracing Trusses."

"Commentary for Permanent Bracing of Metal Plate Connected Wood Trusses."

B. WOOD STRUCTURAL DESIGN STANDARD

Comply with applicable requirements of "National Design Specification for Wood Construction" published by American Wood Council (AWC).

C. MANUFACTURER'S QUALIFICATIONS

Trusses shall be manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "National Design Standard for Metal

Plate Connected Wood Truss Construction." Trusses shall be designed to support all superimposed dead and live loads indicated, with design approved and certified by a structural engineer licensed in the State of Washington.

Provide trusses by a manufacturer, which has a record of successfully fabricating trusses similar to type, indicated and which complies with the following requirements for quality control:

Fabricator participates in TPI "Quality Assurance Inspection Program" as a licensee authorized to apply TPI marks to trusses.

1.6 DELIVERY, STORAGE, AND HANDLING

Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.

Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, manufacturers which may be incorporated in the work include, but are not limited to, the following:

Alpine Engineered Products, Inc.
Truss Span
Tacoma Truss Systems, Inc.

2.2 LUMBER

Lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Inspection agencies and the abbreviations used to reference lumber grades and species include the following:

NLGA - National Lumber Grades Authority (Canadian).
SPIB - Southern Pine Inspection Bureau.
WCLIB - West Coast Lumber Inspection Bureau.
WWPA - Western Wood Products Association.

Provide lumber to actual sizes required by PS 20 to comply with requirements indicated below:

Dressed, S4S, unless otherwise indicated.

Seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inch or less in nominal thickness, unless otherwise indicated.

Factory mark each piece of lumber with type, grade, mill and grading agency.

2.3 FRAMING LUMBER

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

2.4 METAL CONNECTOR PLATES, FASTENERS, AND ANCHORAGES

Fabricate connector plates from metal complying with the following requirements:

A. HOT-DIP GALVANIZED STEEL SHEET

Structural (physical) quality steel sheet complying with ASTM A653, Grade 33; zinc coated by hot-dip process to comply with ASTM A924, Designation G60; minimum coated metal thickness indicated but not less than 0.036 inch.

B. ELECTROLYTIC ZINC-COATED STEEL SHEET

Structural (physical) quality steel sheet complying with ASTM A879 Designation 30Z, and, for structural properties, with ASTM A653, Grade 33; zinc-coated by electro-deposition; with minimum coated metal thickness indicated but not less than 0.047 inch.

2.5 FASTENERS AND ANCHORAGES

Provide size, type, material, and finish indicated for nails, screws, bolts, nuts, washers and other anchoring devices.

2.6 FABRICATION

Cut truss members to accurate lengths, angles, and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.

Fabricate metal connector plates to size, configuration, thickness, and anchorage details required for types of joint designs indicated.

Assemble truss member in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.

Fabricated wood trusses within manufacturing tolerances of ANSI/TPI 1.

Connect truss members by means of metal connector plates accurately located and securely fastened to each side of wood members by means indicated or approved.

PART 3 EXECUTION

3.1 INSTALLATION

Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute.

Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.

Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

Anchor trusses securely at all bearing points to comply with methods and details indicated.

Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

Do not cut or remove truss members.

***** END OF SECTION *****

SECTION 06520

STRUCTURAL FIBERGLASS REINFORCED PLASTICS (FRP) GRATING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of all structural fiberglass reinforced plastic (FRP) items, with all appurtenances, accessories, and incidentals necessary to produce a complete, operable, and serviceable installation as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurements and Payment
01300	Submittals
03300	Cast-In-Place Concrete
05120	Structural Steel

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ASTM D635	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E84	Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

Submit under provisions of Section 01300.

A. GRATING

Submit shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.

B. CONNECTIONS

Submit manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths,

type and sizes of fasteners, clip angles, member sizes, and connection details.

C. TEST REPORTS

Submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

D. SAMPLES

Submit sample pieces of each item specified herein for acceptance by the Engineer as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

1.5 QUALITY ASSURANCE

All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of five previous, separate, and similar successful installations completed within the last 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required. Any material which has become damaged, as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, manufacturers, which may be incorporated in the work include, but are not limited to, the following:

Fibergrate Composite Structures, Inc., Addison, Texas
McNichols Company, Tampa, Florida
IKG Industries, Clark, New Jersey

2.2 GENERAL

All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

Resin shall be Type 1 Isophthalic Polyester, with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties as required.

All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids, and without dry spots, cracks, crazes, or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

All grating products shall have a tested flame spread rating of 25 or less per ASTM E84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.3 FRP GRATING

Provide FRP grating of the type and size as indicated on the Plans.

Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84. Grating shall also have tested burn time of

less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635. Certifications shall be made available to the Engineer when requested and shall be dated within the past 2 years. Test data performed only on the resin shall not be acceptable.

Unless noted otherwise on the Plans, grating color shall be Light Grey. The cover plate shall have a gritted surface, integrally molded into the plate prior to bonding to the grating. The color of the cover plate shall match the color of the grating.

A. MOLDED FRP GRATING

Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement in the grating panel shall be no more than 3/16 inch below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35 percent so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements specified herein.

After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

Grating load/deflection requirements at the required span (shown below) shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Load/deflection not to exceed the following:

Uniform distributed load over a 48-inch span: 150 pounds per square foot, with a maximum deflection of 0.28 inch.

Unless noted otherwise on the Plans, provide grating with non-slip surfacing. Grating shall be manufactured with a concave profile on the top of each bar providing maximum slip resistance. Secondarily applied grit shall be allowed as long as the top surface does not exceed 1/16 inch.

Provide non-slip grating cover plate as indicated on the Plans. The grating cover plate shall be attached to the completed panel of grating by chemical means (epoxy) to ensure integral action of the panel and plate. The panel and grating shall be vacuum assisted to ensure that all contact surface

remain in contact throughout the curing process.

B. PULTRUDED FRP GRATING

Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70 percent and a minimum of 60 percent glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two-piece cross rod system to provide a mechanical and chemical lock. Cross rods shall be flush with the top surface bearing bars for maximum bearing bar stability and maximum slip resistance.

Unless noted otherwise on the Plans, the minimum overall depth shall be 1-5/8 inches with a tolerance of plus or minus 1/16 of an inch. Maximum spacing of bars shall be 1-1/2 inches with maximum cross rods spacing of 6-inches on center.

Grating load/deflection requirements at the required span (shown below) shall be less than the manufacturer's published maximum recommended loads. Load/deflection shall not exceed the following:

> Uniform distributed load of 125 pounds per square foot (PSF) on grating with a clear span of 60 inches with a maximum deflection of 0.38 inches.

Unless noted otherwise on the Plans, provide grating with non-slip surfacing. Grating shall be manufactured with a quartz grit slip resistant surface on the top of each bar. The embedded grit shall not penetrate beyond 3/16 of an inch.

Provide non-slip grating cover plate as indicated on the Plans. The grating cover plat shall be attached to the completed panel of grating by chemical means (epoxy) to ensure integral action of the panel and plate. The panel and grating shall be vacuum assisted to ensure that all contact surface remain in contact throughout the curing process.

2.4 GRATING FABRICATION

Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to

complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

Each covered grating section shall be tied down with appropriate anchors or clips. Manufacturer to provide openings and holes where located on the contract Plans. Grating openings, which fit around protrusions (pipes, cables, machinery, etc.), shall be field cut or, when shop fabricated, discontinuous at approximately the centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.

All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.

Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of 4-feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Contractor shall install gratings in accordance with manufacturers' assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

***** END OF SECTION *****

SECTION 06600

FIBERGLASS REINFORCED PLASTIC (FRP) TANK COVERS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. There shall be furnished and installed fiberglass reinforced plastic (FRP) flat tank covers as shown on the Drawings and as specified herein, which shall include, but not limited to:

1. Tank cover deck panels.

2. Structural supports.

3. Flashing and trim.

4. Fasteners and anchors.

5. Bulb gaskets and sealant.

6. Tank cover accessories and appurtenances indicated on drawings.

1.2 QUALITY ASSURANCE

A. Contractor shall be responsible for verifying all field dimensions for development and approval of manufacturer's drawings.

B. Contractor shall review and confirm in writing the approval of manufacturer's drawings.

C. Tank cover manufacturer shall have full responsibility for design, supply, and installation instructions of all tank cover materials, including any required cover support framing, fasteners, and gasket material. Split responsibility for materials and design is not acceptable.

D. Within the last 10 years, tank cover manufacturer shall have completed a minimum of ten projects of similar type as those required in this scope and that were specific for covering of wastewater treatment plant process tanks.

1.3 PRODUCT SUBSTITUTIONS

A. Refer to Section 01300.

B. Substitutions shall be considered if the Engineer has received a written request at least 2 weeks prior to bid date. Bidders shall be notified by addendum if substitutions are acceptable.

C. Requests for substitutions shall include technical information and any other information required for evaluation.

1.4 PERFORMANCE TESTING

A. Materials shall comply with Federal and Local laws or ordinances, applicable codes, standards, regulations, and/or regulatory agency requirements including:

1. ASTM D638, Standard Test Method for Tensile Properties of Plastics.

2. ASTM D790, Standard Test Method for Flexural Properties of Plastics and Electrical Insulating Materials.

3. ASTM D695, Standard Test Method for Compressive Strength of Plastics.

4. ASTM E84, Standard Test Method for Surface Burning Characteristics of Plastics.

B. Structural framing and deck panels shall meet the performance and design criteria listed herein for the spans and conditions indicated on the drawings. Individual units (independent of any foam-filled core) shall demonstrate compliance with design criteria by full-scale testing.

1. FRP Deck Panels: Large-Scale Uniform Load and Deflection Test.

2. FRP Structural Components: 3 Point Load Bending Test.

1.5 DESIGN CRITERIA

A. Covers shall cover the entire opening in each of the following tanks as shown on the Plans and specified herein: Aerobic Basin, and Membrane Basins 1 and 2. Cover manufacturer shall design cover support on top of tank walls where possible. If internal supports and structural framing are

required, cover manufacturer shall provide design of supports to avoid conflict with and access to other materials and equipment shown on the Plans. The Contractor and cover manufacturer shall attend three, minimum 1 hour design submittal meetings by telephone with the Engineer as coordinated by the Contractor.

B. Design Loads shall comply with local codes. Combined loads shall be determined by Allowable Stress Method.

1. Live: 50 psf (personnel uniform loading)

2. Snow: 25 psf

3. Wind Uplift: 15 psf

4. Dead

a. Deck Panels: Individual units and other materials attached to and supported by the decking panels.

b. Structure: Total weight of the cover structure and other material attached to and supported by the cover structure.

C. Design Loads shall comply with local codes. Combined loads shall be determined by Allowable Stress Method.

1. Dead + Live or Snow Load: Deflection Limit = L/120 (min); Min. Factor of Safety Flexural Strength = 2.5

2. Wind Uplift less Dead Load: Deflection Limit = L/60; Factor of Safety Flexural Strength = 1.5

D. CONCENTRATED LOADS (INCLUDES PERSONNEL LOADS)

Cover deck panels shall be capable of supporting a 500 lb. Concentrated Load over a 1 square foot square area located at mid-span of the panel span with maximum deflection of L/180. Compliance shall be demonstrated by full-scale testing with certification by an independent, registered P.E.

E. AIR INFILTRATION

Air infiltration for tank cover under .5 inch water column negative pressure shall not exceed 1 CFM/LF of gasketed panel side joint and 2.2 CFM/LF of tank cover perimeter and penetrations. Compliance shall have NEBB Certification based on HVAC Duct Leakage Test per "NEBB Procedural Standards for Testing, Adjusting, Balancing, of Environmental Systems."

F. Cover panels shall meet these requirements for removability:

1. Each cover panel shall be removable without having to remove more than one or two adjacent panels.

2. Each cover panel shall be removable vertically and without cutting of a cover component.

1.6 WARRANTY

The warranty shall be provided in accordance with the General Conditions. The warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

1.7 SUBMITTALS

A. Submittals shall include, but not be limited to:

1. Drawings including layouts; connection and framing details; fastener types and spacing; product description.

2. Material certifications.

3. Engineering calculations, signed by a registered professional engineer, confirming compliance with specified structural design criteria.

4. Operation and Maintenance Data for FRP cover and hatches.

5. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

1.8 PAYMENT

No separate or additional payment will be made for the work and material specified herein. All costs for fiberglass reinforced plastic flat odor control tank covers shall be included in the appropriate unit and lump sum bid items.

PART 2 PRODUCTS

2.1 MANUFACTURER(S)

A. The standard for design, characteristics, and performance shall be:

1. Fiberglass Fabricators, Inc., 964 Douglas Pike, Smithfield, RI. Telephone: 401-231-3552; website: www.fibfab.com.

2. Glass-Steel, Inc., 18468 FM 1314 Rd, Conroe, TX. Telephone: 281-572-2211; website: www.glasssteelinc.com.

3. Enduro, 16602 Central Green Boulevard, Houston, TX. Telephone: 713-358-4000; website: www.endurocomposites.com.

4. Strongwell Co., 400 Commonwealth Avenue, Bristol, VA. Telephone: 276-645-8000; website: www.strongwell.com.

5. No other manufacturers shall be allowed.

2.2 MATERIALS

A. Fiberglass reinforced plastic (FRP) structural components including cover panels, beams, and framing shall be manufactured by pultrusion process. Contact molded or hand-laid up fiberglass materials are not acceptable as structural components.

1. Tank Cover Panels

a. Resin type for FRP tank cover decking shall be UV stabilized isophthalic polyester or vinyl ester. General purpose or orthothalic polyester is not acceptable.

b. Glass fiber reinforcements shall be 50 percent (minimum) of the material weight.

c. Materials shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.

d. Materials shall exhibit these Physical Properties (at a minimum):

Tensile Strength	40,000 psi	ASTM D638
Flexural Strength	45,000 psi	ASTM D790
Flexural Modulus	1,690,000 psi	ASTM D790
Compressive Strength	37,000 psi	ASTM D695
Izod Impact (Notched)	25	ASTM D256
Water Absorption	.25% max	ASTM D570

e. Cover panels shall be sealed at side-laps with non-adhesive, 1-inch-diameter neoprene bulb gasket per ASTM C864. The side-lap gaskets shall be factory installed and oriented vertically so they are compressed when an adjacent panel is placed into position.

f. The top of the tank cover decking shall be flat with factory applied, non-skid, and UV resistant surface.

g. Color of deck panels shall be standard gray or beige, unless otherwise selected by Owner.

h. Cover panels shall be designed with top slope to outer edge of panels without low points, to prevent ponding of rain water and washdown water.

B. ACCESS HATCHES

1. Access hatches shall be raised with one-leaf hatch door and fabricated from pultruded fiberglass components.

2. Except where shown on the drawings, access hatches and framing shall fit inside a single deck panel so that individual deck panels with hatches can be removed without affecting adjacent panels and not require additional framing.

3. Underside of hatch lids shall be sealed with factory installed, 3/8-inch-diameter neoprene bulb gasket. Perimeter hatch curb shall be sealed to decking surface with adhesive sealant.

4. Hatches shall have a stainless steel hold-open device to prevent door from blowing open or closing on itself. Hatches shall be secured with hand-operable latches and without special tools.

5. Hatch lids shall have factory applied non-skid, UV resistant surface with plastic or stainless steel lift handles.

6. View port hatches, if indicated on drawings, shall be 12 inches square or less.

7. Hatch openings shall be factory cut into the tank cover decking by Manufacturer.

8. Manufacturer to provide allowance in their scope of work for four additional 24-inch by 24-inch hatches not indicated on drawings, and that may be added during construction phase.

9. Hatches shall be designed with top slope to outer edge of hatch without low points, to prevent ponding of rain water and washdown water on the hatch top surfaces.

C. FRP STRUCTURAL FRAMING

1. Resin type for FRP beams and framing members shall be vinyl ester.

2. Glass fiber reinforcements shall be 50 percent (minimum) of the material weight.

3. Structural components shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.

4. Metallic angles or plates attached to FRP beams or fastening connections shall be 316 Stainless Steel.

D. SAMPLING PORTS

Sampling ports shall be sized and located as indicated on Drawings.

E. FLASHING AND TRIM

1. Provide flashing for stop gates and dissolved oxygen probe mount assembly to allow access and operation of full range including routine dissolved oxygen probe removal.

2. Fiberglass flashing shall be isophthalic polyester with thickness, dimensions, and profile as shown on the drawings.

3. Non-radius end flashing shall be factory attached to individual deck panels.

4. Pipe penetrations shall be flashed in the field with a Sealtite retrofit, zipper type, pipe flashing or equal as provided by Cover Manufacturer.

F. AIR VENTS AND ODOR CONTROL DUCT CONNECTIONS

1. FRP gooseneck ventilation piping, if required, with bird screen shall be provided by Cover Manufacturer. Size and quantity shall be as indicated on drawings.

2. FRP odor control duct connections with a blind flange shall be provided by Cover Manufacturer. Connections shall extend at least 6 inches from top of tank cover deck. Size and quantity shall be as indicated on drawings.

G. HARDWARE

1. Fasteners, anchorage, hinges, and other structural accessories located on underside of cover shall be 316 Stainless Steel.

2. Non-structural hardware shall be either of the materials specified under L.1 or FRP.

3. Perimeter flashing anchors, concrete anchors, or other hardware not exposed to the inside environment of the tank shall be 304 Stainless Steel.

4. Fasteners to attach tank cover decking to structural supports shall be 316 Stainless Steel.

H. GASKETS AND SEALANTS

1. All panel side laps and perimeter conditions shall be gasketed.

a. Gaskets located along longitudinal side laps between panels shall be factory installed, 1-inch-diameter neoprene, bulb type.

b. Gaskets under non-radius end flashing shall be factory installed, bulb type.

c. Gaskets under flashing with a radius and at perimeter of circular tanks shall be installed by the Contractor.

2. Adhesive sealant shall be applied by Contractor at various locations as required by Manufacturer to maximize odor containment.

PART 3 EXECUTION

3.1 HANDLING AND STORAGE

A. MATERIAL HANDLING

1. At the time of delivery, all materials shall be inspected for shipping damage. The freight company and Manufacturer shall be notified immediately of any damage or quantity shortages.

2. The Contractor shall protect FRP materials from cuts, scratches, gouges, abrasions, and impacts. When lifting crated FRP materials, spreader bars shall be used (not wire slings unless materials are fully protected). FRP components shall not be dragged across one another unless separated by a non-scratching spacer.

3.2 INSTALLATION

A. Before placing and attaching components, the Contractor must confirm alignment and location of bearing plates, surfaces, brackets, saddles, etc. All bearing surfaces must be clean and free of debris.

B. Before placing secondary framing members or deck, the Contractor must check the alignment and location of truss members.

C. Contractor shall proceed according to sequences shown on the approved submittal drawings.

D. If applicable, Contractor shall assemble any trusses and ledger angles as shown on Manufacturer's drawings. Install trusses, beam seats, or structural and ledger angles in locations shown on the approved submittal drawings.

E. Position FRP tank cover beams (if applicable) in locations, as shown on the approved Manufacturer's drawings. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the Manufacturer's written consent. Field cutting shall be indicated on drawings by Manufacturer where needed.

F. Anchor FRP beams and adjust tank cover components into final position with proper bearing and alignment at joints, laps, and supports before fastening. Refer to Manufacturer's installation instructions for proper fastener selection, fastener location, driving techniques, and pertinent information for fastening equipment.

G. Starting at the end shown by Manufacturer on Field Drawings, position and place tank cover deck panels in locations as shown. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the Manufacturer's written consent.

H. Fasten or anchor FRP tank cover deck panels into location as shown on approved submittal drawings.

I. Place and attach flashing, trim, and gaskets as shown on approved submittal drawings.

***** END OF SECTION *****

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07110

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install bituminous dampproofing on all backfill wall surfaces, or as shown on the Plans, and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
03300	Cast-In-Place Concrete

1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

Reference	Title
ASTM D41	Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
ASTM D449	Standard Specification for Asphalt Used in Damproofing and Waterproofing
ASTM D1187	Standard Specification for Asphalt Base Emulsions for Use as Protective Coatings
ASTM D1227	Standard Specification for Emulsified Asphalt Used as a Protective Coating

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Bituminous dampproofing shall be W.R. Meadows or equal product foundation coating.

2.2 COLD ASPHALTIC MATERIALS

Cold asphaltic materials shall be in accordance with the following reference standards:

Material	**Reference Standard**
Sealmastic Emulsion Type II	ASTM D1227, Type II

PART 3 EXECUTION

3.1 GENERAL

All surface preparation, primer and finish coat applications shall be in accordance with these specifications and with the manufacturer's recommendations.

3.2 EXAMINATION

The Contractor shall verify that surfaces are durable, and free of matter detrimental to adhesion of dampproofing. The Contractor shall verify items which penetrate surfaces to receive dampproofing are securely installed.

3.3 PREPARATION

The Contractor shall protect adjacent surfaces not designated to receive dampproofing. The Contractor shall clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions. The Contractor shall not apply dampproofing to surfaces unacceptable to manufacturer or applicator. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate. The Contractor shall maintain ambient temperatures above 40 degrees F for 24 hours before and continuously during application until dampproofing membrane has cured.

3.4 APPLICATION

The Contractor shall prime surfaces in accordance with manufacturer's instructions. The Contractor shall apply two coats of dampproofing with roller at a maximum coverage rate of 40 square feet per gallon. Dampproofing shall be applied on all foundation walls from 2 inches below finish grade elevation to the outside top edge of footings. The Contractor shall seal items projecting through dampproofed surfaces with mastic.

***** END OF SECTION *****

SECTION 07210

BATT AND RIGID INSULATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install batt and rigid insulation, as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following document:

Reference	Title
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C1289	Standard Specification for Faced Rigid, Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1320	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

1.4 PERFORMANCE REQUIREMENTS

Materials of this Section shall provide continuity of thermal and vapor and air barriers at building enclosure elements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Owens Corning, Johns Manville, CertainTeed, DOW, or approved equal.

2.2 MATERIALS

A. BATT INSULATION

Type III preformed, foil-faced, glass fiber batt or roll conforming to ASTM C665, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

B. RIGID INSULATION

Type IV rigid, closed cell extruded polystyrene foam board insulation conforming to ASTM C578, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

C. VAPOR BARRIER

Vapor barrier shall be self-adhering, and have permeance conforming to ASTM E96 or ASTM D1970.

D. TAPE

Pressure sensitive, aluminum foil tape. Tape shall be Specialty Tape #425 by 3M, or equal.

E. INSULATION FASTENERS

Galvanized steel impale spindles and clips on 2-inch square flat bases with self-adhering backing and length to suit insulation thickness. Include galvanized steel retaining washer(s) of not less than 1-1/2-inches in diameter capable of securely and rigidly fastening insulation in place. Insulation fasteners shall be by Gemco, or equal.

F. BUILDING WRAP

Mechanically attached water-resistive, vapor permeable air barrier membrane system including primary sheet membrane, self-adhered flashing tape, and flashing primer (as needed). Entire system shall be provided by a single manufacturer. Building wrap shall conform to ASTM

E2357 and ASTM E96, and shall be Tyvek CommercialWrap by DuPont, WrapShield IT by VaproShield, or equal.

G. INSULATION BAFFLES

Insulation baffles shall be rigid polystyrene or PVC, and shall be Raft-R-Mate by Owens-Corning, AccuVent by Brentwood, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

Verify site conditions before beginning installation. Verify that substrate and adjacent materials are ready to receive insulation, and free of all projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 GENERAL

Comply with insulation manufacturer's written instructions applicable to products and applications.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated with vapor barriers placed to face the interior (warm) side of the envelope. Fill all voids with insulation, fit tightly around all obstructions and tight to the exterior side of mechanical and electrical services within the plane of the insulation. Remove projections that interfere with placement. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values.

All miscellaneous voids shall have insulation installed to prevent gaps in insulation using either fiberglass batt compacted to approximately 75 percent of normal maximum volume, or spray polyurethane foam applied according to the manufacturer's written instructions.

Prior to installation of finished surfaces, all vapor-retarder joints and ruptures shall be taped and sealed in each continuous area of insulation to ensure an airtight installation.

3.3 INSTALLATION BELOW GRADE

On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions.

Stagger all joints and butt all panels together for tight fit.

3.4 INSTALLATION IN FRAMED CONSTRUCTION

Install blanket insulation in all cavities formed by framing members. Use insulation widths and lengths that fully fill the cavities. If more than one length is required to fill cavities, provide lengths that will produce a snug fit between ends. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members, and lap all ends and side flanges of facings over framing members.

Prior to installation of attic insulation, install eave insulation baffles between roof framing members on the underside of roof sheathing in insulated attic spaces at vented eaves.

For metal-framed wall cavities, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs. For unfaced blankets, located vapor barrier joints over member faces and extend vapor barrier tight to the full perimeter of adjacent window and door frames, as well as other items interrupting the plane of membrane. Fully tape seal in place. Provide airspace at exterior plane of insulation for ventilation as recommended by manufacturer.

For wood-framed wall cavities, install blankets according to ASTM C1320 and as specified herein. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

***** END OF SECTION *****

SECTION 07410

METAL ROOF AND WALL PANELS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes, but is not necessarily limited to, furnishing and installing of all metal roofing, siding, metal flashing and fascia, gutters, downspouts, and accessories as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
06100	Rough Carpentry
06190	Prefabricated Wood Trusses
07900	Caulking and Sealants
09900	Painting

1.3 SUBMITTALS

Submit in accordance with Section 01300 and as specified herein.

A. PRODUCT DATA

Submit manufacturer's technical product data, installation instructions, and recommendations for Metal Roof and Wall Panels used. Include data substantiating that materials comply with requirements.

B. SAMPLES

Prior to ordering products, submit physical color chips of manufacturer's standard color samples for Owner's selection.

C. SHOP DRAWINGS

Show panel layout, trim installation, and panel attachment, including gutters and downspouts.

D. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

E. WARRANTY

1. Manufacturer's Product Warranty

Manufacturer's standard coating performance warranty, as available for specified installation and environmental conditions.

2. Contractor's Warranty

Warrant panels, flashings, sealants, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for 2 years following project substantial completion date.

1.4 QUALITY ASSURANCE

A. INSTALLER'S QUALIFICATIONS

Installation of panels and accessories by installers with a minimum of 10-years documented experience in metal panel projects of this nature.

B. MANUFACTURER'S QUALIFICATIONS

Manufacturer shall have a minimum of 10-years experience supplying metal roofing/siding to the region where the work is to be done.

C. REGULATORY AGENCY REQUIREMENTS

Comply with IBC and local Building Code requirements if more stringent than those specified.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Protect panels against damage and discoloration. Handle panels with non-marring slings and do not bend panels. Store panels above ground, with one end elevated for drainage. Protect panels against standing water and condensation between adjacent surfaces. If panels become wet, immediately separate sheets, wipe dry and allow to air dry. Remove any strippable film prior to installation and do not allow too remain on panels in extreme cold, heat or in direct sunlight.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Bryer Company, Taylor Metal Products, Metal Sales, or approved equal.

Panel Designations:

Roof: Mechanically seamed panels with a net coverage of 16 inches and panel surface striations. The Bryer Company, "TBC-Superseam," or equal.

Soffits: Hidden fastener, low-profile, ventilated flush panel with a net coverage of 12 inches. Soffit panels shall be perforated with a minimum open area of 11 in^2/ft^2 of panel. The Bryer Company "TBC-Flush," or equal.

Walls: Corrugated, exposed hidden fastener vertical panels with a net coverage of 36 inches. The Bryer Company "7/8 Corrugated" or equal.

2.2 MATERIALS

A. PANELS

1. Base Metal

   Steel conforming to ASTM A924/ASTM A792 Grade 40 or ASTM A446 Grade C, thickness 22 gauge.

2. Coatings

   Protective coatings conforming to ASTM A653, Class G-90.

3. Finish

   Exterior finish includes a 0.2 mil thick corrosion-resistant primer and a 0.8 mil thick finish coat of Polyvinylidene Fluoride (PVF_2), full 70 percent Kynar 500®/Hylar 5000® for a total 1.0 mil dry film thickness.

4. Color

   Manufacturer's standard selection of not less than 12 colors based on physical color chip samples.

5. Sidelap Sealant

Factory applied butyl sealant at all panel-to-panel sealing surfaces.

B. ACCESSORIES

1. Concealed Clips

Galvanized steel conforming to ASTM A653, Class G-90, 16 gauge clips designed to allow thermal movement of panel and configured to secure panel per design conditions.

2. Fasteners

Self-tapping screws, bolts, nuts, and other acceptable fasteners per manufacturer's requirements. Exposed fasteners shall be corrosion-resistant, color-matched with neoprene gasket.

3. Sealants (Field Applied)

Gunnable caulk and tape sealants per Specification Section 07900.

4. Profile Closures

Neoprene or polyethylene foam, die-cut or formed to panel configuration.

5. Trim and Flashing

Material, gauge, and finish to match panels. Profiles shall be as indicated in the Plans and as required to weather seal the structure. Lead or copper flashing is not acceptable for use.

6. Underlayment

Self-adhered ice and water shield conforming to ASTM D1970.

C. GUTTERS AND DOWNSPOUTS

Provide gutters and downspouts of same material as roof panels. Gutters shall be continuous and seamless, formed from flat sheet. Downspouts are to be rectangular. Fasteners shall be same material and finish as panel, with soft neoprene washers, and anchorage shall conform to SMACNA requirements.

D. FABRICATION

Unless otherwise shown on the Plans or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect installed work of other trades and verify that such work is complete to a point where this work may continue. Verify that installation can be performed in accordance with approved shop drawings and manufacturer's instructions.

3.2 PREPARATION

A. FIELD MEASUREMENTS

Verify prior to installation. If field measurements differ from Plan dimensions, notify Engineer prior to fabrication.

B. PROTECTION

Treat, or isolate with protective material, any contacting surfaces of dissimilar materials to prevent electrolytic corrosion, comply with Section 09900. Require workmen who will be walking on roofing panels to wear clean, soft-soled shoes that will not pick up stones or other abrasive material, which could cause damage and discoloration.

C. SURFACE PREPARATION

Clean and dry surfaces prior to applying sealant.

3.3 INSTALLATION

Unless otherwise shown on the Plans or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

A. PANELS

1. Follow metal panel manufacturer's directions and printed instructions.

2. Install roof panel seams vertically.

3. Install wall panel seams: vertically.

4. Lap panels away from prevailing wind direction.

5. Do not stretch or compress panel side-lap interlocks.

6. Secure panels without warp or deflection.

B. ALLOWABLE ERECTION TOLERANCE

Maximum Alignment Variation: 1/4 inch in 40 feet.

C. FLASHING

1. Follow manufacturer's directions and Engineer-approved shop drawings.

2. Overlap roof panels at least 6 inches.

3. Install flashings to allow for thermal movement.

4. Remove any strippable protective film, if used, immediately preceding flashing installation.

D. CUTTING AND FITTING

1. Provide neat, square and true. Torch cutting is prohibited where cut is exposed to final view.

2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.

3. Where necessary to saw cut panels, debur and treat with galvanic paint coating to match factory color.

Downspouts anchorage shall conform with SMACNA requirements.

3.4 CLEANUP AND CLOSEOUT

A. PANEL DAMAGE AND FINISH SCRATCHES

Do not apply touch-up paint to damaged paint areas that involve minor scratches. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Engineer.

B. CLEANING AND REPAIRING

At completion of each day's work and at work completion, sweep panels, flashing and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate. Remove debris from project site upon work completion, or sooner, if directed by the Owner.

***** END OF SECTION *****

SECTION 07900

CAULKING AND SEALANTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install caulking and sealants, as indicated on the Plans and as specified herein.

All exterior wall joints and interior and exterior joints between all differing or dissimilar materials and at windows, doors, roof penetrations, louvers and similar types of openings shall receive sealants to make the joint air and watertight. This includes concrete to CMU, concrete to wood, CMU to wood, concrete to sheet metal, CMU to sheet metal, etc.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
04200	Masonry
08110	Hollow Metal Doors and Frames

1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

Reference	Title
AAMA 800	Sealant Manual, Specifications and Test Methods for Sealants
ASTM C834	Standard Specification for Latex Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1193	Standard Guide for Joint Sealants
ASTM C1311	Standard Specification for Solvent Release Sealants
ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

ASTM D7174	Standard Specification for Preformed Closed-Cell Polyolefin Expansion Joint Fillers for Concrete Paving and Structural Construction
NSF/ANSI 61	Drinking Water System Components – Health Effects

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Sika Corporation, Tremco, BASF Corporation, or approved equal.

2.2 POLYURETHANE SEALANTS

Provide a one-component, gunnable grade, non-sag, solvent-free polyurethane sealant. The sealant shall cure under the influence of atmospheric moisture. Sealant shall meet ASTM C920, Type S, Grade NS, Class 35, under uses NT, T, M, G, I, A, and O. Performance characteristics shall include a 175 psi 21-day tensile strength, a minimum 500-percent ultimate elongation, and a maximum Shore "A" Hardness of 45.

Polyurethane sealants shall be Sikaflex-1a, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.3 SILICONE SEALANTS

Provide a one-component, gunnable grade, neutral cure, silicone sealant. Sealant shall meet ASTM C920, Type S, Grade NS, Class 50, under uses NT, M, G, A and O. Performance characteristics shall include a 200 psi 21-day tensile strength, a minimum 700-percent ultimate elongation, and a maximum Shore "A" Hardness of 25.

Silicone sealants shall be Sikasil WS-295, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.4 ACRYLIC LATEX CAULK

Provide a one-component, gunnable grade, pure acrylic latex sealant. Sealant shall meet ASTM C834, Type OP, Grade -18 °C. Performance characteristics shall include a maximum 25-percent shrinkage, and a movement capability of plus/minus 12.5-percent.

Acrylic latex sealants shall be Tremflex 834, as manufactured by the Tremco, Inc. or equal by BASF Corporation.

2.5 TAPE SEALANT

Provide a 100-percent solid, isobutylene preformed sealant tape. Tape sealant shall meet the American Architectural Manufacturer's Association AAMA 807.3 standard. Performance characteristics shall include a density of 1.5 and a minimum peel adhesion of 8 pounds per inch.

Tape sealant shall be Sikalastomer-95, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.6 PREFORMED FLEXIBLE JOINT MATERIAL

Provide a closed-cell, polyolefin preformed foam joint material. Foam joint material shall meet ASTM D7174. Performance characteristics shall include an expansion recovery greater than 99-percent, a maximum 50-percent compression strength of 15 psi, and a maximum water absorption of 0.25-percent by volume.

Foam joint material shall be Ceramar, as manufactured by W.R. Meadows, or equal.

2.7 PREFORMED FLEXIBLE JOINT BACKER MATERIAL

Provide a closed-cell, polyolefin preformed foam backer rod material. Backer rod material shall meet ASTM D5249 and shall be compatible with the proposed cold-applied sealant.

Backer rod material shall be Kool-Rod, as manufactured by W.R. Meadows, or equal.

2.8 PRIMERS

Provide primer materials made by or recommended by the sealant manufacturer for the conditions of the application, including the materials to be sealed at the joints and the type of sealant or caulking material to be used.

PART 3 EXECUTION

3.1 GENERAL

All sealant and primer work shall comply with ASTM C1193 and with the manufacturer's written instructions.

The Contractor shall confirm that the proposed sealant and primer materials are compatible with any concrete curing compound used, or the Contractor shall lightly sandblast and thoroughly clean concrete joint surfaces prior to application of sealant materials.

All priming and sealant work shall be done under temperature and moisture conditions that are within the requirements of the manufacturer's written instructions.

All exterior dissimilar materials shall be sealed with elastomeric sealants at the joints between the different materials.

3.2 APPLICATION OF SEALANTS

A. PREPARATION OF JOINTS

Inspect profiles and surfaces of all joints prior to application. Verify joint dimensions are adequate for development of the sealant movement capability. All joints shall be solvent cleaned, dry, and free of dust, oils and grease before receiving backing materials and sealant. Floor joints shall be wire brushed, free of laitance or other residues. Aluminum or other metal surfaces to be in contact with sealants shall be wiped clean with xylol or an MEK solvent to remove any coatings or contamination. Joint sealants shall be installed before other surface finishes are applied. Proceed with joint sealant work only once conditions meet the manufacturer's requirements.

B. BACKINGS

Install filler and backer materials in as long of lengths as practicable. Stretch and force into joints with tool designed for that purpose, to a uniform depth, as indicated on the Plans or as required by the manufacturer, allowing for installation of sealant and caulking. Provide filler material in slab shapes for joints 1/2 inch or more in depth, and in 3/4 inch or more wide joints to receive sealing material. Provide extruded rod backer material in all other joints to receive sealant. Filler or backer material shall be of a depth as required to bring the top surface to within 1/2 inch of the slab surface, or as indicated on the Plans. All joints shall include a suitable bond breaker between backing materials and sealant.

C. MASKING

Both sides of joints shall be masked with tape to prevent soiling floor, slab, or wall beyond limits of the joint.

D. PRIMING

Apply primer to all surfaces of joints in contact with sealant materials. Apply full strength and undiluted in a uniform coating of surface. Allow to set or cure prior to proceeding. Do not prime surfaces at back of joint.

E. APPLICATION

Sealant shall be gun applied, giving the joint a full bead of sealant. Skin beads are not acceptable. Tool the bead immediately after application to ensure a firm and full contact with the inner faces of the joint. Joints in sills and other wash surfaces shall be filled slightly convex to obtain a flush joint when dry. Entire perimeter of openings in concrete surfaces shall be sealed. Do not apply sealants to wet or damp surfaces nor in temperatures below 50 degrees F, and as required by the manufacturer. Strike off excess sealant with tooling stick or a knife so that finished bead is slightly below surface. Remove excess sealant as work progresses. Sealants in masonry wall joints are to be a maximum of 1/2-inch deep and not less than 1/4 inch in each dimension. When applying sealant, do not permit thickness of sealant to exceed 1/2 of the width of the joint. Any joints over 1/2-inch wide shall be reported to the Owner and instructions for correcting the applications will be given.

3.3 CLEANUP

Upon completion, the Contractor shall remove and dispose of masking materials. Remove any excess materials and clean adjacent surfaces free from any soiling or staining resulting from the sealing and caulking operations.

***** END OF SECTION *****

DIVISION 8

DOORS AND WINDOWS

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers furnishing and installing hollow metal doors, frames, and glazing as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
07900	Caulking and Sealants
08700	Finish Hardware
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
ANSI Z97.1	Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
HMMA 840	Guide Specification for Installation and Storage of Hollow Metal Doors and Frames

1.4 QUALITY ASSURANCE

Hollow metal doors and frames shall conform to applicable requirements of ANSI/SDI A250.8.

1.5 SUBMITTALS

Submit shop drawings and product data under provisions of Section 01300.

Indicate frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, and finish.

Indicate door elevations and internal reinforcement.

Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

1.6 REGULATORY REQUIREMENTS

Conform to applicable Building Code for frame and door requirements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The hollow metal doors and frames shall be as manufactured by Curries, Ceco, Republic, Steelcraft, or any other SDI member.

2.2 DOORS AND FRAMES

Location	**Classification**
Exterior Doors and Frames	ANSI/SDI A250.8 Level 3, Model 2
Interior Doors and Frames	ANSI/SDI A250.8 Level 3, Model 2

Provide door and frame types and sizes as shown on the Plans.

2.3 DOOR CORE CONSTRUCTION

Insulated doors shall contain a polyurethane core. Minimum U-value shall be as shown on the Plans.

2.4 FABRICATION

Provide fully welded frames for all new construction. Provide fabricated frames of knock down field assembly type for retrofit applications.

Mullions for double doors shall be removable type. Provide metal T shaped astragals for double doors.

Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

Prepare frames of interior doors for silencers. Provide three rubber silencer locations for single doors and mullions of double doors on strike side, and two silencer locations on frame head at double doors without mullions.

Close top edge of exterior doors flush with inverted steel channel closure. Seal weld and grind smooth all door joints watertight. Caulking or filling with body filler of door seams is not acceptable.

2.5 FINISH

Both interior and exterior doors and frames shall be treated with a galvannealed zinc coating per ASTM A653 with a minimum application rate of 0.60 oz/ft^2, or A60 material. Finish painting shall be in accordance with Section 09900 of these Specifications.

The inside of the metal frame profile shall be coated with the dissimilar metals system per Section 09900 of these Specifications. Coating may be shop or field applied.

PART 3 EXECUTION

3.1 INSTALLATION

Frames shall be installed plumb, level and rigid in accordance with ANSI/SDI A250.11 and with HMMA 840. Doors shall be installed in accordance with HMMA 840.

Coordinate with masonry and stud wall construction for proper anchor placement and with installation of glazing. All door frames installed in masonry construction shall be completely filled with the masonry mortar utilized to install the masonry units or be fully grouted with non-shrink grout after installation of the frame. All door frames installed in cast-in-place concrete structures shall be fully grouted with non-shrink grout.

Install door hardware per Section 08700 of these Specifications.

Contractor shall protect doors and frames as necessary during construction of the Project.

3.2 CLEARANCES

Clearance between the door and frame head and jambs shall be 1/8 of an inch. Clearance between the meeting edges of pairs of doors shall be 3/16 of an inch plus or minus 1/16. Maximum diagonal distortion shall be 1/8 of an inch, measured with straight edge, from corner to corner. Clearance between the face of door and the door frame stops shall be 1/16 to 1/8 on an inch.

3.3 ADJUSTING DOORS

Adjust doors and hardware for smooth and balanced door movement.

***** END OF SECTION *****

SECTION 08310

METAL ACCESS HATCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of the Contractor furnishing and installing 10 aluminum access hatches and accessories as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
02530	Utility Structures
03300	Cast-in-Place Concrete

1.3 QUALITY ASSURANCE

Access hatches shall be guaranteed against defects in material and/or workmanship for a period of 10 years by the manufacturer.

1.4 EQUIPMENT LIST

The metal access hatches to be installed are as follows:

Location	Clear Opening	Type
Influent Pump Station	30" x 36"	Type 1
RAS Pump Station	30" x 36"	Type 1
Valve Vault	36" x 48"	Type 1
Anoxic Mixer	24" x 36"	Type 1
Equalization Basin	36" x 36"	Type 1

1.5 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Metal access hatches shall be as manufactured by Halliday Products, Inc., Bilco, L. W. Hatch, or equal.

2.2 ACCESS HATCH TYPE 1

Type 1 access hatches shall be Halliday W1S series, or equal. The hatches shall have 1/4-inch-thick one-piece mill finish, extruded aluminum channel frame, incorporating a continuous concrete anchor. A one and 1-1/2-inch drainage coupling shall be located in the front left corner of the channel frame. A bituminous coating shall be applied to the frame exterior where it comes in contact with concrete. The door panel shall be 1/4-inch aluminum diamond plate reinforced to withstand a live load of 300 psf. The door shall open to 90 degrees and automatically lock with a stainless steel hold-open arm shall incorporate an enclosed stainless steel compression spring assist. The door shall close flush with the frame and rest on a built-in neoprene cushion/gasket. Hinges and all fastening hardware shall be stainless steel. The unit shall lock with a stainless steel slam lock with removable key and have a non-corrosive handle. The unit shall be guaranteed against defects in material and/or workmanship for a period of 10 years.

PART 3 EXECUTION

Units shall be installed as specified herein and as shown on the Plans. The units shall be connected with drain piping as shown on the Plans, and shall be installed according to the manufacturer's recommendations for safe and proper storage.

***** END OF SECTION *****

SECTION 08560

VINYL WINDOWS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of furnishing and installing polyvinyl chloride (PVC) window units complete with hardware and related components as shown on the Plans and as specified herein.

1.2 RELATED SECTIONS

Section	Item
07900	Caulking and Sealants

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. STANDARDS

Testing standards and methods for structural performance, air infiltration and water penetration for vinyl windows are those specified in AAMA Publication 101 for the type of window unit indicated on the Plans.

Provide vinyl windows bearing the AAMA label certifying compliance with requirements of AAMA publication 101 for the type of window unit indicated on the Plans.

Insulated glass units shall be certified to ASTM E2188/E2190 per the Associated Laboratories Incorporated (ALI) guidelines.

B. TESTING

Provide test reports from an independent testing laboratory certifying performance of window units for rate of air infiltration (ASTM E283), water resistance (ASTM E547) and structural performance (ASTM E330) indicated in AAMA publication 101. Test samples shall comply with requirements in AAMA 101 for test samples size and methods.

C. AIR INFILTRATION

Air Infiltration shall not exceed 0.15 cfm per square foot of overall frame area at an inward test pressure of 1.57 psf.

D. WATER PENETRATION

No water penetration as defined in the test method at an inward test pressure of 3.0 psf.

E. STRUCTURAL PERFORMANCE

No glass breakage, damage to hardware, permanent deformation that would impair operation of the unit, or residual deflection at a positive (inward) and negative (outward) test pressure of 37.5 psf.

1.4 SUBMITTALS

A. PRODUCT DATA

Provide product data for each type of product required.

B. SHOP DRAWINGS

Submit shop drawings that include plans, window schedule, sections, and details. Identify and label proposed components that are not supplied by the window manufacturer.

C. TEST REPORTS

Test reports that show compliance with specified performance requirements.

D. CLOSEOUT SUBMITTALS

Submit temporary window labels to identify windows that labels were applied to.

Provide an Owner's manual with clearly defined maintenance instructions.

1.5 STORAGE AND HANDLING

Store materials and accessories away from exposure to environmental conditions that may be harmful to materials.

Store products off ground and in an upright position. Provide cover from weather and construction activity.

1.6 WARRANTIES

The Contractor shall submit a written warranty, executed by the window manufacturer, agreeing to repair or replace units that fail in materials or workmanship for a period of 10 years. Materials and labor are to be covered in full by the manufacturer.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Andersen Windows, Milgard Windows, or approved equal.

2.2 MATERIALS

A. PVC

Windows shall be extruded, high impact resistant, rigid polyvinyl chloride (PVC). Windows shall be constructed in a neat workmanlike manner. All corners of the frame and sash shall be mitered and fusion welded. All welds are to be dressed and finished to match the surrounding frame area.

B. FINISH

Any color applications are to be solid (homogenous) frame color, or rigid PVC co-extruded cap-stock to prevent contrasting scratches or scars.

C. GLASS AND GLAZING MATERIALS

Provide the manufacturer's standard low E coating sealed, insulated glazing material that complies with ASTM E2188 and E2190, and is at least 1 inch in overall thickness. Under no circumstances will a double glazing system incorporating a removable storm sash be allowed. Sash shall be factory glazed from the interior by use of applied PVC glazing beads with EPDM glazing gaskets. The size of the bead shall accommodate the glass thickness. Provide safety glazing where required by code or industry safety standards.

D. WEATHER-STRIPPING

All operating sash members shall be double weather-stripped with extruded EPDM.

E. HARDWARE

Provide the manufacturer's standard hardware fabricated from a non-corrosive material and of sufficient strength to perform its intended function. For application of hardware, use fasteners that match the finish of the hardware being fastened.

F. GLAZING STOPS

Provide screw applied or snap-on glazing stops (beads) coordinated with glass section indicated. Finish glazing stops to match exterior window finish.

G. INSECT SCREENS

Provide removable insect screen panel for each operable sash, with replaceable mesh and vinyl retainer spline.

2.3 FABRICATION

Fabricate window units to comply with specified standards. Units shall be reglazable without dismantling sash framing.

Preglaze units at the factory. All units shall be inside glazed for easy replacement and service from the interior of the building.

Provide concealed metal reinforcements in sash frame for attachment of lock mechanism.

PART 3 EXECUTION

3.1 INSTALLATION

A. GENERAL

Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, accessories, and other window components.

Install windows in framed walls in accordance with AAMA 2400 and/or AAMA 2410.

Operable panels must be closed and locked during installation. Windows must be installed level, plumb, and square with weep holes on the bottom. Provide clearances as noted below.

Adjust operating sash and hardware to provide tight fit at contact points and weather-stripping. Lubricate hardware and moving parts.

B. INSTALLATION IN WOOD

Headers must not be nailed. Nail through fin into framing along sides and base. At head, nail 1/2-inch above fin and bend nails over fin to allow for header deflection. Full support is required along entire length of sill.

Apply flashing tape over installation flanges at sill, sides, and head. Head flashing shall overlap side flashing. Side flashing shall overlap sill flashing. Use non-reflective flashing.

Apply elastomeric sealant around interior and exterior perimeter of window after installation of siding or other finish. Comply with Section 07900, Caulking and Sealants. Do not paint sealant.

C. INSTALLATION IN MASONRY

Window shall be factory sized in each frame opening to allow for 1/4-inch clearance on the top and sides of the window. Provide a minimum clearance of 1/2 inch from the top of masonry to the bottom of any portion of the sill.

Cut and remove installation flanges from the window unit. Secure unit to masonry rough opening using masonry screws or anchors through side jamb, spaced 12-inches o.c. starting 6 inches from corners.

Apply elastomeric sealant around interior and exterior perimeter of window after installation. Comply with Section 07900, Caulking and Sealants. Do not paint sealant.

Masonry cleaners may damage vinyl windows, care should be taken to protect windows during the masonry cleaning process.

3.2 CLEANING

Clean windows in accordance with manufacturer's recommendations. Clean interior and exterior frame, sash members, glass, and insect screens using a mild detergent-and-water solution and a soft cloth immediately after installation.

Remove temporary labels and retain for Closeout Submittals.

***** END OF SECTION *****

SECTION 08700

FINISH HARDWARE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section specifies that the Contractor shall provide complete finish hardware and suitable fastenings for the project. Quantities listed in any instance are for supplier convenience only and are not guaranteed.

Finish hardware includes items known commercially as "builders' hardware" required, for swinging doors. Hardware specified in the same section as the door and/or doorframe will be furnished by the supplier of that Section.

All hardware furnished in this Section shall comply with the requirements of all applicable codes. All items specified in this Section shall be furnished by a factory-authorized distributor maintaining parts, stocks, and services for standard specified items.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
08110	Hollow Metal Doors and Frames

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
UL	Building Materials List

1.4 SUBMITTALS

Submit hardware under the provisions of Section 01300. Indicate product number and finish for all hardware.

Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURER'S

Finish hardware shall be as manufactured by the suppliers listed in the following sections.

2.2 BUTTS

Butts shall be 4-1/2" x 4-1/2" (minimum 1.4 lbs each) for doors 3'-0" wide and under, and 5" x 4-1/2" (minimum 1.67 lbs each) for doors over 3'-0" wide, except as required for 180-degree swing and shall be of the type listed. Doors up to and including 90 inches in height shall have 1-1/2 pair and doors over 90 inches in height shall have two pair. For unusual size or weight doors, furnish type, size, and quantity recommended by the butt manufacturer. All exterior-outswinging doors shall have non-removable pins. Concealed bearing hinges shall have bearing designs that eliminate metal-to-metal contact between knuckles and between the pin and barrel.

Butts shall be as specified in the hardware groups and shall be as manufactured by McKinney, or equal.

2.3 LOCKSETS

Locksets shall be Grade 1 mortise locksets with 2-3/4-inch backsets and 3/4-inch antifriction latch bolt. All locksets and latchsets shall be the product of one manufacturer and shall be UL approved. Functions as indicated in the hardware groups. Provide curved lip strikes with sufficient lip strike to protect trim, i.e. 3/4 inch latch bolts require 3/4-inch minimum clearance for trim, otherwise extended lip strikes must be furnished. Deadbolt functions shall be 1-inch projection.

Locksets and latchsets shall be as specified in the hardware groups and shall be as manufactured by Corbin Russwin, or equal.

All locks shall have wrought box strikes.

2.4 MANUAL FLUSH BOLTS AND DUSTPROOF STRIKES

Dustproof strikes shall be designed for use with a bottom flush bolt and have a spring loaded plunger that returns to floor or threshold level when the flush bolt is retracted.

Manual flush bolts and dustproof strikes shall be as specified in the hardware groups and shall be as manufactured by Rockwood, or equal.

2.5 STOPS

All doors are to have a wall stop or floor stop unless otherwise specified. Where wall stops are specified but cannot be used, substitute a floor stop. If wall stop or floor stop cannot be used, advise the Owner of the specific door during submittal process. Provide proper height floor stops to suit conditions. Contractor to provide solid backing for all wall mounted stops.

Stops shall be as specified in the hardware groups and shall be as manufactured by Trimco, or equal.

2.6 GASKETS AND THRESHOLDS

Gaskets and thresholds shall be as specified in the hardware groups and shall be as manufactured by Pemko, or equal.

2.7 DOOR SILENCERS

The Contractor shall furnish three door silencers for each single doorframe, and four door silencers for each pair of doorframes.

Door silencers shall be as specified in the hardware groups and shall be as manufactured by Ives, or equal.

2.8 KEYING

All cylinder items shall be furnished with visual key control with key code stamped on the face of the keys and marked on the back or side of the cylinders. All standard cylinder items shall be furnished with construction-keyed cylinders.

The Contractor shall coordinate the keying for door locks with the Owner.

2.9 KEY QUANTITIES

Keys shall be furnished in the following quantities:

Type	**Quantity**
MKs	6 each
Construction Keys	6 each
Change keys per keyed cylinder	2 each
Control keys	2 each

2.10 HARDWARE GROUPS

A. MANUFACTURER'S LIST

Manufacturer	Abbreviation
Corbin Russwin	CO
Ives	IV
McKinney	MK
Pemko	PE
Trimco	TR
Rockwood	RW

B. Refer to door schedule and related information concerning the following hardware groups:

HW1 (insulated single door)

	Butts TCA 3386, 630	MK
1 ea.	Exit Device ED5600. L9M55, 630	CO
1 ea.	7-Pin IC Cylinder 1080-112-A02, 630	CO
1 ea.	Wall stop 1270	TR
1 ea.	Threshold 2715 CPK	PE
1 ea.	Door bottom 210 DPK	PE
1 set	Gaskets 2891, 290 DPK	PE

HW2 (insulated double door)

	Butts 3386, 630	MK
1 ea.	Exit Device ED5600L, L9M55, 630	CO
1 ea.	7-Pin IC Cylinder 1080-112-A02, 630	CO
1 ea.	Dustproof Strike 570	RW
1 ea.	Wall stop 1270	TR
1 ea.	Astragal 355 CPK	PE
1 ea.	Threshold 2715 AK	PE
1 ea.	Door bottom 210 DPK	PE
1 set	Gaskets 2891, 290 DPK	PE

HW3 (interior privacy door)

	Butts CB179	ST
1 ea.	Privacy Lockset ML2030 LWA, 630	CO
1 ea.	Wall Stop 1270WV, 626	TR
3 ea.	Silencers 1229	TR

PART 3 EXECUTION

3.1 INSTALLATION

Refer to A.S.A.H.C., B.H.M.A., and S.D.I. for mounting heights.

Unless a conflict arises, the following are standard mounting heights on some products. If a question or conflict should arise, the hardware supplier, if requested, shall assist the Contractor and Owner in determining mounting heights. All measurements are from finish floor except top butt.

A. BUTTS

Top 11-3/4-inch center of butt to top of door. Intermediate equal distance between top and bottom butts. Bottom 13-inch center of butt.

B. DEADLOCKS

60 inch to center of strike.

C. EXIT DEVICES

3.2 ADJUSTING

Hardware shall be adjusted for correct operation.

After installation of hardware and before the building is accepted, Contractor shall inspect the installation and certify that the hardware is correctly installed in accordance with the manufacturer's recommendations. Hardware installer shall make any necessary adjustments.

***** END OF SECTION *****

DIVISION 9

FINISHES

SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of all labor, materials, and equipment for all gypsum wallboard, zinc-coated trim, taping, spackling, and texturing necessary to complete all the work indicated on the Plans and as specified. The work shall include installation of gypsum board, exterior and interior grounds, corner beads, taping, spackling, sanding, and texturing of all joints and screw heads to obtain finished walls ready for painting.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
06100	Rough Carpentry
07900	Caulking and Sealants
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ASTM C36	Specification for Gypsum Wallboard
ASTM C79	Specification for Gypsum Sheathing Board
ASTM C473	Standard Test Methods for Physical Testing of Gypsum Panel Products
ASTM C474	Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction
ASTM C475	Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C840	Specification for Application and Finishing of Gypsum Wallboard
ASTM C1002	Specification for Steel Drill Screws for the Application of Gypsum Wallboard
ASTM C1047	Specification for Accessories for Gypsum Wallboard
ASTM C1396	Standard Specification for Gypsum Board

1.4 QUALITY ASSURANCE

All gypsum wallboard products and joint treatment products shall be obtained from a single manufacturer.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Gypsum wallboard products and joint treatment products shall be as manufactured by National Gypsum Co., Georgia Pacific, USG Corp., or approved equal.

2.2 GYPSUM WALLBOARD

Heavy duty, moisture and abuse resistant gypsum wallboard with reinforcing layers at each face shall conform to ASTM C1629 and ASTM C1396, Type X. Thickness shall be 5/8 inch.

2.3 TRIM ACCESSORIES

Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for fastening and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, and one-piece control joint beads. Unless specifically noted as "exposed," all trim accessories shall be beaded type to be concealed with joint compound.

2.4 JOINT TREATMENT MATERIALS

Provide materials complying with ASTM C475, ASTM C840 and recommendations from the Manufacturer for the applications indicated. Provide 2-1/2-inches wide, perforated tape for joints. Provide two separate grades of ready-mixed, vinyl-type joint compound. One type shall be for bedding tapes and filling depressions. The second type shall be for taping and sanding.

2.5 FASTENERS

Screws shall conform to ASTM C1002 with heads, threads, points, and finish as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

All workmanship and materials shall be of the best quality and any defective work shall be removed and replaced by the Contractor at no additional expense to the Owner. Keep the premises free of accumulations of debris and dust connected with this work and protect adjacent finished surfaces from damage by this work. The Contractor shall establish and maintain application and finishing environment in accordance with ASTM C840. For non-adhesive attachment of gypsum wallboard to framing, maintain not less than 40 degrees F.

3.2 INSTALLATION

All drywall sheets shall be set with staggered joints and screws set deep enough to receive a cover of spackle, spaced in accordance with Wallboard Manufacturer's standard specifications. Install approved zinc-coated corner molds at openings and terminations of wallboards. Cut all wallboard close to and around wall penetrations and electrical outlets. Provide a complete, covered installation in all areas where gypsum wallboard is to be installed.

3.3 FINISHING

After the wallboard has been installed, it shall be finished. Apply joint compound or bedding compound and embed tape leaving uniform thickness of materials underneath tape. Cover screw heads smooth with finished surface of board after each application of joint material. After initial application has been complete, it shall be allowed to dry and then sanded smooth.

Additional coats of joint compound shall be applied and finish sanded until a Level 5 finish has been achieved in accordance with ASTM C840 and left in a condition to receive paint.

Obtain Owner's approval prior to applying paint.

3.4 ESCUTCHEONS

Provide escutcheons around all pipe, conduit, and similar types of penetrations through gypsum wallboard walls and ceiling.

***** END OF SECTION *****

SECTION 09653

RESILIENT WALL BASE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the resilient base material and accessories as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
09250	Gypsum Wall Board
09900	Painting

1.3 SUBMITTALS

A. PRODUCT DATA

Rubber Wall Base.

B. SAMPLES FOR INITIAL SELECTION

Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

C. SAMPLES FOR VERIFICATION

In manufacturer's standard sizes, but not less than 12-inches (300-mm) long, of each product color and pattern specified.

1.4 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS

Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. SOURCE LIMITATIONS

Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 degrees F (10 and 32 degrees C).

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 degrees F (21 degrees C) or more than 95 degrees F (35 degrees C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

B. Do not install products until they are at the same temperature as the space where they are to be installed.

PART 2 PRODUCTS

2.1 RESILIENT WALL BASE

A. RUBBER WALL BASE

Products complying with ASTM F1861, Type TP.

2.2 MANUFACTURERS

A. AVAILABLE PRODUCTS

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Products

    a. Roppee Corporation

    b. Mercer Products Company

    c. Johnsonite

2. Color and Pattern

    As selected by Owner from manufacturer's full range of colors and patterns produced for rubber wall base complying with requirements indicated.

    a. Allow one color.

3. Style: Cove with top-set toe.

4. Minimum Thickness: 1/8 inch.

5. Height: 4 inches.

6. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet.

7. Outside Corners: Formed on job.

8. Inside Corners: Formed on job.

9. Ends: Premolded.

10. Surface: Smooth.

2.3 RESILIENT ACCESSORIES

A. RUBBER ACCESSORIES

Provide necessary accessories as required per manufacturer's recommendations.

2.4 INSTALLATION ACCESSORIES

A. TROWELABLE LEVELING AND PATCHING COMPOUNDS

Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. ADHESIVES

Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. GENERAL

Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone,

using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. GENERAL

Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas as scheduled.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

2. Sweep or vacuum horizontal surfaces thoroughly.

3. Do not wash resilient products until after time period recommended by resilient product manufacturer.

4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by resilient product manufacturer.

C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

***** END OF SECTION *****

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the furnishing and installation of protective coatings, complete-in-place. Special shop coatings and/or factory-applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of paint coats previously applied, at least two field coats of paint shall be applied to all surfaces unless otherwise specified herein. Field painting is not required for factory prefinished equipment items such as pumps, blowers, motors, etc. Touchup of the factory applied coatings may be required.

The word "paint" as used herein shall be taken to include all protective coatings and incidental materials as required with the exception that anodized aluminum or zinc galvanized coatings shall not be considered as paint.

Unless specifically noted otherwise in these Specifications or on the Plans, all work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If an existing wall or ceiling (or similar surface) is modified in someway, the entire wall or ceiling surface is to be painted.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
03300	Concrete
04200	Masonry
06200	Finish Carpentry
07900	Caulking and Sealant
08100	Hollow Metal Doors and Frames
Division 5	Metals
Division 11	Equipment
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

1.3 REFERENCED STANDARDS

The following standards are referenced and shall be considered a part of these Specifications:

American National Standards Institute (ANSI):
A159.1, Surface Preparation Specifications;
Z53.1, Safety Color Code for Marking Physical Hazards

American Society for Testing and Materials (ASTM):
D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
E84, Standard Test Method for Surface Burning Characteristics of Building Materials

National Fire Protection Association (NFPA):
101, Life Safety Code

Steel Structures Painting Council (SSPC):
SP-1, Solvent Cleaning
SP-2, Hand Tool Cleaning
SP-3, Power Tool Cleaning
SP-5, White Metal Blast Clearing
SP-6, Commercial Blast Cleaning
SP-7, Brush-off Blast Cleaning
SP-10, Near-White Blast Cleaning
SP-11, Power Tool Cleaning
SP-13 Surface Preparation for Concrete Surfaces
VIS-89, Visual Standard

1.4 DEFINITIONS

A. PAINT

Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, urethanes, shellacs, varnishes and any other applied coating specified within these Specifications or shown on the Plans.

B. FINISHED ROOM OR SPACE

One that has a finish called for on Room Finish Schedule, or is indicated on the Plans, or is specified herein, to be painted.

C. PAINTING COVERAGE RATE

Coverage's expressed in SF/GAL/coat are the manufacturer's published theoretical coverage's in square feet per gallon per coat.

1.5 SUBMITTALS

In addition to the general submittal requirements listed in Section 01300, the following shall be submitted:

1. Written acknowledgment and certification that products submitted meet requirements of standards referenced in this Section.

2. Manufacturer's application instructions for primer and finish coats.

3. Manufacturer's surface preparation instructions.

4. Manufacturer's full line of color samples for color selection by Owner.

5. If products being used are manufactured by a company other than the specified reference standard, the Contractor must provide a complete comparison of the proposed products with the specified reference products per Part 2.1 requirements, including application procedure, coverage rates, and verification that product is designed for intended use. Information must be provided that demonstrates that manufacturer's products are equal to the performance standards of products manufactured by the Tnemec Company, which is the reference standard.

6. Manufacturer's approval of protective coating systems applicator.

7. List of Applicator's experience and qualifications. A minimum of 5-years of experience in the painting of wastewater treatment plant facilities required.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The following is an approved coating systems manufacturers list subject to compliance with the Specifications contained herein:

1. Ameron Protective Coatings Division.
2. Sherwin Williams.
3. Tnemec Company.

4. Or equal.

The specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the coatings proposed are equivalent to those named. Proposed coatings shall be submitted for review in accordance with these Specifications. Requests for review of equivalency will not be accepted from anyone except the Contractor, and such requests shall not be considered until after the Contract has been awarded.

No substitutions shall be allowed that change the number of coats, thickness or generic type of paint required. All materials shall be brought to the jobsite in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

No coating materials other than those specified shall be brought to the jobsite. Thinners, driers and oils brought to the jobsite shall be only those recommended and approved by the paint manufacturer.

All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products which will be in contact with each other or which will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

All paint used for intermediate and finish coats shall be guaranteed by the paint manufacturer to be fumeproof and suitable for wastewater plant atmospheres containing hydrogen sulfide. Any paint that cannot be so guaranteed shall not be used. Paint shall be lead-free and mercury-free if available, but in no case shall the lead or mercury content cause discoloration in a wastewater plant atmosphere.

Tnemec Company products are the reference standard and Tnemec designations for product type are used herein. Requirements for an approved equal product are listed below:

1. For approval of an equal manufacturer. The Contractor shall provide to the Owner in writing a detailed side-by-side comparison of the proposed equal Products Characteristics, Performance Characteristics, and Application

Conditions for each Tnemec coating specified in this specification. For consideration for approval this written comparison shall be certified and notarized by an officer of the proposed manufacturer as true and correct.

2. For Products Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Volume Solids, Weight Solids, VOC, Mix Ratio, Zinc Content in Dry Film (by Weight), Spreading Rate per coat, Drying Schedule, Shelf Life and Flash Point.

3. For Performance Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Abrasion Resistance, Corrosion Weathering, Direct Impact Resistance, Dry Heat Resistance, Flexibility, Moisture Condensation Resistance, Pencil Hardness, Salt Fog Resistance, Slip Coefficient and Wet Heat Resistance

4. In addition to the detailed side-by-side comparison for approval of an equal manufacturer, The Contractor shall provide to the Owner in writing five similar installations that have had the proposed or equal coating system and date coating system was put into service. In addition the installations names, locations, and owner's name with contact person and telephone number shall be provided.

5. For consideration for approval as an equal coating system the detailed side-by-side comparison shall be submit, with successful bidder's Shop Drawing at the time of the Preconstruction Conference, along with any proposed monetary adjustments to the contract price. As with all shop drawings, final approval rests with the Owner.

6. As a minimum standard any equal coating system shall have a 5-year service history on its coating system.

2.2 PAINT SYSTEMS

A. SUBMERGED METAL

1. Scope

This Section shall apply to all metal, other than bituminous coated pipe and materials, which are to be continuously or intermittently submerged in sewage, water or sludge unless specified otherwise.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Shop Primer System:

Coat One

Product:	Omnithane Series 1
MDFT:	2.5 to 3.5 mils

Field Finish System:

Coat One

Product:	PermaShield Tnemec Series 218-141 Gray
MDFT:	6.0 to 9.0 mils

Coat Two

Product:	PermaShield Tnemec Series 218-141 Gray
MDFT:	6.0 to 8.0 mils

Total MDFT: 15.0 mils

B. NON-SUBMERGED METAL - MILD CONDITIONS

1. Scope

This Section shall apply to all metal which is not submerged but is located indoors which is not subject to splashing from sewage, water, sludge, oil and grease or other corrosive materials unless specified otherwise.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product:	Omnithane Series 1
MDFT:	2.5 to 3.5 mils

Field Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Coat Two
Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Total MDFT: 11 mils

C. NON-SUBMERGED METAL - SEVERE CONDITIONS

1. Scope

This Section shall apply to all metal which is not submerged but is located outdoors or is subject to splashing from sewage, water, sludge, oil and grease or other corrosive materials unless specified otherwise.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Shop Primer System:
Coat One
Product: Omnithane Series 1
MDFT: 2.5 to 3.5 mils

Field Finish System:
Coat One
Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Coat Two
Product: Endura-Shield Tnemec Series 73
MDFT: 3.0 to 5.0 mils

Total MDFT: 10 mils

D. COATING OF FACTORY NON-APPROVED FINISHES

1. Scope

This Section shall apply to all interior and exterior steel windows and frames and other similar type of items which have a factory finish which is not an approved corrosion resistant finish.

2. Surface Preparation

Factory coating is to remain. Provide clean surfaces, lightly sand 100 percent of the surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Primer System:

Coat One

Product:	Typoxy Tnemec Series N27
MDFT:	2.0 to 3.0 mils

Finish System:

Coat One

Product:	Endura-Shield Tnemec Series 73
MDFT:	3.0 to 5.0 mils

Total MDFT: 5.0 mils

E. EXTERIOR PVC SURFACES

1. Scope

This Section shall apply to all PVC pipe and fittings and similar materials that are located outside of buildings and vaults and are exposed to sunlight. Any and all PVC surfaces that are exposed to UV light are to be painted. Interior PVC items do not paint unless otherwise specified. Interior PVC pipe must be labeled and banded as specified.

2. Surface Preparation

Provide clean surfaces, lightly sand 100 percent of the PVC surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Finish System:

Provide One Coat of the following:

Product:	Endura-Shield Tnemec Series 73
MDFT:	3.0 to 5.0 mils

F. STRUCTURAL STEEL - MILD CONDITIONS

1. Scope

This Section shall apply to all interior structural steel. Items which are interior but may be exposed to splashing of liquids or corrosives shall be coated for severe conditions.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product:	Omnithane Series 1
MDFT:	2.5 to 3.5 mils

Field Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Coat Two

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Total MDFT: 11.0 mils

G. STRUCTURAL STEEL - SEVERE CONDITIONS

1. Scope

This Section shall apply to all exterior structural steel components and structural steel items which are interior but may be exposed to splashing of liquids or corrosives.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Primer System:

Coat One

Product:	Series 1 Omnithane
MDFT:	2.5 to 3.5 mils

Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Coat Two

Product:	Endura-Shield Tnemec Series 73
MDFT:	3.0 to 5.0 mils

Total MDFT: 10.0 mils

H. DUCTILE IRON PIPE AND FITTING MATERIALS (IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are continuously or intermittently submerged or exposed to splash or spill of liquids or corrosive atmospheres. This includes all ductile iron materials installed in a wet well, sump, manhole, vault, pullhole, or similar type of structure. Non-immersion service is covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product:	Omnithane Series 1
MDFT:	2.5 to 3.5 mils

Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series 446
MDFT:	8.0 to 10.0 mils

Coat Two

Product:	Hi-Build Epoxoline Tnemec Series 446
MDFT:	8.0 to 10.0 mils

Total MDFT: 16.0 mils

I. DUCTILE IRON PIPE AND FITTING MATERIALS (NON-IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are not continuously or intermittently submerged. Continuously or intermittently submerged items are covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product:	Omnithane Series 1
MDFT:	2.5 to 3.5 mils

Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Coat Two

Product:	Endura-Shield Tnemec Series 73
MDFT:	3.0 to 5.0 mils

Total MDFT: 10.0 mils

J. GALVANIZED SURFACE TOUCHUP

1. Scope

This Section shall apply to all galvanized surfaces, which have received minor damage to the galvanized surface during construction.

2. Surface Preparation

Power tool cleaning, SSPC-SP-3.

3. Coatings

Paint System:

Product:	PerimePrime Tnemec Series 394
MDFT:	3.0 to 5.0 mils

Total MDFT: 3.5 mils

K. ALUMINUM BURIED IN CONCRETE - DISSIMILAR METALS

1. Scope

This Section shall apply to all surfaces, which are conducive to corrosion due to interactions between dissimilar metals, or to chemical reactions, to include embedments in cast-in-place or precast concrete or masonry grout. This Section applies to aluminum, hot-dipped galvanized steel, and any other metals that have a dissimilar metals or chemical reaction concern when installed or embedded in concrete, or against concrete, mortar or grout.

2. Surface Preparation

Lightly sand with 150 grit sandpaper to degloss and roughen surfaces. Solvent cleaning, SSPC-SP-1.

3. Coatings

Finish Coat

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Total MDFT: 4.0 mils

L. GYPSUM WALLBOARD

1. Scope

This Section shall apply to all exposed gypsum wallboard surfaces.

2. Surface Preparation

Sandpaper smooth, dust and contaminant free.

3. Coatings

Primer System:

Coat One

Product:	Elasto-Grip FC, Tnemec Series 151-1051
MDFT:	1.5 to 2.5 mils

Finish System:

Coat One

Product:	Enduratone, Tnemec Series 1029
MDFT:	2.0 to 4.0 mils

Coat Two

Product:	Enduratone, Tnemec Series 1029
MDFT:	2.0 to 4.0 mils

Total MDFT: 5.5 mils

M. METAL DOORS, FRAMES AND TRIM

1. Scope

This Section shall apply to all interior and exterior hollow metal doors, frames and trim.

2. Surface Preparation

All hollow metal doors and frames shall be bonderized, pickled or phosphatized, which will serve as the primer for and shall be compatible with the finish coats to be applied in the field. Prior to field coat application, the surface shall be solvent cleaned SSPC-SP-1, and shall be clean, dry and free of all dirt, oil, grease and any other contaminants.

3. Coatings

Primer System:

Coat One	
Product:	FC Typoxy, Tnemec Series 27
MDFT:	3.0 to 5.0 mils

Finish System:

Coat One	
Product:	Endura-Shield, Tnemec Series 73
MDFT:	3.0 to 5.0 mils

Total MDFT: 6.0 mils

N. CONCRETE BLOCK MASONRY (INTERIOR)

1. Scope

This Section shall apply to all interior concrete block masonry (CMU) surfaces unless otherwise specified in these Specifications.

2. Surface Preparation

Clean, dry, and free of contaminants.

3. Coatings

Primer System:

Product:	Masonry Filler Tnemec Series 1254 WB
MDFT:	80 to 100 sf/gal/coat application rate. Need to provide a smooth, continuous, pinhole free, void-free film, prior to application of finish coating system.

Finish System:

Coat One

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Coat Two

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Total MDFT: 8.0 mils (for finish system only)

O. PAINTED WOOD AND WOOD TRIM

1. Scope

This Section shall apply to all exposed to view interior and exterior wood and wood trim for buildings and structures. Color shall be selected by the Owner.

2. Surface Preparation

Wood surfaces shall be clean and dry. Sand wood as required.

3. Coatings

Primer System:

Product:	Electrogrip, Tnemec Series 151
MDFT:	1.5 to 2 mils

Finish System:

Coat One:

Product:	Envirocrete, Tnemec Series 156
MDFT:	3.0 to 4.0 mils

Coat Two:

Product:	Envirocrete, Tnemec Series 156
MDFT:	3.0 to 4.0 mils

Total MDFT: 9 mils

P. CONCRETE EXPOSED TO CONCENTRATED SEWAGE GASES

1. Scope

This Section shall apply to concrete surfaces exposed to concentrated sewage gases, including ceilings, where noted on the Drawings and/or as specified herein. Color shall be gray or other light color approved by the Owner. Coat following installation of pipe penetrations and grout, but prior to mechanical attachment of structures, restraints, supports or equipment to concrete surfaces and prior to caulking.

2. Surface Preparation

Concrete surfaces shall be clean and dry. Allow 28 days cure time for concrete, or until surface passes the ASTM D 4263 Plastic Mat test (may be less than 28 days for various grout mixes).

SSPC SP13 preparation of concrete surfaces to a standard profile of ACRI CSP 3-5 on all concrete surfaces to be coated. For recoating and repair, mechanically abrade coating surface to provide the ACRI CSP 3-5 standard profile.

Grout all joints, pipe penetrations, lift holes, and hardware pockets with Tnemec Series 218 MortarClad, prior to providing surface filler coat.

3. Coatings

Surface Filler:

Product:	Tnemec Series 218 Mortar Clad
MDFT:	Apply 1/32 inch and to fill any bugholes and surface voids flush to plan of concrete. Provided a monolithic, pinhole-free surface. Provide multiple coats of filler as required.

Finish System:

Product:	Tnemec Series 436 Perma-Shield FR
MDFT:	70.0 to 80.0 mils DFT

Q. BURIED CONCRETE EXTERIOR SURFACES

1. Scope

This Section shall apply to buried exterior concrete surfaces where noted on the Drawings. Coat following installation of pipe penetrations and grout, and prior to caulking.

2. Surface Preparation

Concrete surfaces shall be clean and dry. Allow 28 days cure time for concrete, or until surface passes the ASMT D4263 Plastic Mat test (may be less than 28 days for various grout mixes).

SSPC SP13 preparation of concrete surfaces to a standard profile of ACRI CSP 3-5 on all concrete surfaces to be coated. For recoating and repair, mechanically abrade coating surface to provide the ACRI CSP 3-5 standard profile.

Grout all joints, pipe penetrations, lift holes, and hardware pockets with Tnemec Series 218 MortarClad, prior to providing surface filler coat.

3. Coatings

Surface Filler:

Product:	Tnemec Series 218 Mortar Clad
MDFT:	Apply 1/32 inch and to fill any bugholes and surface voids flush to plan of concrete. Provided a monolithic, pinhole-free surface. Provide multiple coats of filler as required.

Finish System (1):

Product:	Tnemec Series 141 PotaPox
MDFT:	16.0 mils DFT

High Water Table Alternative Finish System (2):

Product:	Tnemec Series 264 Elasto-Shield
MDFT:	70.0 to 80.0 mils DFT

R. EXPOSED TO VIEW INTERIOR CONCRETE WALL AND CEILING SURFACES IN OCCUPIED OR SEMI-OCCUPIED SPACES

1. Scope

This Section shall apply to all exposed to view interior concrete wall and ceiling surfaces in occupied or semi-occupied spaces within buildings and structures. Color shall be selected by the Owner.

2. Surface Preparation

Concrete surfaces must be clean and dry. Provide grout "sacked" finish in accordance with Specification Section 03300.

3. Coatings

Finish System:

Two Coats:

Product:	Envirocrete, Tnemec Series 156
MDFT:	8.0 mils of finish product

S. EXPOSED TO VIEW EXISTING INTERIOR CONCRETE, CMU AND CEILING SURFACES IN OCCUPIED OR SEMI-OCCUPIED SPACES

1. Scope

This section shall apply to all exposed to view existing interior concrete, CMU and ceiling surfaces in occupied or semi-occupied spaces within buildings or structures including walls, floors and ceilings as noted on the drawings that require a newly painted surface be applied.

2. Surface Preparation

Surfaces shall be prepared in accordance with section 3.3 of this Specification.

3. Coatings

Finish System:

Two Coats:

Product:	Envirocrete, Tnemec Series 156
MDFT	8.0 mils of finish product

2.3 COLORS

A. GENERAL

Paint colors used for the finish coatings on process equipment, piping and building surfaces shall conform to the following schedules. All finishes shall be glossy unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform with this color schedule wherever possible. Factory coatings which are damaged during shipment or installation, or which are not of suitable color, as determined by the Engineer, shall be recoated in the field in accordance with these Specifications. Color samples shall be submitted to the Engineer for approval prior to application of any field coatings.

B. PROCESS EQUIPMENT COLOR SCHEDULE

Process equipment to include shall be painted in accordance with the following color schedule:

	Process Unit	Color
(A)	Mechanical Fine Screen	Light Blue
(B)	Pumps	Light Brown
(C)	Mixers	Light Blue
(D)	Blowers and Motors	Light Blue
(E)	Odor Control Fan	OSHA Safety Green
(F)	Non-Potable Water Pump	Dark Blue

Other equipment items and process materials shall be painted with finish colors selected by the Engineer.

C. PIPING COLOR SCHEDULE

Piping Identification: Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, shall have flow directional arrows, and shall be color coded as scheduled below.

Piping scheduled to be color coded shall be completely painted with the indicated colors, except surfaces specified to be unpainted shall have segments painted with the specified coding color long enough to accommodate the required lettering and arrows. All other piping specified to be painted shall match adjacent surfaces, unless otherwise approved by the Engineer.

Location: Lettering and flow direction arrows shall be provided near equipment served, adjacent to valves, on both sides of walls and floors where pipe passes through, at each branch or tee, and at intervals of not more than 50 feet in straight runs of pipe. If, in the opinion of the Engineer, the foregoing requirements will result in an excessive number of labels or arrows on a run of pipe, the number required can be reduced.

Metal Tags: Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, metal tags shall be provided instead of lettering. Tags shall have the specified identifying lettering stamped in, and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel. Where tags are used, pipe shall be color coded as specified.

Lettering: Lettering on piping shall be painted, stenciled, or snap-on markers. Snap-on markers shall be plastic sleeves as manufactured by Brady "Brady snap-on B-915," Seton "Setmark," or equal. Letter sizes shall be as follows:

Outside Diameter of Pipe or Covering	Minimum Height of Letters
5/8 inch and smaller	Metal tags - 1/4 inch
3/4 inch through 4 inch	3/4 inch
5 inch and larger	2 inches

Color Coding and Lettering Schedule: All piping for the following services shall be color coded and identified using the process names given below. Where scheduled, bands shall be 6-inches-wide spaced along the pipe at 5-foot intervals.

Process	**Abbreviation**	**Color of Pipe**	**Color of Letters**
Air Low Pressure	ALP	Not Painted	Black
Chemical Cleaning Solution	CCS	Yellow w/red bands	Black
Drain	D	Dark Gray	White
Equalization	EQ		
Final Effluent	FE	Gray	Black
Force Main	FM	Light Gray	Black
Irrigation	I	Light Blue	Black
Mixed Liquor	ML	Light Brown	White
Non-Pot Water	NPW	Light Blue w/red bands	Red
Odor Control Duct	OCD	Not Painted	Black
Outfall	OTF	Gray	Black
Overflow	OF	Dark Gray	White
Permeate	PER	Light Blue	Black
Potable Water	W	Light Blue	Black

Raw Sewage	RS	Light Gray	Black
Return Activated Sludge	RAS	Light Brown	White
Sample	SAM	Light Gray w/green bands	Black
Sanitary Sewer	SS	Gray	Black
Storm Drain	SD	Light Blue	Black
Sump Pump Discharge	SPD	Not Painted	Black
Vent	V	Not Painted	Black
Waste Activated Sludge	WAS	Light Brown	White
Waste Sludge	WS	Light Brown	White

All exposed piping shall be color coded and lettered. Pipes not tabulated above shall be color coded and lettered as determined by the Engineer.

Electrical conduit shall be painted to match adjacent ceiling or wall surfaces as approved by the Engineer. Vent lines shall be painted to match surfaces they adjoin, otherwise gray.

All valves shall be identified with a valve identification number. Contractor shall provide a computer file (Excel spreadsheet) with this information to the Engineer.

In addition, special painting of the following items shall be required:

Item	Color
Hoist Hooks and Blocks	Yellow and Black Stripes

PART 3 EXECUTION

3.1 GENERAL

It is the intent of these Specifications that materials and workmanship be provided such that the highest quality job is obtained. The completed work, prior to acceptance, must be free from runs, skips, mars and any other disfiguring mark due to faulty workmanship or care of the completed work.

It is the responsibility of the Contractor to ensure that all surfaces are prepared in accordance with the written recommendations and directions of the paint manufacturer whose paint is applied.

Approval of conditions shall be obtained from the Engineer prior to applying any or all coats of paint; however, such approval shall not relieve the Contractor of

their responsibility of conformance with these Specifications and conformance with the manufacturer's recommendations.

It shall be the responsibility of the Contractor to prevent settling of dust or the occurrence of other conditions detrimental to the finished quality of the job and to repair any damaged paint at no additional cost to the Owner.

Materials or equipment delivered with prime coats shall be touched up as required prior to the application of additional coating(s).

The Contractor shall apply each coating at the rate and in the manner specified by the paint manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built-up to the same thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Film thickness shall be determined when dry by the Engineer with a magnetic dry film thickness gauge. The thickness gauge shall be calibrated with test shims.

Where thinning is necessary, only the products of the manufacturer furnishing the paint and for the particular purpose shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees F. No paint shall be applied when the temperature of the surface to be painted is below 35 degrees F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity exceeds 85 percent. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40 degrees F within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until conditions improve to be certain that the surfaces are dry prior to application of paint. No paint shall be applied when the ambient temperature is less than 5 degrees F. above the dewpoint. Further, the day's painting shall be completed well within advance of the probable time of day when condensation will occur, in order to permit the paint film an appreciable drying time prior to the formation of moisture.

Manufacturer's recommended drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times shall be necessary. The manufacturer's recommendations for recoating time intervals shall be strictly adhered to.

Adequate ventilation, which will effectively remove solvents, shall be provided for proper drying of paints on interior surfaces. A minimum of 7 consecutive calendar days at 70 degrees F following the application of the final coat on submerged surfaces shall be required before submergence. Longer periods shall be allowed prior to submergence if recommended by the paint manufacturer or if weather conditions require a longer curing time.

3.2 MIXING AND THINNING

Paint shall be thoroughly mixed each time any is withdrawn from the container. Paint containers shall be kept tightly closed except while paint is being withdrawn.

Paint shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. Only thinners approved by the paint manufacturer shall be used. In no case shall the wet film thickness of applied paint be reduced, by addition of paint thinner or otherwise, below the thickness recommended by the paint manufacturer.

3.3 SURFACE PREPARATION

A. GENERAL

Surfaces shall be dry and thoroughly cleaned of foreign materials with all defects filled or removed. All trades employed shall leave the surfaces of their work in such a condition that only minor cleaning, sanding and filling is required of the painting trade for surface preparation.

Hardware, switchplates, machined surfaces, nameplates, lighting fixtures and all other surfaces not to be painted shall be removed or otherwise protected. Drop cloths shall be provided, where necessary, to avoid spotting of surfaces adjacent to the item being painted. Working parts of electrical equipment shall be protected from damage during surface preparation and painting operations.

Ferrous metal cleaning shall be in accordance with Steel Structures Painting Council Specifications (SSPC).

Description	SSPC
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10
Preparation of Concrete	SP-13

The words "blast cleaning" or equivalent phrases of equal intent shall be taken to refer to the applicable SSPC specification when used in the paint manufacturer's recommendations or these Specifications.

Hand tool cleaning shall be used when power tool cleaning is not possible. Hand and power tool cleaning shall be in accordance with SSPC Specifications SP-2, SP-3 or SP-11, respectively.

The blast cleaning profile depth shall be not less than 1 mil or greater than 2 mils. In the case of equipment to which the manufacturer applies a primer coating in the shop after fabrication, the blast profile depth needs to be as noted above.

B. WOOD

The Contractor shall sandpaper smooth, then remove dust. After prime coat has dried, seal all knots, pitch and resinous sapwood. The Contractor shall putty nail holes and minor defects prior to painting.

C. FERROUS METAL, GALVANIZED METAL AND HOLLOW METAL SURFACES

The Contractor shall assure that fabrication, welding or burning is completed prior to the sandblasting operation. The Contractor shall chip or grind off flux, splatter, slag or other laminations left from welding. The Contractor shall remove all mill scale. The Contractor shall grind smooth rough welds and other sharp projections.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10, submerged surfaces and surfaces to 12 inches above highest liquid level, and areas subject to splash or spillage.

The Contractor shall commercial blast clean, in accordance with SSPC SP-6, all interior and exterior structural steel surfaces, surfaces located 12 inches above submerged areas, and surfaces located in areas not subject to splash or spillage where exposed to open bodies of liquids.

The Engineer reserves the right to accept preparation of these surfaces in accordance with SSPC SP-3 for areas not practical or possible to sandblast to SSPC SP-6 requirements.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10 surfaces, subject to heat in excess of 600 degrees F. The Contractor shall power tool or hand clean in accordance with SSPC SP-2 or SSPC SP-3. The Contractor shall apply prime coat on cleaned surfaces within 2 hours of cleaning. The Contractor shall solvent clean galvanized surfaces in accordance with SSPC SP-1.

D. EQUIPMENT

The Contractor shall sandblast the following equipment items or surfaces in accordance with applicable SSPC standards whether prime coated or not:

Shop primed surfaces, which have 2 percent or more of the primed surface damaged.

If catalyzed epoxy prime coat has been exposed to sunlight for longer than 60 days.

E. GYPSUM WALLBOARD

The Contractor shall repair minor irregularities left by finishers, avoid raising the nap of the paper and verify that the moisture content is less than 8 percent before painting. Contractor shall install sealant as required at edges of wallboard where it abuts different materials prior to painting.

F. CONCRETE AND CONCRETE BLOCK MASONRY

The Contractor shall allow new concrete and concrete block masonry to cure for a minimum of 28 days and shall verify that the moisture content contained in the concrete is stable and not in motion. The Contractor shall verify by performance of a Wet Matt Test per ASTM D4263. The Contractor shall fill concrete surface cracks and irregularities with Portland cement grout to provide a uniform surface texture and shall fill concrete block masonry surface with an epoxy block filler as specified. As a minimum, the Contractor shall brush off blast clean surfaces. The Contractor shall prepare the surface as specified elsewhere in these Specifications.

D. CONCRETE BLOCK MASONRY

The Contractor shall verify that the moisture content is acceptable as noted above, shall remove existing paint that has a tendency to powder, peel or shatter when scraped with a knife, shall hydroblast or sandblast the surfaces of any previous coatings, shall fill cracks and irregularities with portland cement grout to provide a uniform surface texture compatible with new concrete and shall fill concrete block masonry surfaces with a block filler.

G. PREPARATION BY SANDBLASTING

The Contractor shall not sandblast surfaces that will be wet after blasting and before painting. The Contractor shall apply primer to sandblasted surfaces the same day that the surface is blasted and before rusting occurs. The Contractor shall reblast surfaces allowed to set overnight prior to priming or surfaces that show rust bloom.

The sand shall be clean, water washed, with controlled particle size and high silica content. The sand shall have sharp, angular surfaces and contain no clay particles or other extraneous matter.

The profile depth of sandblasted surfaces shall be not less than 1 mil or greater than 2 mils, unless required otherwise by the coating manufacturer.

Compressed air for blasting shall be free of water and oil. The Contractor shall provide accessible separators and traps, shall confine sandblast sand to the area being blasted, shall provide shields of polyethylene sheeting or other such barriers to confine sand and shall plug pipes, holes or openings before sandblasting and keep them plugged until the sandblasting operation is complete and the sand is removed.

The Contractor shall protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from sandblasting. The Contractor shall reblast surfaces not meeting the requirements of these Specifications.

3.4 APPLICATION

A. GENERAL

The Contractor shall mix and apply coatings by brush, roller or spray in accordance with the manufacturer's installation instructions. Spraying equipment shall be inspected and approved in writing by the coating

manufacturer. The Contractor shall provide complete coverage's to the mil thickness specified. The thickness specified shall be dry film mil thickness. All paint systems are "to cover." In situations of discrepancy between the manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern. When color or undercoats show through, the Contractor shall apply additional coats until paint film is of uniform finish and color. The Contractor shall not apply consecutive coats until the Engineer has had an opportunity to observe and approve previous coats.

The Contractor shall apply materials under adequate illumination, shall evenly spread and flow on to provide full, smooth coverage, shall work each application of material into corners, crevices, joints and other difficult to work areas, shall avoid degradation and contamination of blasted surfaces and avoid intercoat contamination, shall clean contaminated surfaces before applying next coat and shall immediately smooth out runs or sags, or remove and recoat entire surfaces. The Contractor shall assure that preceding coats are dry before recoating, shall recoat within the time limits specified by the coating manufacturer and shall allow coated surfaces to cure prior to allowing traffic or other work to proceed.

The Contractor shall coat all aluminum surfaces in contact with dissimilar materials. All fabricated and structural steel shall have prime coat(s) applied in the shop and finish coat(s) applied in the field.

During application of either prime or finish coats, brush coat all weld seams, edges, angles, fasteners and other irregular surfaces to insure a monolithic film, pinhole free surface. Finish coats of paint shall be uniform in color and sheen without streaks, laps, runs, drips, sags or missed areas.

All submerged or intermittently submerged materials shall have surface preparation and coatings applied prior to installation unless otherwise approved by the Engineer. All pipe, pipe supports, and pipe hangers that will be painted shall have surface preparation and coatings applied prior to installation.

B. PRIME COAT INSTALLATION

The Contractor shall prime all surfaces indicated to be painted, shall touch-up damaged primer coats prior to finish coats and shall assure field-applied coatings are compatible with factory-applied coatings. If coatings are not compatible, and if approved in writing by the Engineer, the

Contractor shall apply a 2-mil-thick universal barrier coat recommended by the paint manufacturer prior to applying field coats or completely remove factory coatings and reprime.

The Contractor shall prime ferrous metals bedded in concrete to a minimum of 1 inch below exposed surfaces. The Contractor shall backroll all primer coats applied to existing or new CMU block. The Contractor shall assure sandblasting operations do not result in the embedment of sand particles in paint film. The Contractor shall brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over the entire surface being coated. The Contractor shall backroll concrete, masonry, gypsum board and plaster surfaces with a roller if the primer has been spray applied.

C. FINISH SCHEDULE

All work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If the finish schedule requires wall surfaces to be painted in a particular space, the Contractor shall paint all appurtenant surfaces unless specifically noted not to be painted on the Plans. These items to be painted shall include:

1. Pipe supports, and equipment supports.

2. Insulated or wrapped piping, valves, fittings, hydrants and appurtenances except where covered by lagging.

3. Insulated or wrapped ductwork and appurtenances.

4. Conduit and appurtenances.

5. Ferrous metals.

6. Exposed woodwork.

7. Copper and brass surfaces.

8. Inside and/or outside of ferrous metal tankage.

9. New machinery and equipment except:

    a. Electrical panels;

    b. Switchboards;

c. Switchgear;

d. Safety switches;

e. Motor starter equipment;

f. Busways;

g. Raceways.

The Contractor shall paint the following surfaces in areas not considered as finished areas:

1. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances.

2. Insulated or wrapped ductwork and appurtenances.

3. Exposed wood.

4. New machinery and equipment.

5. Machinery and equipment in sumps, pits, boxes, channels, wetwells and structures.

The Contractor shall paint all exposed interior and exterior surfaces including:

1. Soffits.

2. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances except when covered by lagging.

3. Insulated or wrapped ductwork and appurtenances except when covered by lagging.

4. Conduit and appurtenances.

5. Exterior and interior surfaces of ferrous metal tankage.

6. Ferrous metals.

7. Exposed wood.

8. Plaster surfaces.

9. Concrete block to be sealed, paint interior surfaces only.

The Contractor shall not paint the following elements unless specifically noted on the Plans to be painted:

1. Stainless steel surfaces except as required to identify piping.

2. Exposed to view aluminum surfaces.

3. Galvanized metal surfaces.

4. Fiberglass surfaces except fiberglass piping and piping appurtenances.

5. FRP ductwork unless gel coat color is not acceptable to the Owner.

6. Interior of pipe, ductwork, and conduits.

7. Moving parts of mechanical and electrical units.

8. Code labels and equipment identification and rating plates.

9. Piping, ductwork, or pipe conduit when enclosed between suspended ceiling and overhead slabs or located in pipe chases or surfaces to be lagged.

10. Factory-finished furniture, laboratory casework, metal toilet partitions, kitchen units, lockers, shop and storage equipment or miscellaneous items that have preapproved factory applied finishes.

11. Prefaced masonry, burnished masonry units, or glass masonry.

12. Structural steel or steel deck required to be fireproofed.

13. Contact surfaces of friction-type connections.

14. Pipe and/or duct lagging.

3.5 FIELD QUALITY CONTROL

The Contractor shall be responsible for performing, testing and assuring conformance with all requirements of these Specifications.

The Contractor shall maintain daily records showing:

- Start date of work in each area.
- Date of application for each following coat.
- Moisture content and surface temperature of substrate. Also record weather conditions, ambient air temperature and dew point.
- Provisions utilized to maintain temperature and humidity of work area within paint manufacturer's recommended ranges.

The Contractor shall measure the surface temperature of items to be painted with surface temperature gauges specifically designed for such use. The Contractor shall measure substrate humidity with humidity gauges specifically designed for such use. The Contractor shall measure wet paint with wet film thickness gauges. The Contractor shall measure paint dry film thickness with a Mikrotest gauge calibrated against the National Bureau of Standards "Certified Coating Thickness Calibration Standards." The Engineer may direct measurement of paint thickness at any time during the project to ensure conformance with these Specifications. A sufficient number of dry film thickness measurements shall be made so that there is approximately one measurement for each 100 square feet of surface area painted.

Where a wall or ceiling or other type of surface is disturbed and patched, the Contractor shall repaint entire wall or ceiling. The Contractor shall provide wet paint signs as necessary. The Contractor shall touch up damaged finish coats using the same material as specified for the finish coat.

At the conclusion of all painting activities, Contractor shall submit a painting field test report to the Engineer showing the above information plus results of wet film and dry film thickness tests. Provide four copies of final test report.

3.6 PAINTING SITE

Either shop painting or field painting and surface preparation shall be acceptable when painting work is performed in conformance with this Section, unless the painting is activity specified elsewhere in these Specifications.

3.7 PAINT THICKNESS

All paint thicknesses specified herein are minimum dry film thickness (MDFT). The thickness of paint over metallic surfaces shall be measured with a magnetic thickness gauge; paint thickness over wood or masonry shall vary in accordance with surface texture, but in no case shall the manufacturer's recommended coverage rate be exceeded. The minimum thicknesses given are total coating thickness for the coating specified, including multiple coats of the same material, where applicable.

***** END OF SECTION *****

DIVISION 10

SPECIALTIES

SECTION 10300

SAFETY EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

The Contractor shall furnish and install safety equipment items including fire extinguishers, and ear protectors.

One fire extinguisher shall be furnished and installed in each of the following locations.

A. Operations Building equipment room.

B. Operations Building electrical room.

C. Headworks area.

One ear protector shall be furnished and installed in the Operations Building equipment room.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
15400	Plumbing

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

The fire extinguishers shall be 5-pound monoammonium phosphate, dry chemical, nitrogen pressurized, Underwriter's Laboratories listed. The chemical shall be suitable for Class A, B, and C fires. Fire extinguishers shall have metal valve pressure gauges and corrosion resistant handles and wall hooks.

2.2 EAR PROTECTORS

Ear protectors shall be of the over-the-ear design with adjustable suspension bands. The suspension bands shall pivot on the ear cups to allow the band to rotate through 360 degrees and be worn over the head, behind the head or under the chin. Ear cup mounting shall be adjustable so that the angle of the ear cups

may be adjusted to the wearer's head. Minimum noise reduction shall be 15 DB above 200 Hz.

PART 3 EXECUTION

Safety equipment shall be installed in the general areas specified.

Specific locations shall be determined by a Safety Inspector with the Washington State Department of Labor and Industries. The Safety Inspector's visit shall be arranged by the Contractor. Any costs associated with the Safety Inspector's site visit shall be included in the Contractor's cost for the project.

***** END OF SECTION *****

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing all toilet, bath, and restroom accessories as shown on the Plans, and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following documents:

Reference	Title
ANSI A117	Accessible and Usable Buildings and Facilities
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality

1.4 REGULATORY REQUIREMENTS

Conform to ANSI A117 code for access for the handicapped.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

All toilet and bath accessories shall be as manufactured by Bobrick Washroom Equipment Inc., or equal.

2.2 FIXTURE SCHEDULE

Fixture	Type and Location
Toilet Tissue Dispenser	Bobrick B-76867, Provide one each at each water closet
Toilet Seat Cover Dispenser	Bobrick B-221, Surface-mounted, Provide one at each water closet compartment, Provide one at each water closet
Shelf	Bobrick B-295, Provide one at each shower
Shower Ct. Rod	Bobrick B-6047, Provide one at each shower
Shower Curtain	Bobrick B-204-2, Provide one at each shower
Shower Ct. Hooks	Bobrick B-201-1, Provide complete set for each curtain
Hand Towel Dispenser/ Receptacle	Bobrick B-369, Provide one at each lavatory
Soap Dispenser	Bobrick B-2111, Provide one at each lavatory
Mirror	Bobrick B-166, Provide one at each lavatory
Hooks	Bobrick B-677, Provide one at each water closet

2.3 MATERIALS

A. SHEET STEEL

ASTM A366.

B. STAINLESS STEEL SHEET

ASTM A167, Type 304.

C. TUBING

ASTM A269, stainless steel.

D. ADHESIVE

Contact type, waterproof.

E. FASTENERS, SCREWS, AND BOLTS

Hot dip galvanized, tamper-proof, and security type.

2.4 FABRICATION

Weld and grind joints of fabricated components, smooth. Exposed surfaces shall be formed from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

Grab bars shall be fabricated of tubing, free of visible joints and shall return to wall with end attachment flanges.

Components shall be shop assembled and packaged, complete with anchors and fittings.

Provide steel anchor plates, adapters, and anchor components as required for installation.

2.5 FINISHES

All stainless steel shall have a No. 4 satin luster finish. All components in contact with building finishes shall receive back paint to prevent electrolysis.

PART 3 EXECUTION

The Contractor shall install all accessories in accordance with the manufacturer's instructions and ANSI A117. All toilet and bath accessories shall be installed plumb and level and shall be securely and rigidly anchored to the substrate.

***** END OF SECTION *****

DIVISION 11

EQUIPMENT

SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

The provisions of this Section apply to all Sections of Divisions 11, 13, 14, 15, and 16, unless specifically revised therein.

The Contractor shall direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Provisions wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning and Training
03300	Cast-in-Place Concrete
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, wiring and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and

repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor. Indicating devices such as gauges, flow meter readouts, sight gauges or glasses, and similar type devices shall be oriented to be easily read from the floor, slab, or ground surface at normal operating or maintenance locations without climbing, bending or crossing over piping or equipment. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as authorized by the Engineer. All such minor deviations from the Plans that may include extending oil and lubrication fittings for accessibility and safety shall be executed at no additional cost to the Owner.

1.4 MANUFACTURER'S INSTRUCTIONS

The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.5 SUBMITTALS

A. GENERAL

Product Submittals shall be provided to the Engineer for all equipment specified in Divisions 11, 13, 14, 15, and 16, in accordance with Specification 01300, this Section and the respective equipment specification section. Submittals shall be dated and signed as certified for use in construction of this project.

B. MANUFACTURER'S LITERATURE

Manufacturer's literature shall be submitted for equipment, including, as applicable, performance characteristics, fan curves and pump curves, motor data sheets and methods of assembly.

The following minimum requirements shall accompany all manufacturers' literature submittals:

1. Description of materials.

2. Rating data - Mechanical and Electrical as applicable.

3. Motor Data including bearing and enclosure information.

4. List of any special tools and/or spare parts required and to be furnished, if any.

5. Exceptions taken to the specification and detailed explanation why the exception is being taken.

6. Additional specific information that is specified in the equipment sections.

7. For motor driven equipment served by variable frequency drives (VFDs), provide vibration and critical speed requirements of the equipment, minimum speed requirements of motor and driven machinery, acceleration and deceleration requirements of the equipment, and torque and speed information.

C. SHOP DRAWINGS

Shop Drawings shall be submitted showing sizes and arrangement of equipment, foundations and anchor bolts required, control diagrams, wiring diagrams, pipe hanging details, ductwork layouts and connections to other work. The arrangement of mechanical equipment and appurtenant piping shown on the Plans may be varied as necessary to fit the certified manufacturer's installation drawings. However, the manufacturer's drawings shall not deviate from the Plans and Specifications as to location, size, type and design of equipment.

The following minimum requirements shall accompany all shop drawing submittals:

1. Overall dimensions.

2. Mounting arrangement and dimensions.

3. Connection sizes and orientation.

4. Capacity and location of lifting eyes.

5. Motor arrangement showing location of electrical connections.

6. Detail electrical wiring diagrams, showing component designation and rating, and the connection points and associated terminals and cable identification for connection to the process control system.

7. The Contractor shall ascertain the location of all electrical (power and control) connections in order to properly orient electrical conduits.

D. DESIGN CALCULATIONS

Seismic design calculations shall be submitted for equipment and for supports and anchorage for equipment.

Special seismic certification shall be submitted for all active mechanical and electrical equipment that must remain operable following an earthquake in compliance with ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components.

E. FACTORY TEST REPORTS

Factory tests shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard shall make that requirement a part of these Specifications. Conduct factory tests at the same speeds at which the equipment will operate in the field except as noted.

Where specifically noted, the Engineer may witness performance test. The Contractor shall inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified results shall be supplied by the Contractor to the Engineer.

Factory testing of pumps shall be done in accordance with the requirements and standards of the Hydraulic Institute. Tests of other equipment shall conform to the requirements set forth in these Specifications.

F. IDENTIFICATION OF DELIVERED EQUIPMENT

Each piece of equipment delivered to the project site shall be accompanied by a completed form which will contain at least the following information:

1. Owner’s name and location of project.

2. Contractor’s name and subcontractor if applicable.

3. Name of item being submitted.

4. Specification reference by section, paragraph and page.

5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number).

6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure, insulation type, NEMA Code letter, dimensions, service factor, serial number.

7. Date and signature of person certifying performance.

G. MANUFACTURER'S AFFIDAVITS

Equipment manufacturers, or their authorized representatives, shall each submit a signed and dated written report with respect to their equipment certifying the following:

1. The equipment has been properly installed and lubricated

2. The equipment is in accurate alignment

3. The manufacturer was present when the equipment was placed into operation

4. The manufacturer has checked, inspected, and adjusted the equipment as necessary

5. The equipment is free from any undue stress imposed by connecting piping or anchor bolts

6. The equipment is not imposing any undue stress on any connecting members

7. The equipment has been operated satisfactorily under full load conditions

8. The manufacturer has inspected their equipment during the operational demonstrations and system validation tests to the extent specified

9. The equipment is fully covered under the terms of the guarantee

PART 2 PRODUCTS

2.1 DESIGN

All equipment shall be designed for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation, shall be adequately stayed, braced and anchored, and shall be installed in a neat and workmanlike manner. Appearance, safety, and utility shall be given consideration in the design of equipment. Materials of construction shall be cathodically compatible.

2.2 STANDARD REQUIREMENTS

A. MATERIALS

Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

B. UNIFORMITY

Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

C. SEISMIC REQUIREMENTS

Supports and anchorage of equipment shall comply with the requirements of the 2021 *International Building Code* (IBC) Section 1613 and ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components, as referenced and amended by the IBC. For the following design parameters:

- Risk Category III
- Site Class D
- The component Importance Factor: $I_p = 1.0$
- Design response acceleration coefficients:

$S_{DS} = 0.959g$
$S_{D1} = 0.617g$

- Seismic Design Category D

D. STANDARDS

Provide equipment and materials suitable for service conditions and meeting standard requirements of ANSI, ASME, AWWA, ASTM, NEMA, IBC, NPC, UL and OSHA.

2.3 LUBRICATION

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for a minimum of 1-year's consumption prior to completion, testing and final acceptance.

2.4 EQUIPMENT BASES AND BEDPLATES

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate on a grout or concrete base unless otherwise shown or specified. Provide bases and bedplates with machined support pads, vibration pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide leveling screws in equipment bases and bedplates to aid in leveling prior to grouting.

2.5 ANCHORS AND FASTENERS

Each equipment manufacturer shall furnish the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified. The manufacturer shall submit to the Engineer design calculations regarding recommended sizing and type of anchor bolts, nuts, and washers for securing the equipment, in accordance with the project seismic requirements.

Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All nuts, bolts and washers shall be Type 316 stainless steel. All leveling nuts shall be Type 316 stainless steel.

All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment, or equipment or piping subject to vibration.

Expansion type anchors are not to be used for any submerged applications unless specifically noted on the Plans.

Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Plans, expansion type anchors may be used.

2.6 SAFETY GUARDS

Cover belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all applicable Federal, State, and local codes and regulations; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring loaded hinged doors with latch for service and lubrication access.

All pipes, manifolds, heaters, and other surfaces, which have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or otherwise guarded against contact.

Guards shall comply with the requirements of these Specifications, WISHA Standards, and "The Principles and Techniques of Mechanical Guarding" (OSHA 2057, 1973), whichever is more stringent.

2.7 LIFTING EYES

All equipment weighing over 100 pounds shall be supplied with lifting eyes. Parts of equipment assemblies, which are normally serviced separately, such as motors, shall have individual lifting eyes.

2.8 ELECTRICAL COMPONENTS

Equipment shall be manufactured, fabricated and installed in a manner which permits conduit connection to electrical power and control equipment from below the connection point, terminal box, or connection box without offsets or bends such that the conduit will drain away from the equipment.

Electric motors, control panels, accessories, etc., shall conform to the requirements of Divisions 11, 13, 14, 15 (Equipment items) and Division 16, Electrical.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

All electrical components shall be recognized or labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the Project.

2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This list shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum speed, acceleration, etc. The list shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the motor information for the submitted equipment

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.10 NAMEPLATES/DATA PLATES/IDENTIFICATION

Each piece of equipment and its driver shall be furnished with a stainless steel metal nameplate fastened to the item in an accessible position. This nameplate shall contain the manufacturer's name, equipment rating, capacity, size, model, serial number and speed. Data for motors shall be NEMA standard. All information written or printed shall be in English. Each item of equipment shall bear a different serial number. Measurement units shall be given for ratings and capacity.

Nameplates for tanks and pressure vessels shall give working pressure, test pressure, vessel plate thickness and ASME Code data.

Each piece of rotating equipment shall have a direction of rotation arrow.

Each piece of equipment shall be labeled using a plastic laminate label with the functional name and number of the equipment shown on the Plans or provided by the Engineer. Name and number shall correspond to those used on Motor Control Centers and Panels.

Labels shall be fastened to the equipment base or other acceptable location. The letters shall be at least 1/2-inch high with a border trim on all sides not less than 1/4 inch. Color shall be green background with white letters. Fasteners shall be brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

Units of measure shall be shown on the indicating and totalizing dials of all meters, gauges and other measuring devices.

2.11 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

2.12 PAINTING

Painting of all equipment shall be in accordance with Section 09900 of these Specifications.

2.13 NOISE

Mechanical and electrical equipment shall not create sound levels that are in excess of that permitted by WISHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved.

2.14 VIBRATION AND CRITICAL SPEED LIMITATIONS

Mechanical and electrical equipment shall meet the vibration and critical speed limitation requirements described in Section 11010.

2.15 PRESSURE GAUGE CONNECTIONS

Provide tapped and plugged suction and discharge gauge connections on the pump nozzles or flanges. Where this is not possible, provide gauge connections on the piping immediately adjacent to the pump.

PART 3 EXECUTION

3.1 INSPECTION

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for new equipment installation.

3.2 PREPARATION

Prior to installing equipment, ensure that the areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service the equipment in accordance with the Operation and Maintenance Instruction Manuals and specific requirements included in applicable Sections of these Specifications.

3.3 SPARE AND LOOSE PARTS

Prior to equipment startup provide an inventory of spare and loose parts supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

3.4 INSTALLATION

A. EQUIPMENT

Equipment shall conform to the approved submittals and Operation and Maintenance Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

B. ANCHOR BOLTS

Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed. Prior to assembly, the Contractor shall coat all stainless steel bolts and nut threads with anti-seizing compound.

C. BASE AND BEDPLATE GROUTING

Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except around exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 consecutive days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform corrective work as required to conform to the tolerances given in the applicable Operation and Maintenance Instruction Manual.

The Contractor shall make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Plans. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the complete work. Unless otherwise authorized, all grout shall be a non-shrink, non-metallic grout as stated in Section 03300.

Where practicable, the grout shall be placed through the grout holes in the equipment base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

D. PRESSURE GAUGES

Pressure gauges shall be installed on all pump discharge piping at a location where the gauges can be easily read. The gauges shall be located upstream of the isolation valves, if possible. Gauges shall be installed on other equipment items as specified. The gauges are specified in Division 13 and shall be installed as detailed on the Plans.

3.5 EQUIPMENT STARTUP AND ADJUSTMENT

The Contractor, at their own expense, shall arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to:

- Supervise the equipment installation in accordance with the Operation and Maintenance Instruction Manual.
- Be present when the equipment is first put into operation.

- Inspect, check, adjust as necessary, and approve the installation.
- Repeat the inspection, check and adjust until all trouble or defects are corrected and the equipment installation and operation are acceptable.
- Witness and supervise operational demonstrations and system validation tests to the extent specified.
- Prepare and submit the specified Manufacturer's Affidavit.

The representative shall be experienced and knowledgeable regarding the equipment being tested.

The Contractor shall give initial lubrication to all equipment in accordance with the manufacturer's recommendations.

The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

All equipment shall be field tested and demonstrated to the Engineer that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Current draw and voltage on the motor for each phase shall be measured for each pumping rate measurement. For two-speed pumps, such tests shall be conducted at both speeds. For variable speed pumps, blowers or fans, these tests shall be conducted at minimum and maximum speeds and at the specified duty point.

The Contractor shall furnish and test equipment or measuring devices (including portable flow meters) required that are not part of the permanent installation. Tests for variable speed pumps, blowers, and other equipment shall be performed at 60 Hz and at the initial anticipated flow or capacity levels.

The field test shall demonstrate under all conditions of operation that the equipment:

- Has not been damaged by transportation or installation.
- Has been properly installed.
- Has no mechanical defects.

- Is in proper alignment.
- Has been properly connected.
- Is free of overheating of any parts.
- Is free of vibration in excess of the limits in Section 11010.
- Is free of excessive noise.
- Is free of overloading of any parts.
- Shall operate as specified with the specified control system.
- Is free of critical speeds as specified in Section 11010.

In addition, the entire facilities shall be demonstrated to be in full operating order prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the Contractor's expense.

Equipment start-up and adjustment shall take place before instruction of the Owner's personnel is performed.

3.6 INSTRUCTION OF OWNER'S PERSONNEL

Conduct an instruction program for up to six operations personnel designated by the Owner in accordance with Specification Section 01800. Furnish the services of qualified instructors from the various equipment manufacturers for the duration specified in each specific Section. Include instruction covering basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment.

Provide the instruction program at the Owner's convenience before contract closeout. The Contractor shall audio- and video-record all training sessions, and also provide the Owner with any audio-visual training materials the manufacturer utilizes (i.e., DVDs, PowerPoint presentations, videocassettes etc.). Cost of instruction and audio-visual training materials shall be included in the bid price for the equipment.

3.7 SOUND LEVEL TESTING

Measure the sound level developed by all mechanical and electrical equipment provided under the Contract Provisions. Perform testing in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instruments and record the highest sound levels developed when measured according to OSHA standards in each room and space. Deliver a certified copy of records to the Engineer.

***** END OF SECTION *****

SECTION 11002

EQUIPMENT MOUNTING, SUPPORTS, GROUTING AND INSTALLATION

PART 1 GENERAL

1.1 SCOPE

This section specifies minimum requirements for equipment mounting and supports, including concrete housekeeping pads, equipment bases, supports, anchorage, and accessories with weights greater than 200 pounds. If conflict exists between this section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.

The Contractor shall provide all supports, anchorage, and mounting of all equipment, and in accordance with the manufacturer's recommendations, and industry standards requirements. Each piece of equipment shall be anchored to resist the greater of the maximum lateral and vertical forces required by the local governing code or by the manufacturer of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the Engineer. The Contractor shall provide all elements required to resist the calculated forces described herein or required by the equipment manufacturer. The Contractor shall provide certification that for equipment, 20 horsepower and larger, anchor bolt calculations showing adequacy of bolt sizing and anchor embedment have been performed and signed by a registered structural or civil engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
03300	Cast-In-Place Concrete
Division 11	Equipment
Division 14	Conveying Systems
Division 15	Mechanical

1.3 REFERENCES

This section contains references to the following documents. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	**Title**
ANSI/HI	Baseplate Design
ANSI/HI 1.4	Centrifugal Pumps - Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps - Installation, Operation and Maintenance
API 610, 1995	Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services
API RECOMMENDED	Recommended Practices for Machinery
PRACTICE 686	Installation and Installation Design
ASTM C531	Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacings
ASTM C579	Compressive Strength of (Method/B) Chemical Resistant Mortars and Monolithic Surfacings
ASTM C638	Tensile Properties of Plastics

ASTM C882	Bond Strength of Epoxy-Resin Systems Used with Concrete
ASTM C884	Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C1181	Creep of Concrete in Compression
ASTM D2471	Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
SSPC	Society for Protective Coatings Specifications, Vol. 2

1.4 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (v) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Shop drawings for all equipment bases and anchorage details.

3. Certification of anchor bolt calculations specified in paragraph 11002-1.01 B.

4. Machine and equipment base installation schedule with manufacturers' anchor bolt torque requirements, as specified in paragraph 11002-2.01.

PART 2 PRODUCTS

2.1 GENERAL

All equipment shall be mounted on concrete housekeeping pads. Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate or soleplate grouted into place on the housekeeping pads. Under no circumstances shall equipment supports be grouted directly to concrete slabs or floors. Bases for equipment shall be hot-dip galvanized after fabrication unless otherwise specified.

Prior to initiating any installation efforts, the Contractor shall produce a machine base schedule containing the expected dates for setting anchor bolts, casting housekeeping pads, preparation of housekeeping pads for grouting, grouting, and final anchor bolt clamping for each item of equipment. The schedule shall list the equipment, by equipment number, and shall be accompanied by written verification of anchor bolt clamping torque from the equipment manufacturer.

Installation practices shall follow the guidance presented in Chapters 4 and 5 of API Recommended Practice 686, unless superseded by more restrictive requirements of these specifications or manufacturer requirements.

2.2 CONCRETE HOUSEKEEPING PADS

Concrete housekeeping pads for equipment and floor penetrations shall be at least 2 inches larger in plan on all sides than the steel or cast base and not less than 6 inches above the finished floor elevation, unless shown otherwise on the Drawings, and shall be shaped to drain liquids away from the base. Housekeeping pad details shall follow the requirements set forth in Figure A-4 of API 686 unless superseded by more restrictive requirements of these specifications or the requirements of the equipment manufacturer. All conduits, piping connections, drains, etc. serving the equipment, shall be enclosed by the concrete housekeeping pad. Unless otherwise specified, no conduits, piping connections, drains, etc., will be accepted which rise directly from the floor.

2.3 EQUIPMENT BASES

A. GENERAL

1. Unless otherwise specified, mounting bases for equipment 20 horsepower and larger shall be a minimum of 1 inch thick. All bases shall have edges bearing on the grout surface rounded to a radius of not less than 2-inches to avoid producing stress risers on the grouted foundation. Grout pouring holes (minimum 4 inches in diameter) shall be provided in all bases and all bases shall have grout release holes. Except where vibration isolation systems are specified, all bases shall be grouted as specified in this section. Internal stiffeners shall be provided and shall be designed to allow free flow of grout from one section of the base to another. The minimum acceptable opening in cross-bracing and stiffeners shall be 2-inches high by 6 inches in length. All welds shall be continuous and free from skips, blow holes, laps and pockets.

2. Equipment bases for horizontal pumps shall conform to the requirements of this section, ANSI/HI 1.3.4, API 610 (paragraph 3.3), and shall provide common support for the pump and motor (and flywheel, if one is specified). In the event of conflict, the requirements of this section shall govern. Eight positioning jackscrews shall be provided for all drivers and flywheels (if specified) for all horizontal pump baseplates. All bases for horizontal pumps shall be equipped with jackscrews for positioning and leveling the base prior to grouting.

3. Mounting holes for anchor bolts in the bases, mounting blocks, or sole plates shall be drilled and not burned out and they shall not be open slots. All mounting studs shall be Type 316 stainless steel. Anchor bolts shall be Type 316 stainless steel as specified under paragraph 11002-1.01 B. A nonseize or nongalling compound shall be used on all threads.

4. Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar to 0.002 inch in all directions. Mounting pads shall extend not less than 1-inch on all sides beyond the position for the equipment.

5. Equipment bases for vertical volute-type pumps weighing more than 2000 pounds shall be soleplates or leveling boxes under individual feet or support brackets integral with the volute casting. Direct mounting on the housekeeping pads will not be permitted.

B. TYPE I BASES

Type I bases shall be structural steel bases with thickened steel pads for doweling. The bases shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump bases, which may be "T" or "L" shaped to accommodate the equipment drive and accessories. Pump bases for split case pumps shall include supports for suction and discharge base ells, if required by the specified configuration. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified. Sole plates, mounting blocks and baseplates weighing more than 1000 pounds shall be leveled with jackscrews incorporated into the fabrication. Jackscrews shall be located in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.

C. TYPE II/III BASES

Type II and Type III bases, which are applicable for vibration isolation mounting, are specified in Section 11021.

D. TYPE IV BASES

Type IV bases shall be cast iron. Cast iron bases located within buildings, do not require galvanizing but shall be sealed in accordance with the requirements for bleeding surfaces specified in Section 09900 prior to grouting. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. In no case shall the fastener terminate only into the metal base.

E. SOLEPLATES

Where soleplates are provided, the underside shall be scribed with the words “THIS SIDE DOWN” using welding rod material prior to milling the equipment mating surface flat to a tolerance of not less than 0.002 in./ft in all directions.

F. MOUNTING BLOCKS

Where equipment is fabricated or cast with individual support pads or feet and provision of a common base, as in bottom suction pump, the equipment may be supported on individual piers in lieu of a common housekeeping pad. In such instances, the equipment may be supported at the pads or feet on individual sole plates or mounting blocks, which shall be leveled and grouted into place as specified in this section.

2.4 GROUT FOR EQUIPMENT BASES

A. EPOXY GROUT

1. Unless otherwise specified, grout for setting bearing surfaces of baseplates, soleplates, and mounting blocks on equipment pads shall be Epoxy Grout for Equipment Mounting. The epoxy grout for equipment pads shall conform to the following requirements:

Test	**Results**
ASTM C531	Shrinkage shall be less than 0.080% and thermal expansion less than 17 x 10-6 in/in/oF
ASTM C579	Strength shall be a minimum of 12,000 psi in 7 days when tested by method B, modified.
ASTM C882	Bond strength to Portland concrete shall be greater than 2,000 psi
ASTM C884	Epoxy grout shall pass the thermal compatibility test when overlayed on Portland cement concrete
ASTM D638	Tensile strength shall not be less than 1,700 psi. Modulus of elasticity shall not be less than 1.8 x 106 psi
ASTM C1181	Creep of the epoxy grout shall be less than 0.005 in/in with the test at 70 degrees F and 140 degrees F with a load of 400 psi

ASTM D2471	Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6-inch diameter x 12-inch high is used. Gel time shall be a least 150 minutes

2. The vehicle shall be a two-component (liquid and hardener) system designed to yield the above characteristics when combined with the manufacturer's recommended aggregate system. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150 degrees F, with a load of 1,200 psi. Aggregate for equipment base grout shall be as furnished by the manufacturer of the epoxy grout mix.

B. CEMENTIOUS NONSHRINK GROUT

Cementious nonshrink grout for use with equipment supports for equipment rated 5 horsepower and smaller or weighing less than 1,000 pounds, whichever is less, may be as specified in Section 03300. Procedures for leveling and clamping equipment shall be as specified in this section.

2.5 EPOXY PRIMER

The epoxy primer shall be lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.6 ANCHOR BOLTS

Anchor bolts shall be stainless steel, set in PVC sleeves. Sleeves shall allow a free length projection of not less than 15 bolt diameters above the concrete required to develop the strength of the bolt. Projection above the nut on the baseplate or soleplate shall be no more than 3/4 inch.

2.7 PRODUCT DATA

A. The following shall be provided in accordance with Section 01300:

1. Results of grout strength tests, as specified in paragraph 11002-3.02 E.

PART 3 EXECUTION

3.1 GENERAL

A. Pumps shall be installed in accordance with this section and ANSI/HI 1.4 and ANSI/HI 2.4. Grouting of equipment bases shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the Project Representative accepts an alternate installation procedure in writing, baseplates shall be grouted with the equipment removed.

B. Equipment that is not mounted on vibration isolators shall be anchored directly to the supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist the all imposed forces. All forces shall be transmitted to the base in order to be anchored as required.

C. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections. Where the equipment manufacturer requires a rigid connection between the machine and connecting piping systems (generally, this will be higher discharge head pumps), the flexible coupling shown may be deleted and the Contractor shall install the equipment in the following detailed manner:

1. The equipment housekeeping pad shall be prepared as specified under paragraph 11002-3.02 B.

2. The baseplate, soleplate or leveling blocks supporting the equipment shall be installed, leveled, and grouted in place as specified.

3. The equipment shall be installed, aligned and dowelled in place as specified.

4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding one of the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.

5. All piping shall be fully supported by supports designed to accept their full weight.

6. The final sections of piping shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.

7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the Engineer.

8. After completion of installation and initial run period, unbolt the connection to verify no deflection in alignment.

D. Conduit and piping for future equipment shall be capped flush with the floor or concrete pad in such a manner to allow future connection.

E. The Contractor shall coordinate location of electrical conduit and piping penetrations within the concrete pad and equipment base. All penetrations shall stub-up on the same side of the equipment as required for connection to the equipment. Equipment drains shall be located as required for drainage from equipment.

F. Prior to commencing equipment installation work, the Contractor shall cause the manufacturer of the epoxy grout to be used for equipment installation to conduct a training school for the workmen to be using the product. The school shall be not less than 4 hours in length and shall cover all aspects of using the products, from mixing to application.

3.2 INSTALLATION

A. ANCHOR BOLTS

1. Prior to concrete placement, anchor bolts shall be accurately set according to the manufacturer's foundation drawings and firmly secured to prevent shifting during concrete placement. The bolts shall be embedded in the structural concrete to develop the full strength of the bolt. Concrete in housekeeping pads cannot be used for this purpose. All anchor bolts shall be dimensionally checked against the foundation drawings for proper length, diameter, thread length, thread projection, etc., by a representative of the equipment manufacturer prior to placing concrete. Prior to placing concrete for the housekeeping pad, plastic sleeves shall be placed around each bolt to provide for minor adjustment of bolt position prior to grouting. Sleeves shall be filled with a pliable, non-bonding

material such as silicon rubber or wax to prevent contact between the concrete or grout and the anchor bolt. Bolt threads and projections in the sleeves (refer to paragraph 11002-2.06) above the structural slab shall be protected in the sleeve by heavily greasing or waxing the threads and shank with paste wax and wrapping with plastic sheeting. The protective wrapping shall be firmly secured with tie wires. The protective wrapping shall be removed prior to placing the grout.

2. The equipment manufacturer shall recommend the size of the anchor bolts for the equipment and shall also furnish the recommended tightening torque for the nuts; however, the minimum size bolt shall be 3/4 inch for equipment rated 20 to 100 horsepower, 1 inch for equipment rated over 100 to 300 horsepower and 1-1/4 inches for 300 to 500 horsepower.

B. CONCRETE HOUSEKEEPING PAD PREPARATION

1. After the concrete is fully cured (sample cylinders, as specified in Section 03300, shall be taken and tested for all housekeeping pads supporting equipment weighing more than 1,000 pounds), the housekeeping pad shall be chipped approximately 3/4" to 1", to remove all laitance and defective or weak concrete. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the foundation. Abrasive blast, bush-hammer, jack hammers with sharp chisels or needle gun preparation of concrete surfaces to be grouted are not acceptable. The amount of concrete removed shall be such that the final baseplate or soleplate elevation results in not less than 3" of grout between the surface of the housekeeping pad and lower baseplate flange or the underside of the soleplate, unless shown otherwise on the Drawings.

2. All edges shall be chamfered 2" to 4" at a 45-degree angle. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the surface protected with plastic sheeting until grouting. The grout contact surface on the housekeeping pad shall be coated with one coat (not more than 5 mils) of catalyzed epoxy resin.

C. EQUIPMENT BASES AND SOLEPLATES

All surfaces of equipment bases and soleplates to be in contact with epoxy grout shall be cleaned to SSPC SP-6 and shall be primed with epoxy primer within 8 hours of cleaning.

D. LEVELING AND SHIMMING

1. All machinery shall be mounted and leveled by millwrights. All equipment bases and equipment shall be leveled against steel surfaces. Use of other materials for leveling purposes is strictly and specifically prohibited. Unless otherwise specified, baseplates, mounting blocks and soleplates weighing less than 1,000 pounds shall be leveled on stainless steel blocks 4 inches square and 1-1/2-inches thick with a hole drilled in the center for the anchor bolt, placed under the base at every anchor bolt. Jackscrews acting on flat steel plates shall be used for heavier components. Leveling shall be by use of leveling blocks machined flat on all horizontal surfaces and measuring not less than 4 inches wide horizontally and shims that shall extend not less than three inches beyond the base of the equipment. Leveling blocks shall be coated with a light oil just prior to beginning the leveling and grouting work. Using precut stainless steel shims coated with a light oil between the base and the steel blocks at the anchor bolts, the Contractor shall level the equipment baseplates, soleplates or mounting blocks against the anchor bolt nuts to a maximum tolerance of 0.005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Mounting surfaces for equipment shall be coplanar within 0.002 inch in any direction. The shims shall be placed so the tabs on the shims are easily accessible. A minimum of four shims per anchor bolt shall be used. The total shim thickness at each anchor bolt shall be at least 0.015 inch. Leveling shall be against anchor bolts prior to final grouting.

2. Leveling equipment shall be precision surveying equipment. Machinists' spirit levels will not be permitted for leveling purposes for any base plate or equipment foundation with a plan dimension greater than 4 feet.

3. Leveling nuts may be used for mounting equipment less than 500 pounds. The Contractor shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Wedges will not be allowed.

E. GROUTING

1. Grout forms shall be built of minimum of 3/4-inch thick waterproof plywood and shall be securely braced (minimum brace

size shall be 2" x 4"). Forms shall provide a minimum of 2-inch hydrostatic head above the final elevation of the grout, to assist in flow during installation.

2. Forms must be coated with three coats of paste wax on all areas that will come in contact with the grout to prevent the grout from bonding to the forms. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, grease, etc. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers. Blockouts shall be provided at all shimming and leveling nut positions to allow removal of shimming equipment after the grout has cured. Jackscrews shall be coated with a light oil or other acceptable bondbreaking compound.

3. The 45-degree chamfer strip shall be located at the final elevation of the grout. The final elevation of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange. The top of the grout, on baseplates with solid sides and soleplates, shall be 1.0 inch above the bottom of the baseplate or the underside of the soleplate. The grout's final elevation shall not be so high as to bond the anchor bolt nut and washer.

4. The epoxy resin and hardener shall be mixed in accordance with the grout manufacturer's recommendations. Aggregate shall be slowly added to the mixer one bag at a time. The grout should be mixed only long enough to wet out all the aggregate. Grout shall be placed at the center of one end of the baseplate or soleplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate or soleplate and out the vent holes, to eliminate voids. The grout shall be placed in a manner that avoids air entrapment using a head box to pour grout into the grout holes. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout. The Contractor shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate. Grout placement shall be continuous until the all portions of the space beneath the baseplate or soleplate have been filled. Subsequent batches of grout shall be prepared so as to be

ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air. When the grout has started to take an initial set (determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.

5. A grout sample shall be taken for each piece of equipment to be grouted. The sample shall be placed in a cylinder of sufficient size to yield three 2" x 2" x 2" test samples. The samples shall be tagged with the equipment number, ambient temperature at the time of placement. The samples shall be tested in accordance with the manufacturer's recommendations. Once the epoxy grout cylinder has been completely filled, it shall be placed next to the foundation of the equipment being grouted and allowed to cure for 48 hours. After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by an independent testing laboratory. The results shall be reported directly to the Project Representative. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the Project Representative.

F. COMPLETION

Upon acceptance by the Engineer and the equipment manufacturer's representative after the grout has reached sufficient strength, the shims shall be removed, or leveling nuts or jack screws backed off to allow the grout to fully support the equipment base, leveling block or soleplate. Removal of extended shimming material (direct mounted baseplates weighing 1,000 pounds or less) shall be by sledge hammer, taking care not to damage the grout. The anchor bolts shall be torqued, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer. Anchor bolts shall be torqued in increments of not more than 25 percent of final value in an alternating pattern to avoid stress concentration on the grout surface. Pockets for access to shims, mounting blocks, or leveling nuts shall be filled with grout mix and pointed after the anchor bolts have been torqued to final values.

***** END OF SECTION *****

SECTION 11010

VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1 GENERAL

1.1 SCOPE

A. This Section specifies vibration and critical speed limitations for rotating equipment. Individual equipment Specifications Sections may specify more stringent requirements which shall then govern. Submittals for field-testing are only required when specified in the individual equipment Specifications.

B. This specification outlines the basic standards for acceptance of equipment. Any equipment demonstrating levels above these limits shall be repaired, modified or replaced at the Contractor's expense as determined by the Engineer.

1. General Equipment

a. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude.

b. The presence of discernible vibration amplitude peaks or vibration spectra at a bearing inner or outer race frequencies shall be cause for rejection.

2. Electric Motors

a. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that is more than 40 percent of the peak at rotational frequency.

b. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the 2 times line frequency peak.

C. This section covers requirements for calculating expected vibration resonances.

D. This section covers requirements for on-site field testing of vibration of the installed equipment and reporting the test results.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
Division 11	Equipment
Division 15	Mechanical

1.3 QUALITY ASSURANCE

A. REFERENCED STANDARDS

This Section incorporates by reference the latest revision of the following documents. It is a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
AGMA 6000-B96	Measurement of Linear Vibration of Gear Units
ANSI/HI 9.6.4	American National Standard for Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Values

B. HYDRAULIC INSTITUTE STANDARDS

The current Hydraulic Institute Standards are in process of revision. The standards outlined below shall apply except as modified by other Sections of the contract.

C. INSTRUMENTATION

Provide necessary test instrumentation which has been calibrated within one year from date of test to recognized test standards traceable to the national Institute of Standards and Technology, Washington DC or approved source.

D. TESTING QUALIFICATIONS

Tests shall be performed by an experienced vibration analysis expert who shall interpret the results against this specification and provide recommended acceptance or modification requirements to the Project Representative.

1.4 SUBMITTALS

A. PROCEDURES

See Section 01300 for submittal requirements.

B. The following information shall be provided when specified in the individual equipment Specification Sections:

1. Test plan as outlined in Section 01800.

2. Test data report sheets for each piece of equipment showing mounting location of test instruments.

3. Manufacturer's certified calculations and data showing location of critical speeds in relation to the operating speeds.

4. Any deviation from the vibration or critical speed standards shall be noted on the submittal cover sheet and approved prior to release for manufacture.

5. Test equipment calibration certificates.

1.5 FIELD VIBRATION TESTING

A. GENERAL

Equipment testing for vibration and natural frequencies shall be conducted with equipment, installed, grouted and operational. Test instrumentation shall be portable, temporarily mounted or permanently installed components if suitably calibrated for the test measuring and recording instruments.

B. DEFINITIONS

1. Peak to Peak Displacement

Root Mean Square (RMS) average of the peak to peak displacement multiplied by the square root of 2.

2. Peak Velocity

RMS average of the peak velocity multiplied by the square root of 2.

3. Peak Acceleration

   RMS average of the peak acceleration multiplied by the square root of 2.

4. High Frequency Enveloping

   A process to extract very low amplitude time domain signals associated with impact or impulse events such as bearing or gear tooth defects and display them in a frequency spectra of acceleration versus frequency. Typical manufacturers' notation is "Spike Energy" by Rockwell Automation, (Entek/IRD) or "PeakVue" by CSI.

5. Low Speed Equipment

   Equipment or components rotating at less than 600 rpm.

6. Convert Velocity to Displacement

   D = 19,100 * V / F

   D is the peak-to-peak displacement in mils.

   V is the peak velocity in inches per second.

   F is the frequency in cycles per minute.

C. TEST REQUIREMENTS

1. Measure filtered vibration spectra for peak velocity, peak to peak displacement versus frequency and measure vibration phase in three perpendicular planes at each normally accessible bearing housing on the driven equipment, gear or clutch assembly and the driver. One plane of measurement shall be parallel to the axis of rotation of the component. Measure rotational speeds using a photometric or other tachometer with input directly to the vibration data collector.

2. Fixed speed equipment shall be operated at the design operating condition during the test recording. Variable speed equipment shall be tested to establish performance over the entire speed range.

3. Field test for natural frequency: Excite the installed equipment and support system in three perpendicular planes. Use the same locations as used for vibration tests above. Determine the natural resonant frequency of the driver, clutch or gear, driven equipment and supports.

1.6 VIBRATION ACCEPTANCE CRITERIA

A. VIBRATION DISPLACEMENT LIMITS – PUMPS

Unless otherwise specified, pumping equipment shall not exceed the following Unfiltered Overall Peak-to-Peak Amplitudes (mils).

Operating Speed (rpm)	Non-Clog Pumps	Clean Fluid Pumps
0 – 300	6.0	6.0
301 – 600	5.0	5.0
601 – 900	4.0	3.0
901 – 1,200	3.5	2.0
1,200 – 1,500	3.0	1.8
1,501 – 1,800	2.5	1.5
1,801 – 2,400	2.0	1.0
2,401 – 3,000	1.5	0.8
3,001 – 3,600	1.3	0.7
over 3,600	1.2	0.6

Note: Axial shaft placement is not to exceed 50 percent of the maximum radial shaft displacement relative to the casing.

B. VIBRATION VELOCITY LIMITS

Unless otherwise specified, equipment shall not exceed the following peak velocities (inches/second).

Equipment	Unfiltered Overall Limit	Any Filtered Peak Limit
Non-Clog or Mixed Flow Pumps	0.35	0.25
Clean Fluid Multi-Vane Pumps	0.25	0.20
Motors	0.25	0.20
Steady Bearings	0.25	0.20
Centrifugal Blowers	0.15	0.10
Gear Reducers	< AGMA 6000-B96 limits	
Other Equipment, Radial	0.16	0.10
Other Equipment, Axial	0.10	0.10

1.7 CRITICAL SPEED REQUIREMENTS

A. GENERAL REQUIREMENT

1. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude.

2. The presence of discernible vibration amplitude peaks or vibration spectra at a bearing inner or outer race frequencies shall be cause for rejection.

B. ELECTRIC MOTORS

1. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that is more than 40 percent of the peak at rotational frequency.

2. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the times line frequency peak.

C. Unless otherwise specified, rotating mechanical equipment shall satisfy the following:

1. First critical speed of the constant, variable, and 2-speed driven equipment is to be at least 25 percent above the maximum operating speed or 25 percent below the minimum operating speed.

2. Second critical speed of any 2-speed or variable speed equipment is to be at least 25 percent above or below the maximum operating speed or 25 percent below the minimum operating speed.

D. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below the minimum operating speed and 20 percent above maximum operating speed.

PART 2 PRODUCTS

2.1 VIBRATION INSTRUMENT REQUIREMENTS

A. ANALYZERS

Use digital type analyzers or data collectors with anti-aliasing filter, 12 bit A/D converter, fast Fourier transform circuitry, phase measurement capability, time wave form data storage, high frequency enveloping capabilities, 35 frequency ranges from 21 to 1,500,000 cycles per minute, adjustable fast Fourier transform resolution from 400 to 6400 lines, storage for up to 100 - 3200 line frequency spectra, RS232C data output port, circuitry for integration of acceleration data to velocity or double integration to displacement.

1. Manufacturers

   a. Entek-IRD, Division of Rockwell Automation, Enpac1200 with applicable data analysis software or Entek Model 838 analyzer with built in printer.

   b. Computational Systems Inc., (CSI) Division of Emerson Electric, Model 2120A, Data Collector/Analyzer with applicable analysis software.

B. ANALYZER SETTINGS

1. Units

   English, inches/second, mils and g's.

2. Fast Fourier Transform Lines

   Most equipment 1600 minimum. Motors require enough lines to distinguish motor current frequencies from rotational frequencies. Use 3200 lines for motors with a nominal speed of 3,600 rpm, 3200 lines minimum for High Frequency Enveloping and 1600 lines minimum for low speed equipment.

3. Sample Averages

   Four minimum.

4. Maximum Frequency (Fmax)

a. 40 times rotational frequency for rolling element bearings.

b. 10 times rotational frequency for sleeve bearings.

5. Amplitude Range

Auto Select. Full scale shall not be more than twice the acceptance criteria or the highest peak, whichever is lower.

6. Fast Fourier Transform Windowing

Hanning Window.

7. High Pass Filter

Minus 3 dB at 120 cycles per minute for high-speed equipment. Minus 3 dB at 21 cycles per minute for low speed equipment.

C. ACCELEROMETERS

1. Low Speed Equipment

Low frequency, shear mode accelerometer, 500 millivolts per g sensitivity, 10 g range, +/- 5 percent frequency response from 0.5 hertz to 850 hertz, magnetic mount.

a. Manufacturers

i. Wilcoxon Research, model 797L.

ii. PCB, Model 393C.

2. High Speed Equipment

General purpose accelerometer, 100 millivolts per g sensitivity, 50g range, +/- 2 dB. Frequency response range from 2 hertz to 12,000 hertz when stud mounted or magnetic mount.

a. Manufacturers

i. Wilcoxon Research, Model 793.

ii. IRD Model 943.

PART 3 EXECUTION

Not Used.

***** END OF SECTION *****

SECTION 11021

VIBRATION ISOLATION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies vibration isolation system requirements for mechanical equipment. Additional vibration isolation system requirements are provided in individual mechanical equipment specification sections.

B. This Section requires Supervision by the vibration isolation manufacturer's qualified representative as is necessary to assure correct installation and adjustment of the vibration isolators and seismic restraints.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
11000	Equipment General Provisions
11002	Equipment Mounting, Support, Grouting and Installation

1.3 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
ASHRAE CH 52	Handbook, HVAC Systems and Applications,
Sound and	Vibration Control
IBC	International Building Code

B. QUALIFICATIONS

The vibration isolation manufacturer's qualified representative shall provide supervision as is necessary to assure correct installation and adjustment of the vibration isolators and seismic restraints.

1.4 SUBMITTALS

A. PROCEDURES

Section 01300.

B. Manufacturer and manufacturer's type designation.

C. Manufacturer's catalog data.

D. Seismic system design calculations.

E. Seismic restraint test reports.

F. Installation reports.

G. Static and dynamic deflections, weights, isolator locations, and flexible connector designs.

H. Spring deflections and diameters, compressed spring heights, and solid spring heights.

I. Scale drawing of Type D mounting hanger showing the 30-degree arc capability.

J. Curb mounted base seal and wind resistance details.

K. Seismic restraint load deflection curves up to 1/2-inch deflection along the three principal orthogonal axes.

1.5 DESIGN REQUIREMENTS

A. All vibration isolation systems, including the isolators, seismic restraints, and flexible connectors between the isolated equipment and associated piping, ducting, and/or electrical work, shall be designed, signed, stamped, and dated by a registered Professional Engineer qualified in vibration isolation systems. This provision shall not be construed as relieving the Contractor of its overall responsibility for the work.

B. Flexible connectors shall be provided by the manufacturer of the mechanical equipment item in accordance with the recommendations of the vibration isolation system engineer.

1.6 SEISMIC RESTRAINTS

A. GENERAL

1. Restraint devices shall resist the forces specified and be designed in accordance with the Section 11000.

2. Design lateral forces shall be distributed in proportion to the mass distribution of the equipment.

B. FLOOR MOUNTED EQUIPMENT

1. Provide equipment and appurtenances resiliently floor mounted on spring or pad type vibration isolators, except for curb mounted equipment, with seismic snubbers.

2. Four all-directional restraint/snubbers.

3. Capacity of snubbers, at 3/8-inch deflection, shall be 3 to 4 times the load at the adjacent equipment mount.

4. Restraint assembly shall consist of welded steel interlocking assemblies welded or bolted securely to the equipment or the equipment bases and the supporting structure.

5. Line restraint assembly surfaces, which engage under seismic motion with a resilient elastomer 3/4 inches thick.

6. Restraints shall be field adjustable and be positioned for 1/4-inch clearance both vertically and horizontally or clearance as required preventing interference during normal operation, stopping, or starting.

7. Restraint assembly shall have a minimum rating of 1.0 g based on independent test data.

C. CURB MOUNTED EQUIPMENT

Slack stainless-steel cables designed to provide 1.0 g restraint in the four primary horizontal directions based on independent test data.

D. SUSPENDED EQUIPMENT

1. Restraint assembly for suspended equipment, piping, or ductwork shall consist of plow steel cable attached to steel thimbles with neoprene sleeve all specifically designed for cable service and securely fastened to the equipment, or the equipment base and the building structure.

2. Size cables for a force of 1.0 g with a minimum safety factor of 2.0 based upon independent test data.

3. Install cables to prevent excessive seismic motion and arranged so as not to engage during normal operation, starting, or stopping.

PART 2 PRODUCTS

2.1 GENERAL

A. ACCEPTABLE MANUFACTURER

1. Mason Industries, Inc.

2. Korfund Dynamics Corporation.

3. Consolidated Kinetics Corporation.

4. Approved equal.

B. FLEXIBLE CONNECTORS

Provided by the manufacturer of the mechanical equipment item in accordance with the recommendations of the vibration isolation system engineer.

2.2 BASES

A. See Section 11002.

2.3 VIBRATION ISOLATION MOUNTINGS

A. TYPE A

1. Double deflection neoprene mountings having a minimum static deflection of 0.35 inches.

2. All metal surfaces shall be neoprene covered to avoid corrosion and shall have friction pads both top and bottom so that they need not be bolted to the floor.

3. Bolt holes and anchor bolts where required to resist lateral migration.

4. Resilient washers and bushings to prevent contact between the bolts and the equipment support bases.

5. On equipment such as small vent sets, use steel rails above the mountings to compensate for the overhang.

B. TYPE B

1. Freestanding spring type isolators laterally stable without any housing and complete with 1/4-inch neoprene acoustical friction pads between the base and the support.

2. Leveling bolts shall be rigidly bolted to the equipment.

3. Hot-dip galvanized steel.

4. Springs

a. Diameters shall be no less than 0.8 times the compressed height of the spring at rated load.

b. Minimum additional travel to solid: equal to 50 percent of the rated deflection.

C. TYPE C

1. Type B mountings with a housing having vertical limit stops to prevent spring extension when weight is removed.

2. Provide for equipment with operating weight different from the installed weight, such as chillers, boilers, etc., and equipment exposed to the wind, such as cooling towers.

3. Housing shall serve as blocking during erection and shall be located between the supporting steel and roof or the grillage and dunnage as shown on the Drawings.

4. Installed and operating heights shall be the same. A minimum clearance of 1/2 inch shall be maintained around restraining bolts and between the housing and the spring to prevent interference with the spring action.

5. Limit stops shall be out of contact during normal operations.

6. Hot-dip galvanized steel.

D. TYPE D

1. Steel hangers which contain a steel spring and a 0.3-inch deflection neoprene element in series.

2. Neoprene element shall be molded with a rod isolation bushing which passes through the hanger box.

3. Spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing through a 30-degree arc before contacting the hole.

4. Springs

   Minimum additional travel to solid equal to 50 percent of the rated deflection.

E. TYPE E

1. Double deflection, cork and rubber sandwich pads consisting of a high-density cork layer permanently bonded to top and bottom layers of corrugated oil-resistant synthetic rubber.

2. The corrugated design shall allow deflection to increase with load and shall form a nonskid surface to resist lateral migration of the equipment.

3. Bolt holes and anchor bolts where required to resist migration.

4. Resilient washers and bushings to prevent contact between the bolts and the equipment support bases.

PART 3 EXECUTION

3.1 GENERAL

A. Securely anchor or fasten seismic restraints to the equipment and supporting structure in accordance with approved submittal.

B. Adjust operating clearances so that restraints do not interfere with normal operation of the equipment.

3.2 MOUNTING REQUIREMENTS

A. Unless the equipment incorporates unit construction using an integral rigid frame or is specified otherwise, mount each item of mechanical equipment along with its drive unit on rigid steel or steel and concrete base.

B. CAST IRON BASES

Not permitted when equipment is furnished with a vibration isolation system.

C. VIBRATION

1. Where specified, mount the equipment, including the base, on or suspended from vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the supporting structure.

2. Vibration isolation available internally in the equipment shall not be considered equivalent and shall not be provided when vibration isolation as specified herein is required.

3. Normally provided internal vibration isolators shall be replaced with rigid supports in such cases.

4. Vibration isolators shall be selected in accordance with unit weight distribution to produce reasonably uniform deflections at each support.

D. Unless otherwise indicated, bases, isolators, and deflections shall be as specified in Table 27, ASHRAE CH 52.

3.3 TESTING

A. Seismic restraint tests shall be conducted in an independent laboratory or under the supervision of an independent registered Project Manager.

B. Bolt the snubber assemblies to the test machine as the snubber is normally installed.

C. Test reports shall certify that neither the elastomeric nor the snubber body sustained any obvious deformation after release of load.

3.4 FIELD CERTIFICATION

Upon completion of the installation and after the system is placed into operation, the manufacturer's representative shall make a final inspection and submit its installation report in writing certifying the correctness of installation and compliance with approved submittal. The inspection shall include removal of the flange bolts to insure proper alignment or the piping without bolts. Correct any relative movement or separation of the flange faces without using bolts to distort the makeup.

***** END OF SECTION *****

SECTION 11210

MULTI-STAGE VERTICAL CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing two multi-stage vertical centrifugal pumps as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Non-Potable Water Pump 1	01 NPP 01
Non-Potable Water Pump 2	01 NPP 02

1.4 PERFORMANCE REQUIREMENTS

The multi-stage vertical centrifugal pumps shall meet the following performance requirements.

Parameter	Performance Requirement
Design Capacity (gpm)	30
Design Head (feet)	212
Maximum Shut-Off Head (feet)	310
Discharge Size (inches)	2

1.5 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide a warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The multi-stage vertical centrifugal water pumps shall be Goulds Model e-SV 5SV09 or equivalent by Grundfos. No other manufacturer or model shall be accepted.

The structural, mechanical and electrical designs shown on the Plans are based on equipment manufactured by Goulds. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall at made at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 VERTICAL MULTI-STAGE PUMPS

The pumps shall be of the multi-stage, single suction, vertical centrifugal design. The suction/discharge chamber, pump head, motor stool, and shaft coupling shall be constructed of cast iron. The impellers shall be constructed of stainless steel, laser welded through the front and back shrouds to the impeller vanes. Silica bronze impellers shall not be allowed. The impellers shall be secured to the pump shaft by means of a split cone and nut design. The metallic rotating parts, chambers, and outer sleeve shall be stainless steel. Intermediate bearings shall be bronze. The lower bearing shall be tungsten carbide, mounted in the suction/discharge base and replaceable. The lower shaft journal shall be tungsten carbide and replaceable. The pumps shall be equipped with a cartridge seal, replaceable without disassembling the pump or motor. Water passageways shall be smooth to permit maximum efficiency. Casing shall be hydrostatically tested at 150 percent of the maximum working pressure under which the pump could operate at design speed. The suction flange shall be drilled 125 lb. ANSI. The discharge flange shall be drilled 125 lb. ANSI.

Sealing of the pump liquid cavity shall be sealed with EPDM O-rings and silicon carbide stationary and rotating rings. Silicon carbide shall be imbedded with graphite. Seals shall be mounted over 316 stainless steel shaft sleeves.

The shaft shall be 316 stainless steel, adequately sized for the loads transmitted.

2.3 MOTOR

The motors shall be a standard vertical, TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. The motor shall be constructed with Class F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motors shall be rated at 3 hp, 460 volts AC, 3 phase, 60 Hz, 3,600 rpm synchronous speed (2 pole), continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor. All motor horsepowers shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shutoff to run-out.

The motors shall be standard horizontal, TEFC electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI and IEEE standards. Motors shall be constructed with Class F insulated windings, Design B, 30,000 AFBMA hour rated anti-friction bearings, cast iron frame and end bells.

The motors shall be rated “Inverter Duty” suitable for operation with the variable frequency drives specified in Division 16, Electrical, and shall be coordinated with the thermal, electrical, and mechanical characteristics of the drives actually supplied. Motors shall be suitable for operation on a PWM drive with output to

the motor conditioned by a reactor or filter as shown on the electrical Plans. These motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (2,000 volts minimum) for VFD operation. The turndown ratio for the motors shall be as required for the flow range specified for the pumps. The motors shall be capable of running throughout the operational speed range without supplemental cooling.

The pumps shall be supplied with motors capable of meeting the design conditions specified in Part 1.4 of this Section at a maximum operating frequency of 60 Hz. Operating the motor and associated VFD at above 60 Hz to meet the design conditions is not acceptable.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120-volt AC and 24 volt DC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Motors shall be mounted in a manner that permits conduit connection to the motor terminal box directly using straight lengths of flexible metal conduit (i.e. without offsets or dog legs). Motors shall meet the electrical requirements of WAC 296 46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment." Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11C) table C408.8(1), regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code. If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

Motors shall be by SEW, Baldor, US Motors, Reliance, General Electric or Toshiba/Houston. No other manufacturers shall be accepted.

2.4 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a list of motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.5 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Spare mechanical seal ..... 1 per pump
Required seals and gaskets..... 1 complete set per pump

2.6 PAINTING

Pumps and motors shall be painted in accordance with Section 09900-2.2.B of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

2.7 FACTORY TESTING

The equipment shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.

PART 3 EXECUTION

3.1 INSTALLATION

The pumps shall be installed as shown on the Plans and in strict accordance with the manufacturer's instructions and recommendations. The Contractor shall insure the suction and discharge lines are free from debris, metallic shavings, wire, or other unsuitable material prior to startup. The pump shall be tested at startup and voltage, current, and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording data. The pumps shall be tested for correct rotation at startup.

Pump base shall be securely anchored to the concrete using stainless steel bolts.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pump manufacturer shall be provided. Services shall include 2 days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 11310

DRY-PIT NON-CLOG CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing one new horizontal or vertical, non-clog centrifugal pump as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Waste Activated Sludge Pump	02 WP 01

1.4 PERFORMANCE REQUIREMENTS

Each centrifugal pump shall be capable of meeting the following performance requirements:

Parameter	Performance Requirement
Design Flow (gpm)	172
Total Dynamic Head (feet)	19
Pump Rotor Operating Speed (rpm)	1,200
Design Point Efficiency (%)	≥ 50

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the pump manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.6 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The dry-pit non-clog centrifugal pumps shall be Cornell Model 4NLDL, or approved equivalent equipment manufactured by Flygt. No other manufacturers shall be accepted.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Cornell. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 PUMPS

Pumps shall be equipped with enclosed, non-clog type, close-grained gray iron impeller, statically and dynamically balanced, capable of passing 3-inch-diameter non-compressible spheres. Pumps shall have an inspection opening in the discharge of the casing.

Pump shaft shall have renewable stainless steel shaft sleeve and shall be supported by sealed ball bearings in a one-piece gray iron bearing frame. Each pump shall be supported by a gray iron stand.

The pump casing shall be of back pull-out design with heavy sections to provide long life under abrasive and corrosive conditions, fine grain cast iron ASTM A48, Class 30 with suction and discharge to be Class 125 ANSI flat-face flanges. A bolted and contoured cleanout plug shall be provided on the volute to facilitate maintenance. All mating surface shall have a register fit to ensure proper alignment.

2.3 IMPELLER

The impeller shall be of heavy section cast iron ASTM A48, Class 30. Impellers shall have back vanes to reduce axial thrust and lower the stuffing box pressure. Internal vane edges shall be well rounded to present smooth flow. Impeller shall have a straight non-tapered bore, be dynamically balanced, and will be keyed to the shaft and further secured with a stainless steel washer and a heat-treated alloy steel impeller lock screw.

2.4 STUFFING BOX

The stuffing box shall be integral to the backplate and constructed of ASTM A48, Class 30 cast iron. An extra deep split gland with lantern ring shall be used and designed for the seal.

2.5 MECHANICAL SEAL

The pump shall be provided with a double mechanical seal, John Crane Type 1 or equal, with tungsten carbide vs. silicon carbide faces. The mechanical seals shall be equipped with non-clogging single coil springs and non-sliding internal, secondary elastomers. The design shall not require seal flush water or packing.

2.6 MOTOR

A. APPROVED MANUFACTURERS

Motors shall be by SEW, Baldor, US Motors, Reliance, General Electric or Toshiba/Houston. No other manufacturers shall be accepted.

B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
Motor Size	3 hp
Operating Voltage	480 VAC
Phase	3
Frequency	60 Hz
Synchronous Speed	1,200 rpm
Inverter Duty?	No (Non-VFD)

Parameter	Specification
Motor Overtemperature Protection?	Yes
Classified Environment?	No

C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal, TEFC premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper. Motor design shall be Type B (Standard).

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical, and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

E. MOTOR OVERTEMPERATURE DETECTION

Motor over temperature shall be provided in all submersible motors and all motors over 25 hp. The method of motor over temperature detection shall be as follows.

1. Thermal Switches

Where selected, thermal switches shall be Normally Closed (NC) and shall be sized by the motor manufacturer to open 10 degrees C below the maximum allowed operating temperature for the insulation class and ambient ratings specified herein. These switches shall be internally series connected by the manufacturer with two insulated leads brought to the motor junction box for user connection. These switches shall be suitable for 120 VAC or 24 VDC control circuit applications at 5 Amps.

F. MOTOR SEAL LEAK DETECTION

All submersible motors shall be provided with seal leak detection.

The manufacturer shall supply a 120 VAC-powered, DIN-Rail mounted, seal leak detector, with a set of Form C contacts that transition on the sensing of a seal leak condition. The contacts shall be rated at 5 Amps (minimum) at 120 VAC or 24 VDC. The detectors shall be UL listed and shall operate from 120 volts AC. The Contractor shall be responsible for coordinating the installation and operation of these devices with the motor control center manufacturer or control panel supplier.

G. MOTORS IN CLASSIFIED ENVIRONMENTS

If specified with motor seal leak detection the seal leak detector supplied by the motor manufacturer shall be intrinsically safe and shall comply with the other requirements for seal leak detectors in these specifications.

If specified with motor over temperature detection using thermistors, the thermistor setpoint controller supplied by the motor manufacturer shall provide an intrinsically safe connection between it and the motor. It shall comply with the other requirements for thermistor setpoint controllers in these specifications.

If specified with motor over temperature detection using RTDs, the RTD setpoint controller supplied by the motor manufacturer shall provide an intrinsically safe connection between it and the motor. It shall comply

with the other requirements for RTD setpoint controllers in these specifications.

2.7 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.8 BASE AND COUPLING

The combination pump and driver base shall be a heavy-duty fabricated steel open channel base with large access openings to facilitate grouting. An all-metal shaft guard completely enclosing the coupling shall be provided. The coupling shall be a spacer coupling designed to permit the removal of the rotating assembly without disturbing the motor or the suction or discharge piping.

2.9 HARDWARE

All machine bolts, nuts, and cap screws shall be the hex head type. Hardware (or parts) requiring special tools or wrenches shall not be used.

2.10 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled

boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Gaskets	1 per pump
Wear ring	1 per pump
Impeller nut	1 per pump
Locking set screw	1 per pump
Impeller key	1 per pump
Bearings	1 set per pump
Snap rings	1 set per pump
Grease seal	1 per pump
Grease retainers	1 set per pump
Shaft sleeve	1 per pump
Mechanical seals	1 set per pump

2.11 PAINTING

Pumps and motors shall be painted in accordance with Section 09900-2.2.B of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

2.12 FACTORY TESTING

The pumps shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

PART 3 EXECUTION

3.1 GENERAL

Pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's recommendations. Pump bases shall be securely anchored to the concrete equipment pad using Type 316 stainless steel anchor bolts.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pump manufacturer shall be provided by the Contractor. Services shall include 3 days (two visits) onsite for the supervision of equipment startup, testing, and instruction of the Owner's personnel in the operation and maintenance of the equipment. One visit shall be for installation inspection, certification, testing, and startup; and one visit shall be for training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pump(s) are fully operational. The training shall be at a time and location agreed to by the Owner.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11313

SUBMERSIBLE CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new submersible non-clog centrifugal pumps with guide rails, supports, discharge connection elbow and frame, lifting cable, and any other appurtenances required for a complete and workable system, as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 REFERENCES

American Society for testing and material (ASTM) International

A 48: Standard Specification for Gray Iron Castings.

A743: Standard Specification Iron-Chromium Nickel, Corrosion Resistant

American National Standards Institute (ANSI)

B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.

1.4 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Influent Pump 1	02 IP 01
Influent Pump 2	02 IP 02
RAS Pump 1	02 RP 01
RAS Pump 2	02 RP 02

1.5 PERFORMANCE REQUIREMENTS

The submersible pumps shall be capable of meeting the following performance requirements.

Parameter	Performance Requirement
Influent Pumps 1 and 2	
Design Capacity (gpm)	78
Design Head (feet)	14
Maximum, Shut-Off Head (feet)	31
Discharge Size (inches)	3
Flygt Impeller Code	453
RAS Pumps 1 and 2	
Design Capacity (gpm)	105
Design Head (feet)	16
Maximum, Shut-Off Head (feet)	29
Discharge Size (inches)	3
Flygt Impeller Code	454

1.6 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.7 WARRANTY

In addition to the warranty required in the General Conditions, the pump manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.8 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The submersible centrifugal pumps specified herein shall be provided by a single manufacturer to ensure coordination and compatibility of the equipment.

A. INFLUENT PUMP STATION PUMPS

Pumps shall be Flygt Model NP 3085 SH 3 – Adaptive 455, or equivalent equipment manufactured by Sulzer ABS. No other manufacturers shall be accepted.

B. RAS PUMP STATION PUMPS

Pumps shall be Flygt Model NP 3085 SH 3 – Adaptive 453, or equivalent equipment manufactured by Sulzer ABS. No other manufacturers shall be accepted.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Flygt. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 PUMPS

The pumps shall be capable of handling raw domestic wastewater, scum, or activated sludge. The discharge connection elbow shall be permanently installed in the wet well along with the connection elbow and discharge piping. The pumps shall be automatically connected to the discharge connection when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pumping unit shall be guided by no less than two guide bars and pressed tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the sump or wet well. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. Only single electrical cable pump design shall be acceptable.

Major pump components shall be of gray cast iron, ASTM A-48, Class 30, 35B or 40B, with smooth surfaces devoid of blow holes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be Type 316 stainless steel. All surfaces coming into contact with sewage, other than stainless steel or the impeller, shall be protected by a sewage resistant coating as specified.

Each motor shall include heavy-duty submersible cable of sufficient length to reach the junction box with the motor installed. The pump motor cable installed shall be listed and labeled for submersible pump application with P122-MSHA approval, and this shall be indicated by a code or legend permanently embossed on the cable. The cable shall meet Washington State Department of Labor and Industry requirements for submerged installation in a wet well, exposed in a wet well, and/or installed in conduit. Cable sizing shall conform to NEC requirement for pump motors. Cable length shall be adequate to connect without splicing, to the junction box, motor controller, or other enclosure, as shown on the Plans where the cable will be spliced to other conductors or connected to a device or equipment plus additional 5-foot length to be coiled at the access hatch.

The cable entry water seal design shall be sealed in a manner to guarantee complete waterproof protection. To ensure maximum motor protection, the pump cable entry design shall ensure that no entry of moisture internal to the pumps terminal board and/or motor is possible even if the cable is damaged or severed below water level. The cable entry shall be designed in a manner to relieve strain in the cable at the point of entry to the pump. The cable entry shall consist of a cylindrical grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the

cable. The assembly shall provide an easy method of disconnecting and reconnecting the cable when necessary using the same entry seal. Epoxy potted cable entries which require the cable to be cut to disconnect the pump from the cable are not acceptable.

A moisture sensor shall be provided in the stator cavity to detect the presence of moisture in the stator chamber. This sensor shall be for alarm purposes only. This use of the moisture sensor shall not void the manufacturer's pump or motor warranty.

The pump shaft shall be stainless steel. The pump shaft shall rotate in upper and lower rolling element bearings. These bearings shall be permanently grease lubricated and rated for a B-10 life of 30,000 hours.

2.3 MECHANICAL SEALS

Each pump shall be equipped with two tandem mechanical rotating shaft seals each operating independently. The seals shall be oil lubricated in a separate chamber located between the pump and motor. The seal system shall not rely on the pumped media for lubrication. The pump seal for each pump shall contain one stationary and one rotating tungsten carbide ring. The motor seal shall contain one stationary and one rotating tungsten carbide ring.

Each mechanical seal shall be equipped with its own independent stainless steel spring system, requiring neither maintenance nor adjustment and shall be easily replaceable.

Shaft seals without rotating members or conventional double mechanical seals containing a common spring which require a pressure differential to offset external pressure and effect sealing are not acceptable.

The oil chamber shall be designed to assure that air is left in the oil chamber to compensate for the expansion of the oil due to temperature variations. The drain and inspection plugs, with positive anti-leak seals, shall be easily accessible from the outside.

2.4 IMPELLER

The impeller shall be of 25 percent chrome cast iron (ASTM A532 Alloy IIIA) dynamically balanced, semi-open, multi-vane, back swept, screw-shaped non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The screw shape of the impeller

shall provide induction effect for the handling of up to 5 percent sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft and held by an impeller bolt.

2.5 WEAR RING

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel, or hard stainless steel ring insert that is drive fitted to the volute inlet.

2.6 VOLUTE

The pump volute shall be gray cast iron, ASTM A48, Class 35B, single piece design and shall have smooth fluid passages capable of handling all pumped media which flows through the impeller. Each volute shall be furnished with a replaceable wear ring or wear plate.

2.7 PUMP GUIDES, RAILS, AND HOISTS

Lower guide bar holders shall be integral with the pump discharge connection. Guide bars shall be ASTM A276 standard weight Type 304 stainless steel pipe of the size required by the pump manufacturer. The guide bars shall not support any portion of the weight of the pump. Guide bar brackets, including intermediate guide bar brackets shall be the pump manufacturer's standard design and shall be Type 316 stainless steel. Each pump shall be furnished with sufficient length of Type 316 stainless steel cable grip-eye and safety chain to be used with a hoisting system for pump removal. Guide cables in lieu of rails shall not be accepted.

Provide each pump with the indicated manufacturer's accessories as identified by the following list. Type and size shall be as recommended by the manufacturer. All accessories shall be constructed of Type 316 stainless steel. For convention of terminology, the items listed are as described by Flygt Corporation; comparable and equal accessories by the other named manufacturers are acceptable.

A. Safety chain clip.

B. Cable support grip.

C. Eye bolt (Type 316 stainless steel) for safety chain.

Each pump shall be furnished with a "grip eye" system. The system shall consist of a sufficient length of nylon line for the application, short length of high tensile strength proof-tested Type 316 stainless steel chain and forged steel "grip eye" for

use with mechanical lifting device. System shall be appropriately sized for the weight of the pump to be lifted.

2.8 MOTORS

The motor shall be an induction type with squirrel-cage rotor and housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated copper with moisture resistant, Class F rated 311 degrees F (155 degrees C) insulation or Class H rated 356 degrees F (180 degrees C) insulation. The stator shall be dipped and baked three times in Class F varnish or insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent. The stator core shall be constructed of high silicone steel laminations to minimize eddy current losses. The stator core laminations shall be heat-shrunk fitted and locked to the stator housing to obtain the maximum heat transfer. Bolts, pins, or other fastening devices that may leak during operation are not permitted to hold or locate the stator. The motor shall be designed for continuous duty and capable of sustaining 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be cast of aluminum and be able to withstand, without damage, centrifugal loads at twice-rated speed.

The motors for the Influent Pumps shall be rated 3 hp, 1,800 rpm synchronous speed (4 pole), 460-Volt submersible electric motor, connected for operation on a 480-Volt, 3-phase 60 Hz service. The motors for the Return Activated Sludge Pumps shall be rated at a maximum of 3 hp, 1,800 rpm synchronous speed (4 pole), 460-Volt submersible electric motor, connected for operation on a 480-Volt, 3-phase 60 Hz service.

Pump motors shall be rated “Inverter Duty” suitable for operation with the variable frequency drives specified in Division 16, Electrical, and shall be coordinated with the thermal, electrical, and mechanical characteristics of the drives actually supplied. Motors shall be suitable for operation on a PWM drive with output to the motor conditioned by a reactor or filter as shown on the electrical drawings. These motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (2,000 volts minimum) for VFD operation. The turn-down ratio for the motors shall be 4:1. The motors shall be capable of running through their operational speed range (15 Hz to 60 Hz) without supplemental cooling.

The motor nameplate horsepower (excluding service factor) shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shutoff to run-out. The pump motors shall be listed as suitable for installation in a Class 1, Division 1, Group D (hazardous) location.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120-volt AC control circuits, Klixon, or equal. The sensors shall have insulated conductor leads brought out with the pump cable and connected to a thermal-sensing device that will shut down the motor in the event of a high-winding temperature condition.

A moisture sensor shall be provided in the stator cavity to detect the presence of moisture in the stator chamber. This sensor shall be for alarm purposes only and shall not be used to shut the pump off. The use of this moisture sensor shall not void the manufacturer's pump or motor warranty.

A thermal sensor and moisture sensor monitoring device shall be provided with each pump for mounting in the electrical equipment specified under Division 16. The monitoring device shall be supplied to the equipment supplier for mounting in the electrical equipment. The Contractor shall coordinate the delivery of the monitoring device to the equipment supplier. The device shall be UL recognized and shall operate from 120 VAC. It shall monitor the thermal sensors and the moisture sensor and shall operate two independent dry contacts each rated at 2 amps, 120 VAC if either the motor winding temperature of the moisture level exceed their respective setpoints. It shall release the associated contact when the temperature or moisture level fall below the setpoint value or a reset button is pushed.

The motors shall be manufactured and assembled by the pump manufacturer. The motor shall be designed for operation in 104 degrees F (40 degrees C) ambient temperature and with a temperature rise not to exceed 144 degrees F (80 degrees C) (total maximum temperature allowed 248 degrees F (120 degrees C)). The motor shall be provided with performance curves showing torque, current, power factor, input kW/output kW, and efficiency, with data on starting current and locked rotor current.

The motors shall be sufficiently cooled by the surrounding environment and pumped media. Pumps that require water jackets for cooling shall not be allowed.

Motors shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits, and controllers, 007 Markings on motors and multi-motor equipment."

If any motor fails during the warranty period, the Contractor shall replace the pump with a new pump.

2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Supplier shall maintain a spreadsheet or database tabulation of the motor and load characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This spreadsheet shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum and maximum equipment or motor speed, acceleration/deceleration time of the driven equipment such as pumps, compressors, blowers, etc. The spreadsheet shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the most current motor and driven equipment information for the submitted equipment. The spreadsheet list shall have the following information as a minimum:

Motor and Driven Equipment Characteristics			
Motor Data:	Full Load Amps		Amps
	Nominal Motor Voltage		Volts
	Nominal Motor Frequency	60	Hertz
	Nominal Motor Speed		RPM
	Input Phase Loss Behavior	Fault	
	Recommended Stopping Mode (i.e. coast, brake etc.)		
Driven Equipment Data:	Maximum Motor Frequency		Hertz
	Minimum Motor Frequency		Hertz
	Acceleration Time		seconds
	Deceleration Time		seconds

In addition, the Supplier shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data on a revised motor characteristic spreadsheet.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.10 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled

boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

O-Rings .....one set for each pump
Wear Rings.....one set for each pump
Mechanical Seals .....one set for each pump

In addition, one set of tools required to disassemble and reassemble each pump model shall be provided. The tool sets shall be supplied with a heavy metal portable toolbox with a padlock hasp.

2.11 PAINTING

Pumps, motors, and accessories shall be factory painted in accordance with Section 09900-2.2A of these Specifications.

2.12 FACTORY TESTING

The pump manufacturer shall perform the following inspections and tests on each pump before shipment from the factory:

A. Impeller, motor rating, and electrical connections shall first be checked for compliance to the customer's purchase order.

B. A motor and cable insulation test for moisture content or insulation defects shall be made.

C. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

D. The pump shall be run 30 minutes submerged, at a minimum depth of 6-feet underwater. Record motor amps during test.

E. After 30 minute operational pump test (4), the insulation test (2) shall be performed again.

A written report stating the foregoing steps have been performed shall be supplied with each pump at the time of shipment. Failure to comply with this requirement or the failure of the pumps to meet the stated performance requirements shall result in rejection of the pumps by the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

Submersible pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's instructions and recommendations. Pump base shall be installed using Type 316 stainless steel fasteners.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 3 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment for each unit application. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (2 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price. If the project sequencing allows for the startup, testing and instruction to occur for more than one unit application concurrently, then the manufacturer may do so only if agreed to by the Owner and the Engineer.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11330

ROTARY DRUM SCREEN SYSTEM

PART 1 GENERAL

1.1 SCOPE

There shall be furnished and installed a rotary drum screen system for removing floating, particulate, and fibrous material from the influent wastewater as specified herein. The rotary drum screen system shall include two self-contained, self-cleaned rotary drum filter screens, one screenings washer/compactor, overflow pressure/level transmitters, and all appurtenances including screenings discharge chute between screens and screenings washer/compactor, washer/compactor discharge transport tube, wash water systems and other associated solenoid valves and devices specified herein. This equipment shall be installed at the Headworks facility as shown on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01800	Testing and Training
09900	Painting
11000	General Requirements for Equipment
13451	PLC Programming
15050	Piping Systems
15066	Pipe and Conduit Support System
15100	Valves
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Rotary Drum Screen 1	02 RDS 01
Rotary Drum Screen 2	02 RDS 02
Screenings Washer/Compactor 1	02 WC 01
Screen 1 Overflow Pressure/Level Transmitter	02 PTR 01
Screen 2 Overflow Pressure/Level Transmitter	02 PTR 01
Screen 1 Washwater Solenoid Valve	SV 211
Screen 2 Washwater Solenoid Valve	SV 212
Screen 1 Discharge Chute Washwater Solenoid Valve	SV 213A

Screen 2 Discharge Chute Washwater Solenoid Valve	SV 213B
Washer/Compacter Washwater Solenoid Valve	SV 213AC

1.4 PERFORMANCE REQUIREMENTS

The rotary drum screen system shall continuously receive and screen the pumped influent wastewater and wash and dewater the screenings as specified herein, and neatly discharge the dewatered screenings to a receptacle, as shown on the Plans.

The rotary drum screen system shall operate continuously or intermittently based on demand. The rotary drum screens shall each meet the following design conditions:

Maximum Hydraulic Capacity, gpm	78
Maximum Influent Suspended Solids Concentration, mg/L	400
Perforation Size, mm	2

The screenings washer/compactor shall be capable of handling up to 10 ft^3/hr wet screenings with a minimum feed concentration of 5 to 10 percent dry solids and shall compress the screenings to achieve up to an approximate 80 percent reduction in volume. The average dry weight solids in the washed, compacted screenings shall be 40 percent.

1.5 WARRANTY

The warranty shall be provided in accordance with the General Conditions. The warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

1.6 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for screens, washer compactor, and all ancillary components.

1.7 PAYMENT

No separate or additional payment will be made for the work and material specified herein. All costs for the rotary drum screen system, as specified herein, shall be included in the appropriate unit and lump sum bid items.

The structural, mechanical and electrical designs shown on the Plans are based on equipment manufactured by Kusters. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall at made at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The rotary drum screens shall be a ProTechtor® perforated rotary drum screens by Kusters Water, Model RDS-9, Saveco Flo-RotoDrum RTV500x1000, or Parkson Rotoshear RDS3648EZ. No other manufacturers or models shall be accepted.

The screenings washer/compactor shall be a ProTechtor® Model SPW200 x 700 screenings washer compactor and appurtenances by Kusters Water, Saveco, Parkson. No other manufacturers or models shall be accepted.

2.2 ROTARY DRUM SCREENS

A. GENERAL

Each unit shall consist of a rotating perforated stainless steel screen which is internally fed and is self-contained to prevent splashing and contain odors. The rotary drum screens shall have connections for pumped influent flow, discharge drain, overflow drain, wash water, and odor control ducts. The rotating action of the screen shall cause the captured solids to roll up into and agglomerate and shall be conveyed to the discharge end of the screen by internal flights.

The rotary drum screen assembly shall include a perforated cylindrical screen element, splash guards, inlet headbox assembly (if required), base frame, trunnion wheels, drive system, internal/external sprays, covers, collection pan, and solids discharge chute. The screen shall be designed to provide maximum solids filtration and thus maximize capture of debris, while minimizing the rate of head loss increase through the screen.

The rotary drum screen shall operate intermittently based on a signal from the WWTF PLC.

The rotary drum screens and screenings discharge chute shall be totally enclosed with a cover hood assembly, which will be under negative pressure by the odor control system.

The rotary drum screen components within the cover hood assembly and the internal components of the washer/compactor shall be rated, Class I, Division 1.

B. SCREEN ASSEMBLY

The screening element shall be a perforated cylinder, constructed of type 304 stainless steel. Each end of the screen elements shall be fitted with a type 304 stainless steel end ring welded to the screen element substructure throughout the circumference. End rings shall be 10 gauge with a minimum thickness of 0.135 inch and have stiffening flanges welded around their circumference. One end ring shall be at the discharge end and be designed with an extended bellmouth to provide effective discharge of dewatered solids away from the base of the unit. Each end ring shall also include a stainless steel track area specifically designed to be supported by the trunnion wheel assemblies. The drum shall be either directly driven by a gear motor coupled to the drum via a flexible coupling or by a direct gear and pinion drive with no connecting belts or chains. The screening element perforations shall be a nominal 0.08 inch (2.0 mm).

The screen element shall be equipped with type 304 stainless steel flights. Flights arranged in a helical pattern throughout the length of the screen causing the solids to continually move towards the discharge end. The diverter height shall be a minimum of 0.50 inch. The flights shall be designed to structurally strengthen the perforated cylinder and make it suitable for the intended duty.

The screen frame and the screenings discharge chute shall be constructed from 304 stainless steel plate with a minimum thickness of 1/8 inch.

The screenings discharge chute from each rotary drum screen shall be equipped with a 1-foot wide by 1-foot tall access hatch within 12 inches of the bottom connection to the washer/compactor to allow access and cleaning of the washer/compactor without removing the discharge chute. The access hatch shall be hinged with quick release door locks and constructed of stainless steel plate to match the filter screen frame.

All internal parts which require grease or lubricant application shall be provided with a dedicated zerk fitting or a hinged access hatch with a maximum of two quick release door locks.

C. BASE FRAME AND LOWER COLLECTION PLATE

The base frame shall be constructed of type 304 stainless steel sections, and shall be accurately fabricated to provide a mounting surface for the screen assembly. The frame shall be designed to withstand all loads imposed by the screen components plus wastewater passing through the unit. The base shall also be designed in such a way to allow for four-point support without the linear deflection exceeding 0.0014.

Four anchor bolt holes and four lifting lugs shall be incorporated in the base. Anchor bolt assemblies shall be 304 stainless steel and shall be furnished by the Contractor.

If required a method of changing the perforated screen cylinder angle of inclination shall be provided to raise the screenings discharge end of the screen from 0 degrees to a max of 6 degrees. Standard installation angle will be 6 degrees. The increase or decrease of the screen cylinder slope shall be made possible without dismantling or disassembling the piping to and from the screen.

D. TRUNNION

The trunnion wheel assembly shall be designed such that the wheel and/or sleeve bearing may be replaced independently of the other wheel parts. Cantilevered trunnions are not acceptable. The trunnions must be supported on each side.

The screen assembly shall be provided with four trunnion wheels and trunnion wheel mounting assemblies. The trunnion wheel assemblies shall be accurately mounted to the base frame to provide positive horizontal placement of the screen assembly.

Trunnion wheels shall be constructed of solid polyethylene or solid phenolic resin mounted on stainless steel axles. Each wheel shall have a maximum outside diameter of 10 inches. Each wheel shall be supported by two deep groove, lubricated and sealed bearings. The wheel bearing assembly shall be an anti-friction ball with inner race.

Support shafts shall be of type 304 stainless steel. Each shaft shall be accurately positioned and secured by the trunnion mounting bracket.

Trunnion support brackets shall be fabricated of type 304 stainless steel plates. Each bracket assembly shall be of type 304 stainless steel

construction accurately fabricated to interface with the support base. The bracket assembly shall be designed to locate the trunnion support shafts and support the loads imposed by the cylinder assembly.

E. INLET PIPE AND FLOW DISTRIBUTION BOX ASSEMBLY

All components of the piped inlet shall be fabricated of minimum 12-gauge type 304 stainless steel.

The piped inlet and flow distribution assembly shall be sized for a peak flow as specified herein. Flow shall be controlled to provide smooth, uniform distribution.

An integral overflow pipe shall be provided in case the screen should be inoperative for any reason during flow to the screen. Overflow/high level detection shall be monitored by pressure/level transmitters.

F. SPLASH GUARDS

The screen shall be equipped with external splash guards constructed of minimum 12-gauge type 304 stainless steel. These guards shall be located on each side of the screening element and attached to the base.

The splash guards shall be designed to contain and direct the entire flow through the screen base discharge opening.

The splash guards shall have internal guided flow vanes. The use of rubber or rivets on the splash guards shall not be allowed. The guards shall be designed to be easily removed for maintenance or access purposes.

The splash guards shall be self-supporting throughout their entire length and shall also support the weight of the external covers/hoods which mount on them.

G. COVER HOODS

A cover hood assembly shall be provided for each screen. Each cover hood shall consist of multiple sections each sized to facilitate handling by the operator or maintenance personnel. Each section shall be sufficiently durable to withstand visual damage from 1-inch hailstones, and designed for a live load of 40 psf on horizontal projection plus 30 psf wind load.

Each cover section shall be capable of being removed by a maximum of one operator. Each section of the cover hood shall consist of a panel, plus support members, lift-off hinge and locking assemblies.

Cover panels shall be stainless steel construction with 14 GA minimum thickness and shall be formed in one piece without bolting.

Stiffening angles, base brackets, inspection bars, and all assembly hardware shall be type 18-8 stainless steel, and shall be die formed to insure accurate dimensions of the finished units.

Cover hood assemblies shall fasten to and be supported by the splash guards located below them. The 304 stainless steel fasteners shall be coordinated and furnished by the screen manufacturer, who will also make the final assembly. Cover hoods shall be supplied with odor control duct connections as shown on the Plans.

H. SCREENINGS DISCHARGE CHUTE

Each screen shall include a heavy-duty type 304 stainless steel solids discharge chute connection to a common discharge chute with a bottom connection to the washer/compactor inlet.

The lower part of the chute shall fit closely beneath the screen discharge, so that all solids are captured. The hopper chute shall extend downward. Bottom of the discharge chute shall be reinforced with matching companion mounting holes; stainless steel fasteners shall be provided for attaching a rubber extension chute; the rubber extension chute shall be furnished by the rotary drum screen manufacturer.

The chutes shall converge to a common nominal 8" x 19" discharge opening and the converging sides shall be not less than 60 degrees from horizontal.

Each rotary drum screen discharge chute shall be equipped with a spray nozzle assembly for a total maximum flow of 10-15 gpm @ 40-50 psig. The water supply connection to each side of the discharge chute shall include the following manufacturer supplied components to be shipped loose for installation by the Contractor to the 1-inch NPT connections downstream of the tee connection to the washer compactor pressure reducing valve:

- One main 1-inch NPW isolation manual ball valve (BV 213A, BV 213B.

- One 1-inch solenoid valve (SV 213A, SV213B).

The screenings discharge chute shall be provided with heat tracing and insulation as specified herein.

The screenings discharge chute from each rotary drum screen discharge shall be equipped with a minimum 1-foot-wide by 1-foot-tall access hatch within 12 inches of the bottom connection to the washer/compactor to allow access and cleaning of the washer/compactor and chute without removing the discharge chute. The access hatches shall be hinged with quick release door locks and constructed of stainless steel plate to match the filter screen frame.

I. SCREEN CLEANING SYSTEM

Each screen shall be provided with either an external spray system and rotating horizontal cleaner brush and or an internal and external spray bar for cleaning the drum screen. Non-potable plant water shall be supplied to the spray systems at the required volume and pressure.

The spray system internal piping shall consist of a 304 stainless steel spray header provided with 304 stainless steel spray nozzles with an external 304 stainless steel NPT connection. The nozzles shall be easily accessible for cleaning.

The nozzles shall operate non-potable plant water (treated plant effluent) at 80 psi. Maximum simultaneous flow, at 75 to 80 psig shall be 10 to 15 gpm. Inlet connections to spray header shall be 1-inch NPT.

The cleaner brush shall consist of a rotary nylon bristle mounted on a 304 stainless steel shaft with pillow block bearings at each end. The brush located above the perforated cylinder shall rotate in contact with the cylinder as it turns. The angular contact generated by the unique shape of the brush cleans the perforations. The joint cleaning action of the brush and the wash water sprays effectively maintains the open area of the screen cylinder and prevents blinding.

The spray orifices shall be non-plugging and suitable for use with treated effluent water. The water supply connection to each screen shall include the following manufacturer supplied components to be shipped loose for installation by the Contractor to the 1-inch NPT connections:

- One main 1-inch pressure reducing valve (PRV 211, PRV 212).
- One main pressure gauge (PI 211, PI 212).

- One 1-inch main solenoid valve (SV 211, SV 212).
- One 1-inch internal and external spray assembly manual operated ball valve (BV 211A, BV 211B, BV 212A, BV 212B).

2.3 SCREENINGS WASHER/COMPACTOR

Screenings discharged from the screen discharge chute shall drop into the screenings washer/compactor inlet hopper. The connecting chute between the screen and screenings washer/compactor shall be constructed of minimum 14-gauge 304 stainless steel.

The screenings washer hopper shall be constructed of minimum 12-gauge 304 stainless steel.

The screenings washer/compactor inlet and outlet flanges shall be minimum 1/4-inch 304 stainless steel.

There shall be a spray wash connection at each of the two outlet sides of the screen discharge chute and at the washer compactor unit as shown on the Plans. The screenings washer inlet hopper shall be equipped with a 1-inch diameter, 304 stainless steel spray bar at each discharge side. The spray bar shall be equipped with five spray nozzles, each designed for a minimum flow of 1 gpm at 30 psi. The spray shall be directed to wash down the inside of the hopper. Washwater supply shall be 10 to 15 gpm at 40 to 50 psig.

Primary washing of the screenings in the washing trough shall release fecal matter and organics via a perforated drainage area, which shall be cleaned by replaceable nylon brushes attached by stainless steel clips to the screw auger. The perforated drainage trough shall be made of 6mm thick 304 stainless steel.

The press housing shall be made of 3/8-inch-thick 304 stainless steel.

The 8-inch-diameter screw shall be made of Hardox 400 special steel and the drive shaft shall be one solid piece bolted to the screw for ease of maintenance. Either nylon cleaner brushes shall be attached to the screw flights by stainless steel clips in the drainage area to clean the trough perforations or a 0.31-inch-thick UHMW trough scraper on the OD of the last two flights in the inlet hopper shall be provided.

The final washer system shall consist of a 304 stainless steel cylindrical section with two 1/4-inch stainless steel spray nozzles located at each side of the washing zone. The spray nozzles shall be mounted on 304 stainless steel piping and shall each produce a minimum wash water flow rate of 10 to 20 gpm at a pressure of 40 psi.

The spray orifices shall be non-plugging and suitable for use with treated effluent water. The water supply connection to the washer compactor shall include the following manufacturer supplied components to be shipped loose for installation by the Contractor to the 1-inch NPT connection:

- One 1.5-inch NPW isolation manual ball valve (BV 210).
- One 1.5-inch pressure reducing valve (PRV 210).
- One pressure gauge (PI 210).
- One 1-inch solenoid valve (SV 213C) and one 1-inch ball valve (BV 213C) at each of the three connections.

The drive shaft shall rotate on one axial/radial tapered roller bearing. The drive unit and bearings shall be of manufacturer's standard coated materials. The support plates shall be integral to the main body of the unit and shall be made of 304 stainless steel.

The solids discharge zone shall be a 304 stainless steel extension flanged to the outlet to extend dewatering time and enhance frictional dewatering forces. The pipe extension shall be inclined and have an inside diameter of 8 inches expanding to 12 inches to maximize discharge distance. The configuration of the discharge zone shall be as shown on the Plans.

2.4 GEAR MOTORS

The screen drive unit shall be a direct coupled, helical-worm type gear motor. The gear reducer shall be equipped with anti-friction bearings and shall be designed in accordance with AGMA recommendations for 24 hour, Class II service. The motor shall be a standard horizontal TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motor shall be constructed with Class F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motor shall be rated at minimum of 1 hp, 460 volts AC, 3 phase, 60 Hz, 1,800 rpm synchronous speed (4 pole), continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor.

The screenings washer/compactor drive unit shall be a direct coupled, shaft mounted, helical-worm type gear reducer. The gear reducer shall be equipped with antifriction bearings and shall be designed in accordance with AGMA recommendations for 24 hour, Class II service. The motor shall be a standard horizontal TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motor shall be constructed with Class F insulated windings, B 30,000 antifriction bearings, cast iron frame and end bells. The motor shall be rated at minimum of 2 hp, 460 volts AC, 3 phase,

60 Hz, 1,800 rpm synchronous speed (4 pole), continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor.

The motors shall be standard horizontal, TEFC electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI and IEEE standards. Motors shall be constructed with Class F insulated windings, Design B, 30,000 AFBMA hour rated anti-friction bearings, cast iron frame and end bells.

The motors shall be rated "Inverter Duty" suitable for operation with the variable frequency drives specified in Division 16, Electrical, and shall be coordinated with the thermal, electrical, and mechanical characteristics of the drives actually supplied. Motors shall be suitable for operation on a PWM drive with output to the motor conditioned by a reactor or filter as shown on the electrical Plans. These motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (2,000 volts minimum) for VFD operation. The turndown ratio for the motors shall be as required for the flow range specified for the pumps. The motors shall be capable of running throughout the operational speed range without supplemental cooling.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120-volt AC and 24 volt DC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Motors shall be mounted in a manner that permits conduit connection to the motor terminal box directly using straight lengths of flexible metal conduit (i.e. without offsets or dog legs). Motors shall meet the electrical requirements of WAC 296 46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment." Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11C) table C408.8(1), regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code. If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

Motors shall be by SEW, Baldor, US Motors, Reliance, General Electric or Toshiba/Houston. No other manufacturers shall be accepted.

2.5 CONTROL SYSTEM

The Contractor shall provide and install the local control panels and all electrical and control wiring and conduit connections from the screen components to the control panels. The WWTF PLC will control the screen system components.

2.6 SOLENOID VALVES

Solenoid valves shall be two-way 1-1/2-inch size with 1-1/4-inch full port. They shall be suitable for operating at pressures up to 125-psi differential pressure, and be rated up to 300 psi safe working pressure. All valves shall be normally closed, 120 VAC coil, rated continuous duty, UL approved. Solenoid valves shall be electrically protected with Metal Oxide Varistors (MOVs) at their field terminals and shall be individually fused.

The solenoid valves shall be suitable for use in a Class I Division II Groups D rated hazardous location. The solenoid valves shall be operated via the local control panel with manual operation as an option from the local control panel. Valves shall be ASCO Model 8210 or equal.

2.7 OUTDOOR WEATHER PROTECTION/HEAT TRACING

The washer compactor screenings discharge transport tube and all above grade washwater piping shall be furnished with a 120 VAC heat tracing system for outdoor weather protection that shall completely enclose the screenings transport tube, compaction and dewatering zone, and all spray wash piping and solenoid valves. 120 VAC power shall be derived from the Contractor provided electrical system as shown on the Plans.

The cold weather protection system shall include heat tracing, adjustable thermostat, insulation and stainless steel cladding. The area classification for the heat tracing shall be Class I, Division II, Group D.

The heat tracing system shall be suitable for operation down to a minimum temperature of -25 degrees C (-13 degrees F).

Weather protection system protective cover shall be stainless steel cladding.

The weather protection cover sections shall be easily removable when mounted axially along the transport tube. Weather protection system cover sections shall extend from the discharge chute over the compaction and dewatering zone and down to the main basket support flange gussets. Each cover section shall be designed so that the insulation is completely encapsulated to prevent water intrusion and damage.

Where the wash water supply and electrical wiring conduit penetrates the cover bulkhead adapters shall be provided and the penetration shall be sealed to prevent water intrusion. All fasteners to assemble the cover components shall be stainless steel.

The plant water supply system piping to the screen and the water strainer shall be provided with heat tracing and insulation by the CONTRACTOR as specified in Section 15050.

2.8 PRESSURE REDUCING VALVES

Adjustable self operated type, bronze body, stainless steel integral strainer, and cast iron spring case, 25 to 75 psig outlet pressure range and inlet pressures to 200 psig. Watts AUB-Z3 or equal by B&G, Fisher, Leslie, McAlear.

2.9 BALL VALVES

Ball valves shall be full port, bronze body, TFE seat, with chrome plated ball, Apollo 70-107-01 or equal.

2.10 OVERFLOW PRESSURE/LEVEL TRANSMITTERS

The overflow pressure/level transmitters shall meet the requirements of specification 13419. The pressure/level transmitters shall be mounted to the stainless steel housing adjacent to the overflow pipe connection with the same invert elevation as the overflow pipe to sense and transmit overflow levels to the WWTF PLC for alarm and control. The transmitter connection shall consist of a weld-on, flush-mount stainless steel nipple sized for the installation of the transmitter.

2.11 ADHESIVE ANCHORING SYSTEM

Equipment manufacturer shall design and size all adhesive anchors of ample size and strength required to securely anchor each item of equipment. Adhesive anchor rods, hex nuts, and washers shall be 316 stainless steel unless noted otherwise. Adhesive shall be Hilti HIT 150 injection type, or equal. Expansion-type anchors will not be acceptable.

Anchor bolts shall be supplied and set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.12 SOURCE QUALITY CONTROL

The equipment manufacturer's shop welds, welding procedures, welders and welding operators shall be qualified and certified in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code-Steel" published by the American Welding Society.

Fabricate all parts and assemblies from sheets and plates of 304 stainless steel with a 2D finish conforming to AISI 304 and ASTM A666, unless noted otherwise. Fabricate all rolled or extruded shapes to conform to ASTM A276. Fabricate all tubular products and fittings to conform to ASTM A269, A351 and A403.

Perform all welding in the factory using inert gas, MIG or TIG method. Add filler wire to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Fully penetrate butt welds to the interior surface and provide gas shielding to interior and exterior of the joint.

2.13 SPARE PARTS AND SAFETY EQUIPMENT

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and packaged in hinge-covered, wooden boxes. At a minimum these spare parts shall include the following items:

Trunnion wheel assembly .....2 complete sets
Spray nozzles .....1 matching set of all provided

2.14 VIBRATION

Vibration and critical speed limitations shall be in accordance with Section 11010 and as set forth in the Standards of the Hydraulic Institute.

2.15 DATA PLATES

Data plates shall contain the manufacturer's name, motor size and type, serial number, speed, capacity, and other pertinent data in accordance with Section 11000-2.9. Data plates shall not be painted.

2.16 PAINTING AND SURFACE PREPARATION

All surfaces, with the exception of stainless steel, shall be painted in accordance with Section 09900-2.2.C.

Clean all stainless steel surfaces by using the following procedure:

A. Wire brush all weld areas to remove weld spatter. Brushes shall be of 304 stainless steel and used only on 304 or 304L stainless steel.

B. Glass bead blast or chemically treat all external non-wetted stainless steel to a uniform finish.

PART 3 EXECUTION

3.1 GENERAL

The rotary drum screen system shall be installed as shown on the Plans and in strict conformance with the manufacturer's recommendations.

The Contractor shall provide and install the NPW piping to the wash water connections and shall install the manufacturer supplied fittings on the NPW piping as specified herein and as shown on the Plans. The manufacturer supplied wash water fittings and piping shall be supported as specified in Section 15066 and the fittings shall be installed in locations to allow easy access for maintenance.

3.2 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the rotary drum screen system manufacturer shall be provided. Services shall include 3 days (three visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until start-up is completed and the mechanically cleaned filter screen system is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The Manufacturer shall provide the recommended settings for timers, VFD, and VFD overtorque as described in Section 13451.

In addition to the three visits described above, provide the following follow-up formal training sessions at the Owner's facility for the Owner's operating and maintenance personnel by an instructor familiar with both the manufacturer's equipment and the specific programmed applications provided for this project. Each follow-up training session shall be a minimum of 4 hours. The time remaining after each training session (up to the 4 hour minimum) shall be used to perform diagnostic system tests evaluating system performance and to make any

minor adjustments to the system that may be determined to be necessary for system optimization. This time shall also be used to make any adjustments that the Owner requests for easier or more convenient operator use of the system. One follow-up training session is described below:

- Follow-up 4-hour training session 4 months after startup.

***** END OF SECTION *****

SECTION 11353

DIRECT-DRIVE SUBMERSIBLE MIXERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing a new submersible mixer in the Anoxic Basin as shown on the Plans and specified herein and a second equivalent spare mixer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
09900	Painting
11000	Equipment General Provisions
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Anoxic Mixer	02 MXR 01
Uninstalled Spare Mixer	NA

1.4 PERFORMANCE REQUIREMENTS

A. The mixers shall be submersible, horizontal, axial flow, propeller type coupled with a submersible motor to form an integrated submersible mixer/gear motor unit. The mixers shall be provided complete with guide mast and lifting cable. The submersible mixer shall be equipped with a jet ring.

Mixers shall meet conform to operation under the following requirements:

Parameter	Performance Requirement
Anoxic Mixer	
Tank length (feet)	9
Tank width (feet)	6
Sidewater depth (feet)	14.00

Parameter	Performance Requirement
Wall Height (feet)	17
Suspended solids concentration range (mg/L)	8,000 – 11,000
Thrust (N)	125
Propeller diameter (inches)	8.27
Propeller speed (rpm)	1,675

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Anoxic Mixer shall be Flygt Model 4630 with Jet ring or approved equivalent equipment manufactured by KSB Amamix. No other manufacturers or model shall be allowed.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Flygt. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that

may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

In order to assure uniform quality, product functionality, and ease of maintenance; all of the equipment specified in this Section shall be supplied by one manufacturer.

2.2 MIXER DESIGN

The mixer shall be capable of completely mixing anoxic mixed liquor with a suspended solids concentration between 8,000 and 11,000 mg/L. The mixer shall be able to be raised and lowered and shall be easily removed for inspection or service without the need for personnel to enter the reactor tank. A sliding guide bracket shall be an integral part of the mixer unit. The entire weight of the mixer unit shall be guided by a single bracket which must be able to handle all thrust created by the mixer. The mixer, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 85 feet.

The mixer motor cable installed shall be listed and labeled for submersible mixer application with P122-MSHA approval, and this shall be indicated by a code or legend permanently embossed on the cable. The cable shall meet Washington State Department of Labor and Industry requirements for submerged installation in a wet well, exposed in a wet well, and installed in conduit. Cable sizing shall conform to NEC requirement for mixer motors. Cable length shall be adequate to connect without splicing, to the junction box, motor controller, or other enclosure, as shown on the Plans where the cable will be spliced to other conductors or connected to a device or equipment.

The cable entry water seal design shall be sealed in a manner to guarantee complete waterproof protection. The cable entry shall be designed in a manner to relieve strain in the cable at the point of entry to the mixer.

A moisture sensor shall be provided in the stator cavity to detect the presence of moisture in the stator chamber. This sensor shall be for alarm purposes only and shall not be used to shut the mixer off. This use of the moisture sensor shall not void the manufacturer's mixer or motor warranty.

2.3 PROPELLER

Propeller shall have two blades, Type 316 stainless steel, with thick cross section to resist abrasion and to permit displacement of the stagnation point along the leading edge. Propeller and hub shall be a single-piece casting without weld joints. Each blade shall be contoured such that the tangent line at any point on the leading edge is equal or less steep relative to the circumferential direction than the resulting force, causing fibrous materials to always slide toward the outer radius of the propeller. The propeller shaft shall be made of ASTM A743-79 Type 304 stainless steel.

Propeller shall be surrounded by a jet ring.

2.4 PROPELLER SHAFT SEALS

The critical area where the propeller shaft enters the mixed media shall be sealed by two totally independent mechanical shaft seals, each with its own independent single-spring system. The outer mechanical seal shall be silicone carbide/silicone carbide and shall be protected from solids in the mixed media by a labyrinth cast into the propeller hub/seal housing interface. An oil-filled chamber with drain and inspection plug (each with positive anti-leak seal) shall separate the seals and provide lubrication. The inner seal shall contain one rotating aluminum oxide ring and one stationary corrosion-resistant cemented carbide ring.

2.5 BEARINGS

Bearing sets shall be single row or double row as needed to provide the specified B10 life. The motor shaft shall be supported by two bearing sets sized to provide a B10 of 100,000 hours at all anticipated axial and radial loadings. Motor shaft bearings shall be sealed/shielded (permanently lubricated).

2.6 GUIDE MAST ASSEMBLY

The mixer mast assemblies shall be manufactured from Type 316 stainless steel and shall be sized at the factory to fit the tank depth. The mast shall be 2-inch square tube with a minimum 3/16-inch wall thickness and shall accommodate the mixer sliding bracket. The mast shall be supplied with factory-welded rotation sockets at the top, bottom, and intermediate levels and shall work in conjunction with wall-mounted brackets that secure the unit to the tank wall with 5/8-inch by 6-inch Type 316 stainless steel wedge anchor bolts and with a floor-mounted support assembly. Each socket shall be lined with a Kynar® insert to ensure easy mast rotation and shall be spaced at a maximum of 10-foot intervals. The mast assembly shall be supplied with a positioner plate to facilitate mixer directioning. The positioner plate shall have a minimum of 14 settings with a total of 167 degrees of rotation. The mast assembly shall include a pivoting base bracket

designed to allow for slope in the tank floor. If required, a wall bracket extension shall be supplied by the mast manufacturer and shall be custom fit to ensure a straight and true installation.

Each mixer shall be furnished with 50 feet minimum of Type 316 stainless steel cable, grip eye, and safety chain to be used with a hoisting system for mixer removal. Provide safety chain clip, cable support grip, and eyebolt for safety chain.

2.7 MOTOR

A. APPROVED MANUFACTURERS

Motors shall be by Baldor, US Motors, Reliance, Flygt, or Toshiba/Houston. No other manufacturers shall be accepted.

B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
Motor Size	3 hp
Operating Voltage	460 VAC
Phase	3
Frequency	60 Hz
Synchronous Speed	1,800 rpm (4 Pole)
Inverter Duty?	No
Motor Overtemperature Protection?	Yes
Classified Environment?	Yes

C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal, TEFC premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class H insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper. Motor design shall be Type B (Standard).

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical, and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

E. MOTOR OVERTEMPERATURE DETECTION

Motor over temperature shall be provided in all submersible motors and all motors over 25 hp. The method of motor over temperature detection shall be as follows.

1. Thermal switches

Where selected, thermal switches shall be Normally Closed (NC) and shall be sized by the motor manufacturer to open 10 degrees C below the maximum allowed operating temperature for the insulation class and ambient ratings specified herein. These switches shall be internally series connected by the manufacturer with two insulated leads brought to the motor junction box for user connection. These switches shall be suitable for 120 VAC or 24 VDC control circuit applications at 5 Amps.

F. MOTOR SEAL LEAK DETECTION

All submersible motors shall be provided with seal leak detection.

The manufacturer shall supply a 120 VAC-powered, DIN-Rail mounted, seal leak detector, with a set of Form C contacts that transition on the sensing of a seal leak condition. The contacts shall be rated at 5 Amps

(minimum) at 120 VAC or 24 VDC. The detectors shall be UL listed and shall operate from 120 volts AC. The Contractor shall be responsible for coordinating the installation and operation of these devices with the motor control center manufacturer or control panel supplier.

G. MOTORS IN CLASSIFIED ENVIRONMENTS

Motors shall be suitable for use in Class I div 1 environments.

If specified with motor seal leak detection the seal leak detector supplied by the motor manufacturer shall be intrinsically safe and shall comply with the other requirements for seal leak detectors in these specifications.

If specified with motor over temperature detection using thermistors, the thermistor setpoint controller supplied by the motor manufacturer shall provide an intrinsically safe connection between it and the motor. It shall comply with the other requirements for thermistor setpoint controllers in these specifications.

If specified with motor over temperature detection using RTDs, the RTD setpoint controller supplied by the motor manufacturer shall provide an intrinsically safe connection between it and the motor. It shall comply with the other requirements for RTD setpoint controllers in these specifications.

2.8 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.9 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

O-Rings .....one set for each unit supplied
Bearings .....one set for each unit supplied
Power cable grommets .....one set for each unit supplied
Mechanical seals .....one set for each unit supplied
Lip seals .....one set for each unit supplied

The Contractor shall also provide a spare mixer as specified herein.

2.10 PAINTING

Units, motors, and accessories shall be painted in accordance with Section 09900-2.2C of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

2.11 FACTORY TESTING

The manufacturer shall perform the following inspections and tests on each mixer before shipment from the factory:

A. Impeller, motor rating, and electrical connections shall first be checked for compliance to the customer's purchase order.

B. A motor and cable insulation test for moisture content or insulation defects shall be made.

C. Prior to submergence, the mixer shall be run dry to establish correct rotation and mechanical integrity.

D. The mixer shall be run 30 minutes submerged, at a minimum depth of 6-feet underwater. Record motor amps during test.

E. After 30 minute operational mixing test (D), the insulation test (B) shall be performed again.

A written report stating the foregoing steps have been performed shall be supplied with each mixer at the time of shipment. Failure to comply with this requirement or the failure of the mixer to meet the stated performance requirements shall result in rejection of the mixers by the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

The submersible mixers shall be installed as shown on the Plans and in strict accordance with mixer manufacturer's instructions and recommendations. Mixers shall be securely anchored using Type 316 stainless steel bolts or Type 316 stainless steel threaded rods in epoxy adhesive anchors equivalent in size and strength to that recommended by the manufacturer.

3.2 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (1 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price. If the project sequencing allows for the startup, testing and instruction to occur for more than one mixer application concurrently then the manufacturer may do so only if agreed to by the Owner and the Engineer.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11370

ROTARY POSITIVE DISPLACEMENT BLOWERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new rotary positive displacement blowers with acoustical enclosures as shown on the Drawings and as specified herein.

The blowers shall each be complete with motor, V-belts and sheaves, base, inlet filter, inlet silencer, discharge silencer, check valve, pressure relief valve, OSHA coupling guard, expansion joints, vibration isolators, acoustical weatherproof enclosure, and all associated equipment, including temperature and pressure gauges, for a complete and workable air blower system, as shown on the Drawings and specified herein. The blowers shall be compact, frame-mounted units with the inlet and discharge configurations, specified herein and shown on the Drawings.

The blower manufacturer shall provide and have complete responsibility for blower systems, which include blowers, motors, acoustical enclosures, and accessories. The entire blower package and its components shall comply with all applicable safety and environmental regulations.

The Contractor shall provide an automatic unloading valve for each blower if required for proper operation of the blower. Blowers shall be compatible with variable frequency drives.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitations
11021	Vibration Isolation Systems
11375	Air Diffusion Equipment
15050	Piping Systems
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Aeration Basin Blower	01 AB 01

1.4 PERFORMANCE REQUIREMENTS

The blower shall have the following capacities and discharge pressures when operated at an elevation of 80 feet above sea level, inlet pressure of 14.48 psia, inlet air temperature of 20 to 100 degrees F, and relative humidity of 20 to 100 percent.

Parameter	Performance Requirement
Aeration Blower	
Design Inlet/Standard Capacity (icfm/scfm)	76/68
Minimum Inlet/Standard Capacity (icfm/scfm)	17/16
Discharge Pressure Rise (psig)	5.7
Max. Blower Rotor Speed (rpm)	1755
Max. Free Field Noise Pressure @ 3 Feet (dB (A))	62

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Aeration Basin Blower shall be Aerzen Delta Blower Generation 5 Model GM 3 S DN 50 or equivalent equipment manufactured by Roots. The acoustical blower enclosures shall be manufactured by the blower manufacturer and shall be factory installed. No other manufacturers or models will be accepted.

The structural, mechanical and electrical designs shown on the Drawings are based on the equipment manufactured by Aerzen. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Drawings to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

Blower manufacturer's requiring a separate motor driven fan for enclosure cooling, in lieu of the shaft driven fan cooled models specified herein, shall indicate this in their bid proposal and the Contractor shall be responsible for any additional conduit, wiring, and instrumentation supply and installation required.

2.2 BLOWERS

Each blower shall be rotary lobe positive displacement type, of the tri-lobe involute design, and furnished by one manufacturer. The impellers, impeller casings, and end plates shall be of a close-grained, high-strength cast iron and strongly ribbed internally for strength and to prevent distortion under operating conditions.

Maximum blower air discharge temperature shall be 275 degrees F.

The impellers shall operate without rubbing or liquid seals or lubrication. The impellers shall be timed by a pair of single helical AGMA 12 quality gears with hardened and ground teeth; minimum AGMA service factor of 1.70. Gears shall be mounted on the shafts with a tapered interference fit, and secured by a locknut.

The impellers shall be balanced by metal removal and not by adding counter weights. To ensure smooth operation without vibration, balancing to be at lobe weights not on outer profile to avoid weakening lobe. The shafts shall be of machined steel and shall run in four heavy-duty anti-friction bearings, having a minimum B-10 life expectancy of at least 100,000 hours. Bearing holders with retainer allowing positive bearing containment and with ground spacers to accurately and permanently locate rotor clearances within blower casing.
The rear bearings and gears shall run in a splash oil type housing. The drive end and bearings shall be splash oil lubricated and contained within one oil reservoir. Front and rear covers to be removable for easy access for bearing and gear inspection.

Blowers shall have four piston ring type labyrinth seals at each end of each rotor and the cavity between the air side and oil side seals shall be vented through threaded ports to allow external purging or containment of any lubricating oil or process gas which may have migrated past the seals.

The end covers shall be cast iron complete with amply sized oil sight glasses for observation of the oil levels.

Blowers shall be mounted in the horizontal position. A common base shall be supplied under each blower and motor. It shall be fabricated of deep section rigid steel, reinforced to withstand normal loading.

2.3 DRIVE

Each blower package shall be supplied with a V-belt drive that shall be of the high capacity type, oil and heat resistant. Drive shall be designed for a minimum service factor of 1.4 times operating power (bHp), or 1.1 times the motor nameplate Hp, whichever is larger to allow a minimum of 1.4-service factor based on the maximum blower bHp. Belt tensioning shall be automatic without the use of any devices or interaction on the part of the operator. Neither slide rails nor load-adjusting springs shall be used. Sheaves shall be dynamically balanced regardless of the operating speed.

The belt drive shall be guarded in compliance with OSHA regulations. Portions of the guard shall be easily removable allowing for belt inspection and replacement. Guard material shall be carbon steel.

2.4 INTAKE AIR FILTER/SILENCER

Each blower package shall be supplied with one combination inlet filter/silencer. The filter media efficiency must meet the requirements of ASHRAE 52.2 MERV7 50 to 70 percent at 3 to 10 microns corresponding to EN779 G4. The inlet filter/silencer shall be mounted directly to the inlet flange of the blower. The

silencer portion shall be located upstream of the inlet filter. Filter and silencer performance losses shall be included in the blower performance calculation.

Vacuum gauge or other suitable device shall be supplied and mounted, for sensing of inlet vacuum and blinding of filter medium.

2.5 DISCHARGE SILENCERS

Each blower package shall be supplied with one combination base frame/discharge silencer. The silencer shall be a chamber type design for maximum sound attenuation and shall not use fibrous or absorption materials of any kind. Fabricated of a single shell of pressure vessel quality steel with continuous welds, the silencer must be subject to a pressure test for tightness and strength at a minimum of 1.65 times the maximum blower operating pressure. The silencer shall have a machined inlet connection where the discharge flange of the blower stage bolts directly to, with no intermediary pieces. Discharge silencer performance losses shall be included by the blower vendor in the blower performance calculation. The discharge silencer shall be rated for service to 275 degrees F.

The base frame shall be constructed from welded carbon steel or cast iron that shall be designed to maintain alignment of the blower internal components and the drive during operation. It shall be designed to resist distortion while being installed on vibration isolating mounts. The blower manufacturer shall supply a stainless steel grounding lug fully welded to the base.

2.6 FLEXIBLE CONNECTIONS

Each blower package shall be connected to the plant process air piping using a flexible connector located downstream of the discharge silencer to prevent transmission of noise and vibration from the blower package into the piping. The flexible connectors shall be Class 125 ANSI/ASA flange, single-arch type, multiple-ply rubber or synthetic elastomer, reinforced flexible connection, and shall be complete with steel backing rings. The flexible connector shall be rated for service to 275 degrees F.

2.7 CHECK VALVES

Each blower package shall be supplied with one check valve that shall be installed on the discharge line, designed for heavy-duty type shutoff service. It shall be of the full-bore, low pressure-drop, flapper type design with a steel body, Class 125 pressure rating, and 316 stainless steel flap embedded in EPDM with full-contact seal, for service to 275 degrees F. The valve shall be removable without disturbing the piping.

Pressure losses produced by the check valve shall be included in the blower performance calculation. Check valves shall be by Aerzen, Duo-Check, or equal.

2.8 PRESSURE RELIEF VALVES

Each blower package shall be supplied with a single pressure safety valve on the discharge side of the blower mounted downstream of the discharge silencer and upstream of the check valve. The safety valve shall be set to protect the blower from exceeding its maximum pressure rating, and shall be sized to pass 100 percent of the design flow. The valve shall be field adjustable, spring loaded, and have a certificate of conformity to PED. The pressure relief valve shall also be housed by the sound enclosure and shall relieve into a segmented section of the sound enclosure. The safety valve shall be rated for service to 275 degrees F.

2.9 PRESSURE AND TEMPERATURE INSTRUMENTATION

Pressure and temperature gauges shall be furnished and installed on the blower discharge header as shown on the Drawings with an indicator mounted on the outside of the blower enclosure. The pressure gauges shall be glycerin-filled and have a range of 0 to 15 psig with a minimum 4-inch-diameter dial, with a pulsation snubber, Ashcroft or equal. The temperature gauge shall be a 90 degree back angle with a 4-inch aluminum scale with black etched figures graduated from 80 to 250 degrees C, a red reading, hand calibrated tube, a 3-1/4 inch stem, including a 3/4-inch male pipe thread and a stainless steel bulb. The brass case shall have a gray enamel finish, a rattle-proof glass front and shall be resistant to moisture, dust, and fumes.

Each blower discharge assembly shall also be equipped with a temperature switch. The temperature switches shall have a manual reset function. The temperature switches shall have a SPDT contact rated to switch at least 3A at 120 VAC and at least 1A at 24 VDC.

A vacuum gauge shall be furnished and installed on each blower inlet. The vacuum gauges shall be oil filled and have a range of 0 to 30-inches water (vacuum) and shall have a minimum of a 4-inch-diameter dial. Pressure and vacuum gauges shall be supplied with a bronze pressure snubber.

2.10 VIBRATION ISOLATION PADS

Each blower package shall be supplied with vibration isolating feet with a minimum efficiency of 80 percent. Blower manufacture shall be responsible for attenuating noise and vibration in the blower package such that no special installation base shall be required, nor shall any additional measures be required to reduce vibrations from the blower package being transmitted to the base or the piping.

2.11 ACOUSTIC ENCLOSURES

Each blower package shall be supplied with an acoustic enclosure covering the entire blower package. The panels shall be made of galvanized steel sheet. The skid shall be of the same color. The sound enclosure acoustic material shall comply with UL 94 - HF1 for fire-retardant, self-extinguishing, non-dripping materials.

The enclosure and the blower package shall be both mounted on a skid/oil-drip pan designed for meeting environment protection standards. Fork lift channels shall be included to allow for easy transportation and installation.

A grounding strap shall be installed between the blower base and the package skid to bypass any vibration isolating mounts. Quick release panels, each less than 50 lbs. (as mandated by OSHA) must provide easy and quick access for routine maintenance of the blower and the package components.

A shaft driven, high efficiency, blower enclosure ventilation fan shall be included to provide ventilation and cooling integral to the sound enclosure. The cooling fan shall be sized for sufficient heat removal from the sound enclosure, even when the blower is operated with a VFD. Blower manufacturers requiring a separate motor driven fan for cooling shall indicate this in their bid proposal and the Contractor shall be responsible for any additional conduit, wiring, and instrumentation supply and installation required.

Electrical components, instrumentation and instrument connections shall not be mounted or interface with moving panels of the sound enclosure.

Both blower oil sumps shall be piped to a common fill and drain, located at the front of the package for easy maintenance. An oil level indicator shall be mounted on the outside of the enclosure, which gives an accurate oil level indication while the blower is in operation. All oil lines to be hydraulic hose with fittings. No plastic tubing with compression fittings are allowed.

The sounds attenuating enclosure external finish shall be applied as a powder coat rated for 4,000 hours direct salt spray.

The installed sound attenuating enclosure must be designed with hinged, lift-off panels to provide access to all maintenance points without disassembly of the enclosure. The panels must have fully retained closure fasteners.

For this installation the blower enclosure will be grounded using the blower motor grounding conductor. No supplemental grounding conductor for the blower enclosure shall be required for the blower warranty.

2.12 MOTOR

The motors shall be standard horizontal, TEFC premium efficiency electric induction, motors meeting NEMA MG-1 and other applicable NEMA, ANSI and IEEE standards. Motors shall be constructed with Class F or H insulated windings, Design B 30,000 AFBMA hour rated anti-friction bearings, cast iron frame and end bells. The motor for the Aeration Basin Blower shall be rated at a maximum of 5 hp, 460 volts AC, 3 phase, 60 Hz, 1,800 rpm synchronous speed (4 pole), inverter duty at 40 degrees C ambient air temperature with a 1.15 service factor. The motor nameplate horsepower (excluding service factor) shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shutoff to run-out.

The motors shall be rated "Inverter Duty" suitable for operation with the variable frequency drives specified in Division 16, Electrical, and shall be coordinated with the thermal, electrical, and mechanical characteristics of the drives actually supplied. Motors shall be suitable for operation on a PWM drive with output to the motor conditioned by a reactor or filter as shown on the electrical Plans. These motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (2,000 volts minimum) for VFD operation. The turndown ratio for the motors shall be as required for the flow range specified for the blowers. The motors shall be capable of running throughout the operational speed range without supplemental cooling.

The blowers shall be supplied with motors capable of meeting the design conditions specified in Part 1.4 of this Section at a maximum operating frequency of 60 Hz. Operating the motor and associated VFD at above 60 Hz to meet the design conditions is not acceptable.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120 volt AC and 24 volt DC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Motors shall be mounted in a manner that permits conduit connection to the motor terminal box directly using straight lengths of flexible metal conduit (i.e. without offsets or dog legs).

Motors shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment."

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11C Table C408.8(1)), regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

Motors shall be by Baldor, US Motors, Reliance, Toshiba/Houston; or WEG, with an extended warranty. No other motor manufacturers will not be accepted.

2.13 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION (SEE SECTION 11000-2.9)

The Contractor shall maintain a spreadsheet or database tabulation of the motor and load characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This spreadsheet shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum and maximum equipment or motor speed, acceleration/deceleration time of the driven equipment such as pumps, compressors, blowers, etc. The spreadsheet shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the most current motor and driven equipment information for the submitted equipment. The updated spreadsheet shall be provided to the variable frequency drive suppliers prior to shop testing of the VFDs. The spreadsheet list shall have the following information as a minimum:

Motor and Driven Equipment Characteristics			
Motor Data:	Full Load Amps		Amps
	Nominal Motor Voltage		Volts
	Nominal Motor Frequency	60	Hertz
	Nominal Motor Speed		RPM
	Input Phase Loss Behavior	Fault	
	Recommended Stopping Mode (i.e. coast, brake etc.)		
Driven Equipment Data:	Maximum Motor Frequency		Hertz
	Minimum Motor Frequency		Hertz
	Acceleration Time		seconds
	Deceleration Time		seconds

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the

Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data on a revised motor characteristic spreadsheet.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments of the motor characteristics and include in the list described in the preceding paragraph.

2.14 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Shaft Bearings.....one set for each blower
End Cover Oil Seal .....one set for each blower
Main Oil Seals.....one set for each blower
Complete Set of Gaskets and O-rings.....one set for each blower
Inlet Filter Element .....two for each blower
Drive Belts .....one set for each blower

2.15 PAINTING

Blowers, motors, acoustical enclosures and accessories shall be factory painted in accordance with Section 09900-2.2B of these Specifications.

2.17 FACTORY TESTING

An actual performance bench stage test per ISO 1217 shall be performed on each blower at the factory prior to shipment. Blower manufacturer certification shall be submitted to the Engineer prior to delivery of the blowers.

PART 3 EXECUTION

3.1 INSTALLATION

The blowers and accessories shall be installed as shown on the Drawings and as specified herein and in accordance with the manufacturer's instructions.

All piping will be supported so as to preclude the possibility of exerting undue forces and moments on the blower flanges. Suitable flexible couplings will be furnished to isolate the blowers from the piping system.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, capacity, and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 3 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (2 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price. If the project sequencing allows for the startup, testing and instruction to occur for more than one blower application concurrently then the manufacturer may do so only if agreed to by the Owner and Engineer.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11374

REGENERATIVE BLOWERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing a new regenerative blower as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
09900	Painting
11000	Equipment General Provisions
11010	Vibration and Critical Speed Limitations
15050	Piping Systems
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Waste Activated Sludge Blower	01 WB 01

1.4 PERFORMANCE REQUIREMENTS

The blowers shall have the following capacities and discharge pressures when operated at an elevation of 80 feet above sea level, inlet pressure of 14.7 psia, inlet air temperature of 20 to 100 degrees F, and relative humidity of 20 to 100 percent.

Parameter	Performance Requirement
Regenerative Blower 1	
Design Maximum Standard Capacity (scfm)	62
Discharge Pressure (psig)	7.0
Maximum Blower Speed at Design (rpm)	2500
Free Field Noise Pressure @ 3 Feet	65 dB(A)

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The regenerative blower shall be Ametek Rotron model DR633AY72M or equal as manufactured by Roots. No other manufacturers or models shall be accepted.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Ametek Rotron. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

In order to assure uniform quality, product functionality, and ease of maintenance; all of the equipment specified in this Section shall be supplied by one manufacturer.

2.2 REGENERATIVE BLOWERS

The regenerative blower shall include the impeller, motor, and silencers. The housing which encases these elements shall be made of high strength aluminum alloy and be of one-piece construction. The impeller shall be constructed of high strength aluminum. The blower inlet and outlet flanges shall be cast iron. Soft metals such as aluminum shall not be acceptable. The unit shall include permanently lubricated sealed ball bearings for operation under high speed, and high and low temperatures. Bearing shall be B10 Life rated for 15,000 hours of continuous operation.

2.3 INTAKE AIR FILTER/SILENCER

The blower package shall be supplied with one combination inlet filter/silencer. The filter media efficiency must meet the requirements of ASHRAE 52.2 MERV7 50 to 70 percent at 3 to 10 microns corresponding to EN779 G4. The inlet filter/silencer shall be mounted to the inlet flange of the blower. The silencer portion shall be located upstream of the inlet filter. Filter and silencer performance losses shall be included in the blower performance calculation.

Vacuum gauge or other suitable device shall be supplied and mounted, for sensing of inlet vacuum and blinding of filter medium.

2.4 DISCHARGE SILENCERS

Each blower package shall be supplied with one combination base frame/discharge silencer. The silencer shall be a chamber type design for maximum sound attenuation and shall not use fibrous or absorption materials of any kind. Fabricated of a single shell of pressure vessel quality steel with continuous welds, the silencer must be subject to a pressure test for tightness and strength at a minimum of 1.65 times the maximum blower operating pressure. The silencer shall have a machined inlet connection where the discharge flange of the blower stage bolts directly to, with no intermediary pieces. Discharge silencer performance losses shall be included by the blower vendor in the blower performance calculation.

The base frame shall be constructed from welded carbon steel or cast iron that shall be designed to maintain alignment of the blower internal components and the drive during operation. It shall be designed to resist distortion while being installed on vibration isolating mounts. The blower manufacturer shall supply a stainless steel grounding lug fully welded to the base.

2.5 FLEXIBLE CONNECTIONS

The blower package shall be connected to the plant process air piping using a flexible connector located downstream of the discharge silencer to prevent transmission of noise and vibration from the blower package into the piping. The flexible connectors shall be Class 125 ANSI/ASA flange, single-arch type, multiple-ply rubber or synthetic elastomer, reinforced flexible connection, and shall be complete with steel backing rings.

2.6 CHECK VALVES

The blower package shall be supplied with a check valve that shall be installed on the discharge line, designed for heavy-duty type shutoff service. It shall be of the full-bore, low pressure-drop, flapper type design with a steel body, Class 125 pressure rating, and steel flap embedded in EPDM with full-contact seal, for service to 275 degrees F. The valve shall be removable without disturbing the piping.

Pressure losses produced by the check valve shall be included in the blower performance calculation. Check valves shall be by Duo-Check, or equal.

2.7 BUTTERFLY VALVES

Each blower discharge line shall be furnished with a butterfly valve, suitable for use on air systems as shown on the Plans and described herein. Discharge valve shall be a high performance butterfly valve with lever actuator, double flanged or wafer, Class 125 pressure rating. Butterfly valves shall have cast iron body, stainless steel shaft, aluminum bronze disc, Buna-N seal and liner, and all materials shall be suitable for operation at temperatures to 275 degrees F.

Butterfly valves shall be Milwaukee Valve MW Series or equal.

2.8 PRESSURE RELIEF VALVES

Each blower package shall be supplied with a single pressure safety valve on the discharge side of the blower mounted downstream of the discharge silencer and upstream of the check valve. The safety valve shall be set to protect the blower from exceeding its maximum pressure rating, and shall be sized to pass 100 percent of the design flow. The valve shall be field adjustable, spring loaded, and have a certificate of conformity to PED. The pressure relief valve shall also be housed by the sound enclosure and shall relieve into a segmented section of the sound enclosure.

2.9 PRESSURE AND TEMPERATURE INSTRUMENTATION

Pressure and temperature gauges shall be furnished and installed in the blower package with an indicator mounted on the outside of the blower enclosure. The pressure gauges shall be glycerin-filled and have a range of 0 to 15 psig with a minimum 4-1/2-inch-diameter dial, with a pulsation snubber, Ashcroft or equal. The temperature gauge shall be a 90 degree back angle with a 4-1/2-inch aluminum scale with black etched figures graduated from 80 to 250 degrees C, a red reading, hand calibrated tube, a 3-1/4 inch stem, including a 3/4-inch male pipe thread and a stainless steel bulb. The brass case shall have a gray enamel finish, a rattle-proof glass front and shall be resistant to moisture, dust, and fumes.

Each blower discharge assembly shall also be equipped with a temperature switch. The temperature switches shall have a manual reset function. The temperature switches shall have a SPDT contact rated to switch at least 3A at 120 VAC and at least 1A at 24 VDC.

A vacuum gauge shall be furnished and installed on each blower inlet. The vacuum gauges shall be oil filled and have a range of 0 to 30-inches water (vacuum) and shall have a minimum of a 4-1/2-inch-diameter dial. Pressure and vacuum gauges shall be supplied with a bronze pressure snubber.

2.10 VIBRATION ISOLATION PADS

Each blower package shall be supplied with vibration isolating feet with a minimum efficiency of 80 percent. Blower manufacture shall be responsible for attenuating noise and vibration in the blower package such that no special installation base shall be required, nor shall any additional measures be required to reduce vibrations from the blower package being transmitted to the base or the piping.

2.11 ACOUSTIC ENCLOSURES

Each blower package shall be supplied with an acoustic enclosure covering the entire blower package. The panels shall be made of galvanized steel sheet. The skid shall be of the same color. The sound enclosure acoustic material shall comply with UL 94 - HF1 for fire-retardant, self-extinguishing, non-dripping materials.

The enclosure and the blower package shall be both mounted on a skid/oil-drip pan designed for meeting environment protection standards. Fork lift channels shall be included to allow for easy transportation and installation.

A grounding strap shall be installed between the blower base and the package skid to bypass any vibration isolating mounts. Quick release panels, each less than

50 lbs. (as mandated by OSHA) must provide easy and quick access for routine maintenance of the blower and the package components.

A shaft driven, high efficiency, blower enclosure ventilation fan shall be included to provide ventilation and cooling integral to the sound enclosure. The cooling fan shall be sized for sufficient heat removal from the sound enclosure. Blower manufacturers requiring a separate motor driven fan for cooling shall indicate this in their bid proposal and the Contractor shall be responsible for any additional conduit, wiring, and instrumentation supply and installation required.

Electrical components, instrumentation and instrument connections shall not be mounted or interface with moving panels of the sound enclosure.

Both blower oil sumps shall be piped to a common fill and drain, located at the front of the package for easy maintenance. An oil level indicator shall be mounted on the outside of the enclosure, which gives an accurate oil level indication while the blower is in operation. All oil lines to be hydraulic hose with fittings. No plastic tubing with compression fittings are allowed.

The sounds attenuating enclosure external finish shall be applied as a powder coat rated for 4,000 hours direct salt spray.

The installed sound attenuating enclosure must be designed with hinged and/or lift-off panels to provide access to all maintenance points. The panels must have fully retained closure fasteners.

2.12 MOTOR

A. APPROVED MANUFACTURERS

Motors shall be by Baldor, US Motors, Reliance, Flygt, or Toshiba/Houston. No other manufacturers shall be accepted.

B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
Regenerative Blower	
Motor Size	7.5 hp
Operating Voltage	480 VAC
Phase	3
Frequency	60 Hz
Synchronous Speed	1,800 rpm
Inverter Duty?	Yes
Motor Overtemperature Protection?	Yes
Classified Environment?	No

C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal TEFC premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper. Motor design shall be Type B.

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical, and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

2.13 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor

protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.5 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.6 PAINTING

Blowers, motors, and accessories shall be painted in accordance with Section 09900-2.2C of these Specifications.
Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

2.7 FACTORY TESTING

A. PERFORMANCE

Tests shall be in accordance with the ASME Power Test Code for Centrifugal Compressors and Exhausters, PTC-10-1974 (reaffirmed 1986) edition. Power measurement shall be determined as described in Paragraph 4.38, "Measurement of Shaft Input by Electric Motors," except electrical input shall be measured at the input to the Inverter/VFD, not the electric motor. The ASME Code, PTC 19.7-1980, Part 7, "Measurement of Shaft Power," Section 5 shall also be followed. The input wire horsepower to the VFD shall be determined. That is, the objective of

performance tests is to confirm the power consumption of the VFD/drive motor and blower unit. The test shall include determination of the surge point and verification of the design points.

1. The net delivered flow rate and discharge pressure shall be measured, recorded, and guaranteed with no negative tolerance. There shall be no other tolerances or measuring uncertainties used in reporting test results, i.e., the tests shall be reported with ± zero percent tolerance, except for an allowance of ± 5 percent error on input power per ASME 19.7, Paragraph 5.06.

2. The capacity of the blower shall be defined as per Paragraph 4.26 of the ASME PTC-10 Power Test Code. Specifically, capacity is defined as, "the net rate of flow compressed and delivered, expressed in terms of cubic feet per minute at the prevailing inlet pressure and inlet temperature. It shall be measured in a suitable manner to exclude effectively all external leakage losses from sources such as shaft seals." That is, air flow shall be measured on the discharge side of the blower at zero percent tolerance.

3. All test equipment shall be calibrated and certified by an independent test agency no more than 12 months prior to the test date. Certificates shall show the stability of calibration over a period of at least one year per ISO 9001, Paragraph 4.11.

4. A written report certifying that the blowers have been satisfactorily tested shall be submitted to the Engineer.

B. ELECTRICAL AND CONTROL SYSTEM FUNCTIONAL TEST

The manufacturer shall submit the results of an electrical and control system functional system test certified by a professional engineer or testing laboratory to the Engineer.

C. NOISE

The manufacturer shall submit the results of a full-load noise level test certified by a registered engineer or testing laboratory to the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

The blowers and accessories shall be installed as shown on the Plans and as specified herein and in accordance with the manufacturer's instructions.

All piping will be supported so as to preclude the possibility of exerting undue forces and moments on the blower flanges. Suitable flexible couplings will be furnished to isolate the blowers from the piping system.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, capacity, and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (1 day) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for one additional service call during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11375

AIR DIFFUSION EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing, installing and testing a fine bubble membrane diffused aeration system in the Aeration Basin and a coarse bubble diffused aeration system in the WAS Tank as shown on the Plans and specified herein.

The equipment shall include drop piping, air distribution headers and supports, blow-off piping and valves, and diffusers. The equipment shall be complete up to and including the drop pipe flange connection to each diffuser grid, as shown on the Plans.

The fine bubble-diffused aeration equipment shall provide full-floor diffuser coverage in the areas of the Aeration Basin and WAS Tank shown on the Plans. The manufacturer shall submit the recommended diffuser grid arrangement in each process unit for the Engineer's review.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
11370	Rotary Positive Displacement Blowers
13205	Vertical Polyethylene Tanks
15050	Piping Systems

1.3 PERFORMANCE REQUIREMENTS

The diffuser system shall have an oxygen transfer efficiency as stated below. Standard conditions shall be at an elevation of 80 feet above sea level, a minimum water temperature of 10 degrees C, and using the non-steady state procedure.

Parameter	Performance Requirement
Aeration Basin	
Diffuser Type	Fine bubble
Design Standard Oxygen Requirement (lb O_2/d)	310
Maximum SCFM/Diffuser (9-inch Disc)	2
Maximum Air Available (SCFM)	68
Maximum Allowable Pressure at top of drop leg (psig)	4.51
Diffuser Submergence (feet)	9.2
WAS Tank	
Diffuser Type	Coarse Bubble
Maximum SCFM/Diffuser (9-inch Disc)	6.2
Maximum Air Available (SCFM)	62
Maximum Allowable Pressure at top of drop leg (psig)	6.6

The quantities of diffusers required are based on the Maximum Allowable Air Rate per diffuser are the minimum quantities acceptable. Additional diffusers shall be furnished as required to satisfy the standard oxygen requirements without exceeding the maximum air available. In addition to the in-basin diffuser quantity required, an extra 10 percent of this quantity shall be supplied as uninstalled spare membranes.

The headloss through the disc diffuser shall not exceed 16 inches of water under clean water conditions and at the maximum air rate available.

1.4 EXPERIENCE REQUIREMENTS

A reference list for full scale operating wastewater treatment plants using the diffused aeration equipment, not pilot or demonstration plants, shall be supplied with equipment submittals. This list shall include the names and telephone numbers of contacts. The reference list must have a minimum of five installations each operating for at least 3 years. Reference plants must have a diffuser count equal to or greater than the number of diffusers required for this project. Diffusers at referenced plants must be membrane disc style.

The Equipment Manufacturer shall submit full scale operating data from at least three facilities demonstrating the fine bubble membrane product to be supplied has maintained at least 96 percent of the new (original) membrane process aeration efficiency after 3 years of operation. Tests conducted in-house by the manufacturer shall not be acceptable.

1.5 QUALITY ASSURANCE

A. FINE BUBBLE MEMBRANE DIFFUSER TESTING

1. Option A – Certified OTE Test Data

a. Provide certified test data from a previously conducted shop clean water performance test to demonstrate the capacity of equipment to meet the specified oxygen requirements. Test shall have been conducted per the ASCE Clean Water Test Procedure. Testing shall have been conducted at a diffuser submergence and diffuser density within plus or minus 20 percent of those required for the subject project. Provide data from a minimum of three test runs.

b. Tests shall have been conducted by an independent testing firm. In-house testing shall not constitute acceptable data.

c. Test data shall be provided with equipment submittals.

d. If acceptable certified test data cannot be provided, the aeration system supplier shall conduct a Factory Oxygen Transfer Test to substantiate aeration system performance.

2. Option B – Factory Oxygen Transfer Test

a. Conduct a shop clean water performance test to demonstrate the capacity of equipment to meet the specified oxygen requirements. Conduct tests at the manufacturer's facility by independent testing firm and allow witnessing by the Engineer. Include all costs for testing, including witnesses' expenses in equipment price.

b. Perform tests in accordance with the latest ASCE Clean Water Test Procedure.

c. Conduct at least three test runs each at each of the three specified design conditions.

d. Testing shall be conducted in a tank having a surface area greater than 200 square feet to eliminate the potential of wall effects. Testing shall be conducted at the specified submergence and a diffuser density equivalent to the actual project tank configuration. Diffuser density is defined as

the ratio of the total tank surface area to the total combined diffuser surface area.

e. Submit data from all tests for review by the Engineer, following the completion of the testing and prior to equipment shipment.

1.6 SUBMITTALS

Submittals shall be in accordance with Section 01300 and 11000. In addition, the submittals shall include the following:

A. Aeration diffuser layout, including drop pipe and purge locations

B. Membrane material integrity and chemical resistance data (fine bubble)

C. Test data on diffuser backflow mechanism (fine bubble)

D. Reference list of full scale facilities

E. Three full-scale clean water oxygen transfer efficiency test reports (fine bubble)

F. Membrane performance reports after 3 years of operation (fine bubble)

G. Structural calculations

H. Build America, Buy America certificate of compliance

1.7 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.8 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The air diffusion system including fine bubble diffusers shall be manufactured by Aquarius, Environmental Dynamics International (EDI), or SSI Aeration. No other manufacturers shall be accepted.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Aquarius. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

All diffusers supplied shall be furnished by one manufacturer.

2.2 FINE BUBBLE MEMBRANE DIFFUSERS

Diffusers shall be installed in the diffuser grids in the Aeration Basin and WAS Tank to meet the performance requirements. Approximate dimensions of the diffuser grids are shown in the Plans.

Diffuser membrane shall be an ethylene propylene elastomeric material (such as EPDM) with an ultraviolet inhibitor and compounds designed for resistance to chemical attack, weathering and aging. Data shall be provided to show the types of chemicals the membrane is resistant to. With the general arrangement Plan submittal, the Manufacturer shall provide certified data documenting the integrity of the membrane.

The membrane diffuser shall have an integral backflow prevention mechanism. Certified test data on the diffuser back flow mechanism as specified herein shall be provided. The backflow valve shall be designed without any mechanical moving parts. If the backflow mechanism is designed with moving parts, the manufacturer shall provide certified data with equipment submittals, prepared by

an independent consultant, documenting the operation of the backflow mechanism over a minimum of 15,000 cycles in wastewater without mechanical failure or jamming.

The membrane shall be secured on to the mounting holder with a tongue and groove lip designed to increase the tension on the point of engagement as the diffuser air rate increases. All metallic fine bubble diffuser components shall be Type 316 stainless steel. Type 304 stainless steel shall not be acceptable.

An acceptable alternative membrane retaining device shall be a PVC threaded retaining ring that secures the membrane to the mounting holder with an air-tight, positive O-ring seal.

Furnish PVC diffuser element holders with an air plenum chamber below the diffuser support plate. The element holders shall provide complete peripheral edge support for the membrane diffuser element. Solvent weld element holders to the distribution headers in the factory to resist dead load of 200 pounds applied vertically to the outer edge of the diffuser unit. Diffuser holders attached to the distribution header via mechanical fasteners shall not be acceptable.

2.3 COARSE BUBBLE DIFFUSERS

Coarse bubble diffusers shall be furnished and installed in each oxidation ditch bioselector and Aerobic Digesters 1 and 2. All welded parts shall be fabricated from sheets and plates of Type 304L stainless steel with a 2D finish. Non-welded parts shall be fabricated from Type 304 stainless steel.

All welding shall be conducted in the factory using MIG, TIG or plasma-arc welding inert gas processes. Simplex diffuser connectors shall be factory welded to the air header and located as shown on the Plans. The headers and connectors shall be designed to resist a vertical dead load applied to the threaded end of the connector that results in a bending moment of 1,000 inch-lbs. without exceeding 24,000 psi design stress in any part of the header wall or connector. To limit long term flexural failure of the system, mutually reinforce the connectors by continuously welding gussets between the vertical sidewall of the header and both sides of the connector ends. Provide gussets with a minimum cross sectional area of 0.125 square inches. Gussets shall be welded to the connector no less than one inch from the connector ends and to the sidewall of the pipe within 1/2 inch of the horizontal centerline. Welding of the connectors to the header shall be by means of a full penetration butt weld. Use of fillet welds at the connection between the diffuser connector and header is not permitted.

All stainless steel shall be pickled by using the following procedure:

A. Remove all carbon deposits, greases and oils by pickling and neutralizing to aid the regeneration of a uniform corrosion resistant chromium oxide film.

B. After welding and brushing, all stainless steel assemblies and parts shall be completely immersed in a pickling solution consisting of 10 percent nitric acid and 3 percent hydrofluoric acid in a water bath at 140 degrees F for a minimum of 15 minutes. The parts shall be free of iron particles or other foreign material after this procedure. Scrub as required. Immediately follow by a final thorough rinse in clean hot water and let dry. Corrosion protection techniques not utilizing full immersion are not acceptable.

C. The manufacturer shall verify that pickling has been performed per the above specifications.

The diffusers shall be of proven non-clog design with no flexible or moving parts. The diffusers shall consist of a balancing nozzle with orifice insert, if required, an invert air reservoir, air exit ports, cast end cap at inlet end and a full-length deflector along the bottom of the diffuser. The inlet end cap shall be cast with an alloy equivalent to Type 304L stainless steel. The inlet end cap shall be provided with a Schedule 80, 3/4-inch NPT male pipe thread connection and integral hex head nut. The diffuser bodies and outboard end caps shall be fabricated from Type 304L stainless steel. The cast end cap shall be connected to the diffuser by a full penetration buttweld. The diffuser layout and number shall be as shown on the Plans.

2.4 DIFFUSER AIR PIPING

A. GENERAL

The diffuser supplier shall furnish drop pipes, submerged manifolds and diffuser headers in each diffuser grid. Piping shall be fabricated in conformance with this Section and as shown on the Plans.

B. DROP PIPE

Dropleg and connected submerged main header shall be sized as shown on the Plans and fabricated from Type 304L stainless steel pipe conforming to ASTM A312. Other non-welded parts and pieces such as nuts, bolts, washers, supports, follower flanges and anchor bolts shall be made from Type 316 stainless steel.

All stainless steel pipe larger than 2 inches in diameter shall be Schedule 10S and conform to ASTM A778. All stainless steel pipe 2 inches and smaller in diameter shall be fabricated from Type 304L stainless steel pipe conforming to ASTM A 312, and shall be Schedule 40.

All threaded fittings shall be Type 304 stainless steel and conform to ANSI Class 150, B16.3.

All gaskets shall be 45 to 55 durometer (Shore A) neoprene.

All Type 304L stainless steel material shall conform to the chemical requirements of ASTM 240-72A and AISI 304L, except that the maximum carbon content shall be limited to 0.30 percent. Dimensions shall be as shown on the Plans with dimensional tolerances uniform to ASTM 554-72 and ASTM A530-72.

All welding shall be completed in the factory. Field welding shall not be permitted. All welding shall be by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint.

Interior weld beads shall be smooth, evenly distributed with an interior projection not exceeding 1/16 inch beyond the ID of the air header or fittings.

The outside welds shall be wire brushed. Brushes shall be stainless steel and used only on stainless steel.

All stainless steel shall be pickled by using the following procedure:

1. Remove all carbon deposits, greases and oils by pickling and neutralizing to aid the regeneration of a uniform corrosion resistant chromium oxide film.

2. After welding and brushing, all stainless steel assemblies and parts shall be completely immersed in a pickling solution consisting of 10 percent nitric acid and 3 percent hydrofluoric acid in a water bath at 140 degrees F for a minimum of 15 minutes. The parts shall be free of iron particles or other foreign material after this procedure. Scrub as required. Immediately follow by a final thorough rinse in clean hot water and let dry. Corrosion protection techniques not utilizing full immersion are not acceptable.

3. The manufacturer shall verify that pickling has been performed per the above specifications.

C. MANIFOLDS AND HEADERS

All manifold and distribution header pipe and fittings for fine bubble diffusers shall be constructed of Type 1, Grade 1 PVC with $Ti0_2$ ultraviolet light inhibitor conforming to ASTM D-1784. Pipe shall have a minimum hydrostatic design stress rating of 2,000 psi.

Manifold pipe shall be Schedule 40 conforming to ASTM D1784, D1785 and D2466.

Distribution header pipe and fittings for fine bubble diffusers shall conform to ASTM 3034-80, SDR 30.5, with a minimum wall thickness of 0.138 inch.

Distribution header pipe for fine bubble diffusers shall be provided with factory installed, high strength PVC mounted saddles for mounting diffuser holders. Field installation of mounting saddles shall not be acceptable.

Air distributor sections shall be joined with positive-locking fixed-threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation. Push on, bell and spigot, slip-on or expansion-type joints are not acceptable for submerged joints. Design threaded union joints with a spigot section connected to one end of the distribution header, a threaded socket section connected to the mating distribution header, an O-ring gasket, and a threaded screw-on retainer ring. Solvent welding shall be done in the factory. Flanged joints shall be designed with a Class 125 ANSI drilling angle, face ring, following flange and stainless steel hardware.

Removable end caps shall be supplied at the ends of all headers to allow purging of debris before operation.

Fine bubble diffuser distribution piping grids shall be provided with liquid purging systems. Each distribution grid shall be provided with one purge system. Purge system piping shall be 1-inch PVC with shut off valves.

Piping assemblies shall be designed to withstand expansion and contraction from the specified field operating conditions.

Maximum spacing between distribution headers shall not exceed 4 feet to prevent solids deposition.

Manufacturer shall provide connection to the WAS tank PVC down pipe assembly, from a point 2 feet above the tank floor. See Section 13205.

D. SUPPORTS

Adjustable pipe supports shall be provided which allow movement of the pipe to compensate for variation in tank floor height, allowing adjustment of ±4 inches total vertical variation and 1/2-inch lateral variation. Support system shall be designed for installation on flat concrete floors with a safety margin of ten against calculated buoyant forces. Space supports on maximum 8-foot centers. Calculations shall be provided by supplier with shop Plans to verify structural design of pipe supports.

All stands, nuts, bolts, washers, and expansion fasteners shall be of Type 316 stainless steel.

The manifold supports for the vertical polyethylene WAS tank shall be provided by the manufacturer and shall be concrete pedestal blocks that rest on the bottom of the polyethylene tank with fasteners. The concrete pedestal blocks shall be sufficient in quantity and size to prevent uplift of the system as supported by calculations to be approved with the submittal. The dropleg for the WAS tank will be provided tank manufacturer with supports in place upon tank delivery.

The manufacturer shall supply the WAS tank coarse bubble air diffuser system support system, ensuring all components are engineered for secure installation within the FRP tank, without mechanical connection to the tank floor. The manufacturer shall submit calculations for and provide the necessary quantity of non-corrosive, engineered concrete pedestal supports for the supplied system. These pedestal supports shall be designed to rest securely on the FRP tank floor, effectively supporting the diffuser manifolds to prevent system uplift, mitigate vibration, and maintain optimal structural integrity and alignment during all operational conditions.

2.5 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Fine bubble membrane diffuser disks .....10% extra as uninstalled spares
Diffuser holders and attachment hardware ....5% extra as uninstalled spares

2.6 PAINTING

Air diffusion equipment shall be painted in accordance with Section 09900-2.2.B of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

2.7 FACTORY TESTING

The air diffusion equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall ensure that the complete system will operate as desired under field conditions.

PART 3 EXECUTION

3.1 INSTALLATION

Aeration equipment shall be installed as shown on the Plans and in accordance with the manufacturer's instructions and recommendations. All diffuser air connections on a single header shall be installed in a single horizontal plane within a tolerance of plus or minus 1/4 inch.

3.2 FIELD TESTING

The Contractor shall notify the Owner and Engineer in writing when the installation is ready for inspection. The inspection shall be performed in the presence of the Engineer. All piping, joints and supports shall be inspected for proper installation and conformance to the Plans.

Piping shall be inspected with leveling instruments to insure that all headers are level and diffuser outlets are within a maximum of $\pm$1/4 inch of same elevation.

The Contractor shall fill the tanks to a depth of 1 foot above the diffusers. With the blowers operating, the equipment shall be checked for leakage. A visual check that air is evenly distributed throughout each tank shall be performed.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the air diffusion equipment manufacturer shall be provided. Services shall include 3 days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment for each process unit application. One trip (2 days) shall be for installation inspection, certification and

testing; and one trip (1 day) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the air diffusion equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price. If the project sequencing allows for the startup, testing and instruction to occur for more than one unit application concurrently, then the manufacturer may do so only if agreed to by the Owner and the Engineer.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11501

MEMBRANE EQUIPMENT SYSTEM INSTALLATION

PART 1 GENERAL

1.1 SCOPE

A. The work to be provided by the Contractor under this specification section shall include the installation of the equipment, instrumentation, materials, and appurtenances as supplied by the Membrane Equipment System Supplier (the Supplier) and includes the supply and installation of additional equipment, instrumentation, and materials as specified herein and as shown on the Plans and otherwise indicated in the Contract Documents.

B. The Contractor shall be assigned all portions of the executed Contract with Kubota Membrane USA Corporation, titled, "Procurement of Membrane Equipment System and Services" except for work associated with the bid item titled "Preconstruction Services" in said contract. The executed Procurement of Membrane Equipment System and Services, Contract is included with the Specifications Volume II, Appendix A.

C. The Contractor shall coordinate with Kubota (the Supplier), for the supply, delivery, storage, and installation requirements for the Membrane System. The Contractor shall coordinate with Kubota (the Supplier), for the Membrane System. The information for the Contact person for Kubota, is included below:

Mr. Brian Travis
Project Manager
KUBOTA Water and Environment USA Corporation
19910 N Creek Pkwy, Suite 100
Bothell, WA 98011
Direct Tel: 425-534-1006
Email: brian.travis@kubota.com

D. The equipment, instrumentation, and materials to be provided by the Supplier are summarized herein and are also shown on the Contract Plans and detailed in the Supplier 100 percent Submittal Documents and Plans in Volume No. II, Appendix B of the Specifications, and in Appendix B of the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01110	Summary of Work
01190	Reference Standards
01300	Submittals
01800	Testing, Commissioning, and Training
11000	General Requirements for Equipment
11010	Vibration and Critical Speed Limitations
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical
Volume II, Appendix A	Procurement of Membrane Equipment System Supply and Services Contract
Volume II, Appendix B	Membrane Equipment System Supplier 100 Percent Submittal Documents
Plans, Appendix A	Membrane Equipment System Supplier 100 Percent Submittal Documents

1.3 EQUIPMENT LIST

Equipment numbers are listed on the Plans and are provided on the Equipment List in Appendix B of the Specifications.

1.4 SUBMITTALS

The Contractor shall provide submittals for items in the Contractor's scope of supply in accordance with Section 01300 of these Specifications.

1.5 SUMMARY OF SUPPLIER'S SCOPE OF SUPPLY AND WORK

A. The major equipment items to be supplied by the Supplier for installation by the Contractor include, but are not limited to the following:

1. Four submerged membrane modules, cassettes, frames, and rails.
2. Three permeate pumps.
3. Three air scour blowers.
4. In-basin membrane tank piping as identified on plans.
5. Membrane chemical cleaning system.
6. Valves and instrumentation shipped loose for installation.
7. Control Panels

B. The equipment, piping, valves, and instruments to be supplied by the Supplier for installation by the Contractor are listed, identified and detailed in the Equipment List, P&ID drawings, and other documents included in the Supplier 100 percent Submittal Documents and Plans in Volume No. II, Appendix B of the Specifications and Appendix B of the Plans. The equipment, piping, valves, and instruments to be supplied by the Supplier for installation by the Contractor are also shown on the Plans. The equipment, piping, valves, and instruments to be supplied by the Supplier will be shipped loose for installation by the Contractor as shown on the Plans and Specifications.

C. The Supplier will furnish a Membrane Equipment System Control Panel for installation by the Contractor.

D. The Supplier will provide PLC programming for the Membrane Equipment System Equipment.

E. The Supplier will provide construction on-site services, including Membrane Equipment System, installation assistance, training, startup and testing assistance for the Membrane Equipment System Equipment for the number of days and site trips as Specified in Section 11500-3.3B of the Membrane Equipment System Supply and Services Contract.

F. The Supplier will provide post-construction on-site services, including Membrane Equipment System commissioning and performance optimization services for the Membrane Equipment System Equipment for the number of days and site trips as Specified in Section 11500-3.3C of the Membrane Equipment System Supply and Services Contract.

G. The Supplier will provide remote support services, including providing toll-free telephone and internet-based support for the Membrane Equipment System Equipment for the time period as Specified in Section 11500-3.3D of the Membrane Equipment System Supply and Services Contract.

H. The Supplier will provide testing, commissioning, and training for the Membrane Equipment System Equipment as specified in Section 01800 of the Procurement of Membrane Equipment System Supply and Services Contract. The Supplier will provide for the number of man days as specified in Section 11500-3.3B of the Procurement of Membrane Equipment System and Service Contract for testing, commissioning, and training and for other construction on-site services.

I. The Supplier will submit factory and field test reports, PLC and OI programming submittals, equipment O&M manuals, and Manufacturer's affidavits for the Membrane Equipment System Equipment.

J. The Supplier will supply warranty services and on-call performance optimization services.

K. Supplier shall size all anchor bolts required for anchoring equipment components, accessories, and structural steel members to their concrete supports and foundation. Equipment anchors are identified in the Membrane Equipment System Supplier 100 Percent Submittal Documents.

1.6 SUMMARY OF CONTRACTOR'S SCOPE OF SUPPLY AND WORK

A. The Contractor shall unload the equipment and materials delivered by the Supplier and shall store all items as recommended by the Supplier. The dimensions storage requirements for the submerged membrane units are summarized in the Instruction Manual for the Submerged Membrane Unit in the Supplier 100 percent Submittal Documents and Plans in Volume No. II, Appendix B of the Specifications.

The Contractor shall be prepared take receipt of all of the Membrane Equipment System Equipment between the dates listed in the Summary of Work Specification Section 01110-1.5. The Contractor shall coordinate with the Supplier for delivery of the equipment.

The Contractor shall take receipt of the Membrane Equipment System and shall store all Membrane Equipment System items at an approved storage location. The membrane cassettes and diffuser pallets and associated components shall be stored in a temperature controlled environment between 5 degrees C and 40 degrees C and as required in Volume II, Appendix B, Section 103 of the Specifications. The approximate dimensions of these pallets and associated components are as follows:

- Four pallets at 3.5' L x 3.5' W x 8' H (membranes).
- Four pallets at 5' L x 4' W x 2' H (diffusers).
- One lifting tool at 3.5' L x 3.5' W x 2' H.
- Two cardboard boxes each 2' x 1' x 1'.

B. The Contractor shall furnish and install Motor Control Centers (MCCs), variable speed drives, panelboards, and transformers as shown on the Plans. The Contractor shall furnish and install all wiring interconnections, including wiring, conduit, disconnect switches, control stations, and other appurtenances required to provide power connections from the power distribution and motor control equipment to the Membrane Equipment System electrical loads. The Contractor shall furnish and install all instrumentation wiring, conduit and other appurtenances required to provide connections between the Membrane Equipment System components and the Membrane Equipment System Control Panel as shown on the Plans. The Contractor shall furnish and install all communications wiring, conduit and other appurtenances required to provide connections between the Membrane Equipment System Control Panel and the Plant PLC, as shown on the Plans. Termination of field wiring in the Membrane Equipment System Control Panel shall be performed by the Contractor in accordance with the Plans supplied with the Membrane Equipment System by the Supplier.

C. The Contractor shall install all equipment, instruments, piping, valves structural supports, and appurtenances supplied by the Supplier. The equipment, instruments, piping and valves to be supplied by the Supplier for installation by the Contractor are listed in the Equipment List and detailed information is provided for these items in the Supplier 100 percent Submittal Documents and Plans in Volume No. II, Appendix B of the Specifications, and these items are shown on the P&ID drawings in Appendix B of the Plans. The membrane system mechanical drawings, control panel, and electrical drawings are also detailed in Appendix B of the Plans. Instruments will be shipped loose for installation by the Contractor as shown on the Plans and Specifications.

D. The Supplier will furnish the permeate (PER) and low pressure air (ALP) piping, located in the Membrane Basins, for installation by the Contractor as identified on the Plans and Specifications.

E. The Contractor shall furnish and install the permeate (PER) and low pressure air (ALP) piping, from the connection points to the Supplier supplied piping, within the Membrane Basins, to all other connection points as identified on the Plans and Specifications. The Contractor shall furnish and install all other piping and connections to Supplier supplied equipment, instruments, valves, and appurtenances as shown on the Plans and Specifications.

F. The Contractor shall consult with the Supplier for installation support via telephone during normal business hours, Central Time.

G. The Contractor shall test all piping associated with the Membrane Equipment System as Specified in Section 15050.

H. The Contractor shall field verify all Membrane Equipment System instrumentation and equipment installation and wiring in the presence of the Engineer to show compliance with the Contract Documents. Upon completion of the field verification, the Engineer will provide a punch list of incomplete items which shall be completed by the Contractor prior to notifying the Supplier that the equipment is ready for startup and testing by the Supplier. Membrane Equipment System equipment and devices supplied by the Supplier and installed by the Contractor, which require electrical power, instrumentation, or control connections, **shall not** have power applied to the device or equipment by the Contractor prior to the arrival of the Supplier onsite for startup. Initial application of power to the devices or equipment shall occur only as part of the Supplier's startup and commissioning. All instruments shall be wired by the contractor at the instrument. Wires shall not be landed on the IO terminals until the Supplier is onsite. Contractor shall supply required labor to complete wiring while Supplier is on site. Supplier shall witness wiring at all I/O points.

I. The Contractor shall provide written notification to the Supplier that the equipment, piping, and electrical work have been installed and verified to be compliant with the Contract Documents and the Contractor shall provide 21 days notice for the Supplier to arrange for startup and testing.

J. The Contractor shall furnish and install all anchor bolts required for anchoring equipment components, accessories, and structural steel members to their concrete supports and foundation as sized by the Supplier.

K. The Contractor shall provide assistance (to the Supplier) for testing, commissioning and training of the Membrane Equipment System.

L. The Contractor shall provide on-site painting or touchup painting of equipment supplied by the Supplier which is damaged or chipped during installation. Contractor shall match colors as closely as possible based on commercial color matching. Any welds on galvanized structural parts shall be cleaned and painted with a high zinc content paint per the paint manufacturer's instructions by the Contractor. Paint shall match

galvanized surface color.

M. The Contractor shall provide and install all required piping and conduit supports for all piping, conduit, and ductwork installed, as Specified in Section 15066.

N. The Contractor shall furnish and install miscellaneous grout, anchor bolts, nuts, washers, anchor bolt adhesive, caulking, cleaner/primer, shims, threaded rod, anti seize compound, and epoxy as required.

O. Contractor shall avoid cross contamination of stainless steel surfaces by removing all carbon steel chips, filings, grinding dust and weld splatter from stainless steel surfaces daily.

1.7 WARRANTY

All equipment Supplied by the Supplier will be provided with a warranty covering defects in material and workmanship for a minimum period of 2 years from the date of successful completion of the Initial Performance Test, per Volume II, Appendix A, Section 11000-1.5, for the Membrane Equipment System. The membrane modules and Supplier manufactured equipment will be provided with a warranty in accordance with Volume II, Appendix A, Section 11500-1.5.

The Contractor warranty shall be provided in accordance with the General Conditions. The Contractor warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

1.8 PAYMENT

All costs for the Membrane Equipment System Supply, Construction Services and Post Construction Services as Specified in the Contract Procurement of Membrane Equipment System and Services shall be paid to the Contractor and shall be transferred to the Supplier and shall be for the amount for Bid Item No. 2, listed in the Proposal.

No separate or additional payment will be made for the work and material specified herein. All costs for the Membrane Equipment System Installation, as shown on the Plans and as specified herein, shall be included in the appropriate unit and lump sum bid items.

***** END OF SECTION *****

SECTION 11510

ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes labor, materials, and services to furnish a new pressurized, closed-vessel, high-intensity ultraviolet (UV) disinfection system, as specified herein. The UV system shall be complete and operational with all instrumentation and control equipment, UV cleaning systems and devices, appurtenances and accessories as specified herein and shown on the Drawings.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01800	Testing and Training
09900	Painting
11000	General Requirements for Equipment
13419	Pressure Transmitters
15050	Piping Systems
15066	Pipe and Conduit Support System
15100	Valves
Division 16	Electrical

1.3 EQUIPMENT LIST

Item	Equipment Number
UV Reactor 1	01 UV 01
UV Reactor 2	01 UV 02
UV Control Panel 1	01 UVCP 01
UV Control Panel 2	01 UVCP 02
UV Transmittance Monitor	01 UVT 01

1.4 DESIGN CRITERIA

The UV equipment shall disinfect municipal wastewater effluent (permeate from a flat-plate microfilter membrane bioreactor) with following characteristics:

Peak Equalized Flow (pass hydraulically)	0.112 mgd (78 gpm)
Peak Day Flow (Disinfection Design Flow)	0.062 mgd (43 gpm)
Maximum Monthly Flow	0.038 mgd (26 gpm)
Annual Average Flow	0.024 mgd (17 gpm)
Max Total Suspended Solids (TSS)	5 mg/l
UV Transmittance @ 253.7 nm	65%
Maximum Turbidity	0.5 NTU
Water Temperature	41°F to 86°F
Ambient Air Temperature	41°F to 104°F
Maximum Inlet Fecal Coliform Count	10,000/100 ml

The UV equipment shall be configured as follows:

Quantity of UV reactors (vessels)	2 (1 duty, 1 standby)
Maximum Head Loss at Peak Day Flow	<24 inches of water/reactor
Power Supply	480/277 volts, 3-phase, 60 Hz

The system sizing and configuration offered by the UV System Supplier to meet the performance requirements specified herein shall be evaluated by the Engineer. The system shall be furnished with the latest components and equipment available at time of shipment.

1.5 PERFORMANCE REQUIREMENTS

Based on the Design Criteria, the effluent shall be in compliance with the performance requirements as follows:

Minimum UV Dose(1)	30 mJ/cm^2 with MS2 bioassay
Lamp Aging Factor(2)	0.50
Fouling Factor(2)	0.80
Effluent Fecal Coliform Count	200 MPN/100 ml (daily maximum)

(1) Dose shall be the reduction equivalent dose (RED), with one reactor out of service, that was assigned to the UV test reactor based on reactor validation testing. The RED is equivalent to that measured with the collimated-beam apparatus for the same degree of inactivation of the target microorganism.

(2) Or factor demonstrated in testing conducted in accordance with NWRI Guidelines and submitted to the California Department of Public Health.

The UV system shall be designed to deliver the minimum UV dose at peak day flow with one UV reactor out of service, with the minimum UV Transmittance, using the provided default end of lamp life (EOLL) and quartz sleeve fouling factors. The dose calculation shall be based on the Supplier's submitted T1 or MS2 independent third-party bioassay for the UV equipment. The use of a higher lamp aging and fouling factors shall be considered only upon review and approval of studies conducted under the NWRI Guidelines and submitted to the California Department of Public Health. Engineering report and/or California DPH letter approving lamp aging and fouling factors must be submitted.

The Supplier shall provide with the product submittals a copy of the bioassay study performed on the UV equipment line by an independent third party using IUVA, UVDGM or NWRI protocols, with an explanation of how the study is scaled to the proposed system configuration.

1.6 PERFORMANCE GUARANTEE

The UV System Supplier shall guarantee the performance of the completed system to meet the performance requirements as stated in Part 1.5 during the 7-day acceptance test.

The design of all equipment included in the Contract and of each item thereof shall be proper and adequate for the specified purpose; the work done under this Contract, the workmanship performed, and the materials and equipment included therein shall be free from defects and flaws and shall comply with the Specifications and all other requirements of the Contract expressed or implied; the strength of all parts of said materials and equipment shall be adequate for the purpose specified.

Should evidence of non-compliance with this performance guarantee arise during the acceptance test, the Owner shall notify the UV System Supplier of the performance deficiency. Upon receipt of such notification, the UV System Supplier shall have 2 days to provide a factory trained representative on site, to review the operational records, identify the problem, recommend remedial action, and/or to provide additional training to the plant staff to improve the disinfection performance.

1.7 WARRANTY

In addition to the warranty required in the Equipment Purchase Contract, the lamp ballasts shall be warranted for 5 years, prorated after 1 year. The UV lamps shall be warranted for 8,000 hours when operated in automatic mode with fewer than six on/off cycles per day while fully submerged. Pro-rated lamp warranties shall

not be accepted. In case of premature UV lamp failure, the UV System Supplier shall offer the following:

1. Lamp Failure Before 8,000 Hours – Send a replacement lamp free of charge.

Within the warranty period should evidence of non-compliance with the Specifications arise, the Owner shall notify the UV System Supplier of the performance deficiency. Upon receipt of such notification, the UV System Supplier shall have 10 days to provide a factory trained representative on site, to review the operational records, identify the problem, recommend remedial action, and/or to provide additional training to the plant staff to improve the disinfection performance.

1.8 SUBMITTALS

Submittals shall be made in accordance with Section 01300. This information should be provided in the following format.

A. PRODUCT SUBMITTALS

In addition to the requirements in Section 01300, product submittals for the UV System shall include the following:

1. Comments and exceptions paragraph by specification paragraph. Provide detailed information on structural, mechanical, electrical or other changes or modifications necessary to adapt non-specified materials to the arrangement or details shown.

2. The use of a higher lamp aging and fouling factors shall be considered only upon review and approval of studies conducted under the NWRI Guidelines and submitted to the California Department of Public Health. Engineering report and/or California DPH letter approving lamp aging and fouling factors must be submitted.

3. UV dosage calculations based on the approved bioassay and factors.

4. A copy of the bioassay study performed on the UV equipment line by an independent third party using IUVA, UVDGM or NWRI protocols, with an explanation of how the study is scaled to the proposed system configuration.

5. Hydraulic calculations demonstrating compliance with specified hydraulic criteria.

6. Harmonic calculations.

7. Detailed engineering calculations showing efficiencies of electrical components and power requirements per reactor.

8. Electrical enclosure construction and layout drawings. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.

9. Detailed proposed procedure for conducting the functional field tests.

10. Disinfection performance guarantee.

11. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

B. PLC AND OI PROGRAMMING SUBMITTAL

Provide a PLC and OI programming submittal to the Engineer a minimum of 4 weeks prior to equipment delivery. For this submittal:

1. Include the project files created by the PLC programming software. The PLC code shall include provisions for communications with the future plant SCADA system as described below. These project files shall be sufficient to reload the operating code to the PLC using the PLC programming software. The project files shall include annotation and commenting sufficient to allow a reviewer to follow the PLC logic.

2. Include PLC tagnames exported to a tab or comma delimitated text file. This text file shall include all tagnames accessible from a remote PLC, OI, or HMI. For each tagname, the text file shall include the name, description, and any additional information required to retrieve the data remotely.

3. Include a PDF of the PLC code. Create the PDF using the PLC programming software and a software based PDF creator. (For this item, a PDF created from scanned documents is not acceptable.)

The PDF shall include the PLC configuration, a complete tagname cross reference, and all of the PLC code.

4. For each OI, include the project files created by the OI programming software. These project files shall be sufficient to reload the operating configuration to the OI using the OI programming software.

5. For each OI, include OI tagnames exported to a tab or comma delimitated text file. These text files shall include all tagnames for information from remote PLCs. For each tagname, the text files shall include the name, description, source of the information, datatype, and scaling information.

6. The files included in submittal may be provided as either:

   a. Four copies each recorded to a finalized, single session write once optical media (CD-R, DVD-R, DVD+R).

   b. Electrically as an optical disc image file. Arrange with the Engineer how to provide the optical disc image.

7. For either option, the file system shall be one of the following:

   a. ISO 9660 with Joliet extension information.

   b. ISO 9660 with Joliet extension information and UDF 1.02.

   In particular, the disc shall not be authored with a packet writer.

1.9 DELIVERY, STORAGE, AND HANDLING

The equipment shall be delivered by the Supplier to the site ready for installation. The equipment shall be delivered at a time coordinated with the Contractor.

The packaging shall be of such quality and strength to prevent damage of deformation during shipping, and to maintain the integrity of the equipment during storage. The equipment shall be unloaded in a manner to prevent damage such as buckling or distortion of frames, marring of surfaces, lamp/quartz breakage, or any other damage to the units, electrical systems, controls, etc.

All items damaged during shipping or unloading shall be replaced by the Supplier at no expense to the Owner.

The equipment shall be stored indoors in a dry area; the ambient temperature will be controlled between 60 degrees F and 104 degrees F. The equipment shall be elevated above floor level.

1.10 PAYMENT

No separate or additional payment will be made for the equipment and services specified herein. All costs for the ultraviolet disinfection system, as specified herein, shall be included in the lump sum price listed on the Proposal.

The structural, mechanical and electrical designs shown on the drawings are based on equipment manufactured by Nuvonic UV. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall at made at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

1.11 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The UV Disinfection System shall be Nuvonic ProLine PQ AL 100, or WEDECO/Xylem Model LBX 90e. No other manufacturers or models shall be accepted.

2.2 GENERAL REQUIREMENTS

Provide a UV system complete with UV vessels, control panels, automatic wiping system, UV cleaning system and UV intensity monitoring system(s), as herein specified.

The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.

UV vessel(s) shall not require draining in order to calibrate the UV intensity sensor.

The system shall be capable of continuous disinfection while automatically cleaning the UV lamp sleeves without reducing or shadowing the output of the lamps.

All material exposed to UV light shall be Type 316 stainless steel, Type 214 or 220 quartz, Teflon, Viton or other suitable UV resistant material. All wiring exposed to UV light shall be TeflonTM coated.

All metal components in contact with effluent shall be Type 316 stainless steel. All nuts, bolts, and washers shall be Type 316 stainless steel.

2.3 UV LAMPS

The UV lamps shall be low-pressure, high-output lamps. The low-pressure high-output amalgam UV lamps shall have an arc length of 56.3 inches (143 cm) and use lamp bases made of metal and ceramic construction, resistant to UV and ozone. The medium-pressure lamps shall have an arc length of 20 cm and use lamp based made of metal and ceramic construction, resistant to UV and ozone.

The minimum UV lamp output after a 100-hour burn-in period shall be 150 watts of UV-C energy at wavelength from 220 at 280 nm. Low-pressure amalgam UV lamps with less than 150 watts UV-C output at 253.7 nm shall not be acceptable.

In case of a power failure, the UV lamps shall not require more than 10 minutes cool down period prior to restart.

The UV lamp output shall not fluctuate more than 5 percent due to water temperature variations between 41 and 86 degrees F (5 and 30 degrees C).

The operating skin temperature of the UV lamp shall not exceed 266 degrees F (130 degrees C) in order to minimize the possibility of quartz fouling for low pressure lamps.

The UV lamp filaments shall be the clamped design, significantly rugged to withstand shock and vibration.

2.4 UV LAMP ASSEMBLIES

Each UV lamp assembly shall consist of a UV lamp, enclosed in an individual quartz sleeve, and with the one or both ends appropriately sealed using an O-ring sealed quartz end plug.

UV lamps shall be removable with the quartz sleeve and wiper system remaining in place.

The UV lamp sleeve shall be a single piece of clear fused quartz circular tubing, open at one end or both ends. It shall be rated for a minimum UV transmittance of 92 percent, which shall not be subject to degradation over the life of the system.

All electrical connections to the lamp assembly shall be made at one end or at both ends.

The electrical connection end(s) of the quartz sleeve shall be sealed by means of a protective retainer plug designed with dual O-rings to seal and hold the sleeves in parallel alignment. The retainers shall remain in place to protect the quartz sleeve ends against accidental damage, without impeding the removal and replacement of the UV lamp.

2.5 UV REACTOR

The UV System Supplier shall furnish stainless steel reactors (vessels) with ANSI Class 150 flanged pipe connections.

The UV vessels shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.

The UV vessels shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves without requiring special tools.

Systems designed whereby the lamps are inserted through a metallic bulkhead or which otherwise prevent continuous cooling of the lamp electrodes by the effluent will not be permitted.

Each UV vessel shall have one vessel-mounted calibrated UV intensity sensor.

Each UV vessel shall have a minimum of one stainless steel cleaning drain valve.

The UV vessel(s) shall consist of a circular configuration of UV lamps.

The lamp array configuration shall be uniform with all lamps parallel to each other. The lamps shall be spaced per the Supplier's standard design. The single array pattern shall be continuous and symmetrical throughout the UV vessel.

2.6 UV REACTOR SUPPORT

The Contractor shall design and provide UV Reactor supports, anchors bolts and mounting hardware in accordance with the requirements of Section 15066, and the seismic requirements of Section 11000.

2.7 AUTOMATIC WIPING SYSTEM

The UV vessels shall be equipped with an electrically powered automatic wiping system.

The automatic wiping system shall use Teflon or viton and PTFE wipers to clean the quartz sleeves. Wipers using metal brushes will not be allowed to avoid damages or scratches on the quartz sleeve or sensor window.

The automatic wiping system shall be electronically controlled and provide a fully automatic, unattended operation. The wiping interval shall be adjustable from 1 to 7 times per hour or every 15 minutes.

The wiped length of the quartz sleeve shall be no less than the complete arc length.

2.8 UV INTENSITY MONITORING SYSTEM

One UV intensity sensor shall continuously monitor the UV intensity in each UV vessel.

The physical construction of the UV intensity sensor shall be built and certified according to the DVGW W294 or O-Norm-M5873 standards.

The UV intensity sensor shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 253.7 nm. It shall have sensitivity at 253.7 nm of greater than 95 percent. Sensors whose sensitivity to other wavelengths amounts to more than 5 percent of the total sensitivity will not be allowed.

The UV intensity sensor system shall be factory calibrated. Calibration shall be valid for a minimum of 1 year unless otherwise specified.

The Supplier shall provide all cable required for connecting the UV intensity monitors to the manufacturer provided electrical control panels.

The UV intensity sensor shall be capable of being removed from the UV vessel without interrupting the disinfection process or draining the UV vessel.

2.9 UV TRANSMITTANCE MONITORING SYSTEM

One inline UV transmittance (UVT) monitor shall continuously monitor the UV transmittance of the influent (permeate) to the UV system.

The contractor shall provide the power connection to the UVT monitor from the plant electrical system and the 4-20 mA control connection to the WWTF PLC. The WWTF PLC will provide the UVT signal to each of the UV control panels via Ethernet connection. The UVT monitor shall measure transmittances from 10 to 100 percent with an accuracy of 1 percent of full scale. The UVT monitor shall be a Sensorex UVT LED-SW or equal, with an automatic cleaning system. The Supplier shall supply all power and control wiring for connection between the UVT monitor and the control system enclosures with a minimum of 50 of cable length. Supplier shall provide UVT monitor 316 stainless steel sanitary flange adapter kit, including sanitary connection, gasket and clamp, Sensorex UVT0009 or equal). Contractor shall mount adapter kit to allow sensor to be in main flow path of the 4-inch PER pipe and shall provide a 1.5-inch sanitary cap for maintenance.

The UVT monitor shall include:

- A single UV-C LED light-source and single silicon-carbide UV sensor, to ensure no measurement drift between multiple light-sources or sensors. The UV sensor and UV light-source should have a nominal input and output at 254nm.

- An automatic cleaning system, to prevent scaling of any surfaces in contact with the process water. The automatic cleaning system shall be capable of operation without interrupting the measurement interval. A manual start of the cleaning system shall be possible through the operator interface.

- A back-lit operator interface, that shall display the current value of UV-transmittance in units of %.

- A 4-20 mA analogue output for data transmission to the UV system controller.

- All necessary temperature, flow and/or pressure regulators/reducers required to ensure safe, reliable operation, or shall otherwise have no restrictions with respect to the design temperature, flow or pressure of the process stream.

- A low voltage, input power supply of 24 VDC.

The UVT measurement interval shall not be greater than 60 seconds to ensure variation in UVT are adequately detected.

All wetted parts must be compatible with prolonged exposure to the process stream and be compliant to NSF-61.

The replacement interval of the UV light-source shall be greater than 2 years.

The UVT monitor shall be capable of a field calibration check.

The manufacturer shall provide the required length of cable, with required end connector for installation in a conduit to the control panel with an additional 10 feet of cable to be coiled at the control panel, spliced, and terminated in the control panel by the Contractor.

The manufacturer shall provide the required process pipe connection system to include pipe clamp, adapter, and gasket, for easy removal and inspection of the UVT monitor.

The UV control system shall modulate the lamp intensity in response to the measured UV Transmittance.

2.10 ELECTRONIC OR ELECTROMAGNETIC BALLASTS

The ballasts shall be electronic microprocessor controlled designed as slot cards fitting into a rack system with a plug connector for ease of maintenance or of the electromagnetic type.

Each ballast shall have independent control and monitoring circuits.

The ballast shall produce an earth-free lamp power supply operating at above supply frequency and optimized to preserve lamp life.

If using an electronic ballast, the ballast system shall incorporate a galvanic separation of the two circuits. In case of the secondary circuit operating in abnormal conditions regarding voltage and/or amperage, the ballast shall shut off the lamp concerned.

If using an electronic ballast, the ballast system shall incorporate a filament preheat circuit to minimize lamp failure on startup.

The operating power factor for the ballasts shall be 0.98 or higher, or 0.92 or higher for electromagnetic ballasts.

The ballast shall be capable of varying the lamp power between 50 to 100 percent proportional to 4-20 mA control signal.

The ballast cabinets shall be adequately cooled with dry air utilizing forced ventilation or air conditioning. The ambient temperature within the existing building may reach as high as 104 degrees F (forced ventilation but no air conditioning is provided). The configuration of ballast cooling shall include a minimum of two independent forced ventilation and/or air conditioning systems, to reduce risk of ballast overheating in the event of a single ventilation failure. Ballast systems, which rely on natural ventilation, or a single forced ventilation system will not be permitted.

2.11 ELECTRICAL AND CONTROL SYSTEM

A. GENERAL

The electrical system shall be designed to provide:

1. Maximum reliability of the UV disinfection system.

2. Segregation of plant services and supplies into sensible groups to allow for safe and simple maintenance or servicing while maintaining the required level of disinfection.

3. Plug and socket quick disconnect facilities enabling non-technical personnel to carry out lamp replacement without the need for any tools or special isolation procedures.

4. The system and all electrical components shall be approved by a Nationally Recognized Testing Laboratory or have approval for installation in the State of Washington in accordance with Section 11000.

The system shall be designed for energy conservation based on four dose parameters (lamp output intensity, quartz sleeve transmittance, water quality transmittance, and water flow) in a manner that minimizes any loss of disinfection capacity. Based on these parameters, the system shall

automatically vary the UV lamp power proportionally to the dose requirement. The system specified shall be able to continue providing disinfection of peak day design flow with the largest single reactor out of service. The system shall be programmed to have a dose equation that is identical to the third-party bioassay derived equation, and can be modified to incorporate a revised dose equation, if necessary. The plant operator shall be able to vary the design dose setting. A system that actively monitors only flow and UV transmittance for theoretical dose-paced control is not acceptable.

The dose delivered by the UV system shall be linearly variable within a range of 50 percent to 100 percent of maximum power in both manual and automatic operating modes. If the variability differs between modes, the automatic mode of operation shall be the sole mode considered. Power variation in "steps" shall not be permitted.

The piping configuration for the UV banks allows the banks to be operated in series mode only. There are no automatic valves associated with the reactors that require UV PLC control. Each UV bank will be controlled based on the "On/Off" signal from the WWTF PLC and based on the required dose and the measured parameters according to the dose equation. When in "Auto", a UV bank shall turn off during periods when an "Off" signal is read from the WWTF PLC and the bank shall power on to warm up when an "On" signal is read from the plant control system. When the bank has warmed up and is ready to receive flow, the UV control system shall generate a "System Ready" signal to the WWTF PLC. An "Off" signal will be generated by the WWTF PLC when the Permeate Pumps are off for a period of 15 minutes. When an "Off" signal is generated, the UV PLC shall hold the last read UV Transmittance value prior to receiving the "Off" signal and report this value. When an "On" signal is read from the WWTF PLC, the UV PLC shall begin reporting the actual UV Transmittance value after 1 minute of generating a "Ready" signal. No alarms for UV Transmittance should be generated when an "Off" signal is read from the plant control system. An "On" signal will be generated by the WWTF PLC when the level in the Process Basin approaches the level setpoint to turn on the Permeate Pumps. The WWTF PLC shall change the lead/lag designation of each bank each time they are both off. The UV System Supplier shall provide the required connection cable and switches to allow the two UV PLC's to communicate with each other if required. The UV control system shall vary the dose delivered to the banks as required and turn the associated bank on and off based on data read from the WWTF PLC.

Harmonic distortion correction equipment, if required by the submitted harmonic calculations, shall be provided by the UV System Supplier as required to meet IEEE519-1992 of The Institute of Electrical and Electronic Engineers.

B. CONTROL PANELS (ELECTRICAL ENCLOSURE)

Each UV vessel shall be powered and controlled by one Electrical Enclosure. All items furnished by the Supplier requiring electrical power shall be powered through the Electrical Enclosures provided by the Supplier.

Each of the Electrical Enclosures shall contain a PLC, operator interface, control instrumentation, plant interface termination points, electronic or electromagnetic ballasts, power distribution, any required power transformers, and all necessary electrical components to operate the UV system.

A power supply of 480 volts, 3-phase, 3-wire, 60 hertz will be provided to the Electrical Enclosure. Enclosures limited to receiving 240 volts AC or single phase power are not acceptable.

The Electrical Enclosures shall be free-standing or wall mounted UL/NEMA Type 12 painted steel enclosures, with channel sills, to be installed inside a building. Electrical Enclosures shall be built by a fabrication shop recognized by an electrical testing laboratory program such as UL 508.

All heat-sensitive components within the Electrical Enclosures shall be adequately cooled with dry air utilizing forced ventilation or air conditioning. The ambient temperature within the existing building may reach as high as 104 degrees F (forced ventilation but no air conditioning is provided).

The Electrical Enclosure shall incorporate an Allen Bradley Compact Logix Programmable Logic Controller (PLC) and shall include industry-standard Ethernet IP ports for direct communication to the Plant PLC, without the need for additional hardware or software. The PLC shall be continuously monitoring and controlling the UV reactor's functions.

The Electrical Enclosure shall include a DIN rail-mounted Ethernet Switch to allow internal UV communications and to allow the Plant PLC to communicate with the UV PLC. Switch shall have a minimum of

five 10/100 Base T RJ-45 ports and shall be powered from the Electrical Enclosure.

Electrical Enclosure Operator Interfaces (OI) shall be menu driven with automatic fault message windows appearing upon alarm conditions. The OI shall operate via an alphanumeric menu-driven display screen with automatic fault messages windows upon alarm conditions. The Operator Interface shall be a 6.5-inch color screen, Allen Bradley Panelview 700 Plus or equal.

The OI shall provide access to all status and control functions for operations personnel, with password access to limit change options dependent on authority.

The OI shall also provide access to diagnostic information, e.g., I/O status, and all PID and control functions for the commissioning engineer to allow changes to be made with appropriate password without the need for a programming terminal.

Minor alarms shall be provided to indicate to plant operators that maintenance attention is required. Minor alarms shall include:

1. Low UV intensity warning shall be preset at the factory for 65 percent of the intensity after 100 hours. Alarm set point shall be field adjustable.

2. Individual lamp failure shall indicate which lamps are out of service.

3. Wiper system failure shall indicate when a wiper system is not functioning properly.

Major alarms shall be provided to indicate an extreme alarm condition in which the disinfection performance may be jeopardized. Major alarms shall include:

1. Low UV intensity alarm. This alarm shall be field adjustable. Low alarm shall be preset at 45 percent.

2. Adjacent lamp failure shall indicate failure of two or more lamps, which are adjacent to each other.

3. Multiple lamp failure alarm shall be actuated on the failure of more than a preset 5 percent of lamps in a single reactor. This preset percentage shall be field adjustable.

4. PLC failure.

5. Critical instrument failure shall be actuated on the failure of an instrument or communications link resulting in a control signal being lost. This condition shall instigate a default routine in the PLC control to put all available UV lamps on to ensure that disinfection will be achieved if possible.

6. Incomplete sequence shall indicate failure of the auto control of bringing or removing a reactor in or out of service.

7. UV system power failure shall be actuated on the failure of a main power supply to the UV system.

8. Alarms shall identify the affected lamps by an address system. The address shall specify the individual reactor and lamp (i.e., Reactor 1, Lamp 2).

The 20 most recent alarms shall be recorded in an alarm history register and displayed on the OI when prompted.

The minor and major alarms shall be fully configurable to allow the Engineer/Owner to determine the priority levels for individual alarms.

The PLC application software shall incorporate delay times for all alarm signals to prevent spurious false alarms from fleeting signals, and to follow for intelligent plant items, e.g. Electronic Ballasts, to carry out self diagnostics and corrective action before initiating external UV system alarms.

Individual lamp status shall be monitored by the PLC and provide status information on the operator interface (OI), showing:

- Individual lamp On/Off status
- Reactor running hours
- Reactor On/Off cycles
- Individual lamp running hours
- Reactor measured UV intensity (in w/m^2)

The PLC shall monitor the wiper system "end of travel" position switches to determine system fouling etc.

It shall be possible to set the status of individual reactors in either "Manual," "Off," or "Auto" mode from the Electrical Enclosure.

In the event of failure or interruption of operation of the UV control and monitoring system, each UV reactor shall continue to operate in the local mode and provide the designed disinfection performance.

The UV control system shall be capable of interfacing with the Plant PLC system through an Ethernet IP communications link. The following tables summarize the minimum status conditions and data that may be transmitted to and from the plant control system. The UV System Supplier shall provide additional data points as required to ensure the plant control system has access to process data available at the operator interfaces. The UV System Supplier shall provide up to 20 additional data points if required for the control algorithms.

DATA READ BY PLANT CONTROL SYSTEM VIA ETHERNET FROM EACH UV PLC

Condition	Type
Auto/Manual Mode Selection	Discrete
UV Bank Ready	Discrete
UV Bank Running	Discrete
UV Bank Fail	Discrete
Common Minor Alarm	Discrete
Common Major Alarm	Discrete
Lamp Fail	Discrete
Wiper Fail	Discrete
Cabinet Overheat	Discrete
UV Dose	Analog
UV Radiation Intensity	Analog

DATA READ FROM PLANT CONTROL SYSTEM VIA ETHERNET TO EACH UV PLC

Condition	Type
Plant Effluent Flow	Analog
UV Permissive On/Off	Discrete
Remote Wipe	Discrete
Remote Set Power	Discrete
UV Transmittance	Analog

2.12 LABORATORY PHOTOMETER

A single beam UV photometer with front panel and 100 percent transmittance control adjustment shall be supplied to measure the UV transmittance of the effluent. UV photometer shall be a portable ABB UviTec UV254 Field Meter, Real Tech Real UV254 Portable Meter P220, or equal.

The range shall be 0 to 100 percent transmittance with a wavelength accuracy of ±0.16 half bandwidth.

Accessories shall include two matched quartz cuvettes, 100 percent transmittance standard solution and cuvette cleaning solution.

2.13 SPARE PARTS AND SAFETY EQUIPMENT

The following spare parts and safety equipment shall be supplied:

A. Two UV lamps.

B. One sleeve.

C. One ballast.

D. Four lamp wiper rings.

E. One operator's kit including gloves and one face shield that blocks UV light wavelengths between 200 and 400 nm.

F. A complete set of any special tools required for maintenance or to dissemble the UV housing, lamps, tubes or control panel assemblies.

G. Two UVT monitor dehumidifier units (if applicable).

2.14 FACTORY TESTING

All major components of the UV Disinfection System including the control system shall be factory tested for compliance with the construction and functional requirements specified herein, and a certification of the results of these tests shall be submitted in writing to the Engineer for each module and control panel separately, prior to shipment. Refer to Section 11000 for factory testing and reporting requirements.

PART 3 EXECUTION

3.1 INSTALLATION

Installation by the general contractor shall be in strict accordance with the manufacturer's shop drawings, instructions and recommendations, and the Drawings.

Care shall be taken to avoid warping and misalignment and to maintain the required tolerances. Proper alignment and support shall be provided to assure proper installation.

The Contractor shall coordinate the installation of the UV transmittance monitor with the UV transmittance monitor manufacturer and Installation and O&M manual. The UV transmittance monitor shall be mounted to the UV system influent pipe in the location shown on the plans. The Contractor shall 2-inch FNPT pipe connection to the UV system influent pipe, approximately 1-inch long (Contractor shall verify). The Contractor shall install the required pipe adapter, gasket, and clamp for the UV transmittance monitor pipe mounting system to the 2-inch FNPT pipe connection.

3.2 FIELD FUNCTIONAL TESTS

Prior to startup, the UV Disinfection System described herein shall be inspected for proper alignment, correct operation, proper connection, and satisfactory function of all components. The Supplier shall approve the installation and provide written Certificate of Proper Installation that the system components have been installed correctly and are ready for operation. Otherwise, the Supplier shall note their findings in a written Installation Deficiency Report to the Owner, with a copy provided to the Engineer. Startup and testing may begin once the Engineer has received the Certificate of Proper Installation from the Supplier.

Proposed testing procedures and forms shall be developed by the UV System Supplier, submitted to and approved by the Engineer, before scheduling and performing the functional test.

Functional testing shall be in accordance with the procedures in Section 01800, be witnessed by the Engineer and shall demonstrate that the System and related control system operate in accordance with the specifications including all operating, monitoring, and shutdown functions. Functional testing shall include operational confirmation of the interface between the UV PLCs and the UV equipment and shall include testing of all alarms, wiping systems and ancillary equipment and cleaning systems. Instruments that cannot be field calibrated shall be checked for accuracy in the field.

The Supplier shall furnish to the Owner a written manufacturer's affidavit, per Section 110000, that the UV system and accessory equipment was installed, started up and tested in accordance with the Supplier's standards.

3.3 ACCEPTANCE TEST

Upon completion of functional test and startup, an acceptance test period of 7 consecutive days will be made to determine whether the equipment shall meet all design criteria and performance requirements herein. During this time, the equipment will be operated by the Owner's operational staff under the operational and control conditions specified herein. In case the actual flow rate is less than the design maximum day flow rate, the UV reactors will be operated with reduced lamp output in accordance with the manufacturer's dose pacing algorithm. The UV reactors will be alternated during the acceptance test period to verify that each reactor is capable of meeting the performance requirements.

Grab samples will be taken by the Owner of the influent and effluent of the UV system, 3 days per week. Sampling, preservation and analysis protocols will be in accordance with *Standards and Methods for the Examination of Water and Wastewater* (APHA-AWWA-WPCF, latest edition). Sampling will be conducted weekdays between the hours of 9:00 a.m. and 3:00 p.m. The flow rate will be recorded at the time of sampling.

Analyses to be performed on the grab samples are effluent fecal coliform, UV system influent UV transmittance, and influent TSS. In addition to the above measurements and sampling, the following measurements will be recorded:

- Amps, kW and kWh used by disinfection equipment, measured by continuous monitoring.

- Lamp intensity, as measured by the lamp intensity meters.

The effluent quality from the treatment plant determined by the average results obtained during the acceptance test period must, at a minimum, meet the performance requirements stated herein. This shall be confirmed by the Engineer. The acceptance test shall be considered successful and the performance guaranty met if the bacterial densities comply with the performance requirements presented herein.

In addition to the manufacturer's services required in Part 3.4, the Supplier shall be on-call for the entire period of the acceptance test.

Should evidence of non-compliance with this performance guarantee arise during the acceptance test, the Owner shall notify the Supplier of the performance deficiency. Upon receipt of such notification, the Supplier shall have 2 days to provide a factory-trained representative on site, to review the operational records, identify the problem, recommend remedial action, and/or to provide additional training to the plant staff to improve the disinfection performance. Following such remedial action, a second 7-day acceptance test period shall be granted.

Should said equipment, when tested for a second period, fail to meet all of the performance requirements as well as operating and performance data requirements, as set forth herein, the Owner shall have the option of requiring the Supplier to remove the equipment from the premises without cost to the Owner and within 60 days after rejection, refund to the Owner all payments that have been made to him. The Owner may, however, purchase the equipment for the contract price.

3.4 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the UV System Supplier, who is familiar with the equipment specified herein, shall be provided. Services shall include a minimum of 3 days (two visits). One day shall be for installation inspection, certification and testing, wherein the testing shall include testing of all alarms, wiping system, and dose pacing. The second trip (2 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the UV Disinfection System is fully operational and shall be at a time and location agreed to by the Owner. The Supplier shall also have a representative on-call for the entire acceptance test and commissioning periods.

In addition to the two visits described above, provide the following follow-up formal training sessions at the Owner's facility for the Owner's operating and maintenance personnel by an instructor familiar with both the Supplier's equipment and the specific programmed applications provided for this project. Each follow-up training session shall be a minimum of 4 hours. The time remaining after each training session (up to the 4-hour minimum) shall be used to perform diagnostic system tests evaluating system performance and to make any minor adjustments to the system that may be determined to be necessary for system optimization. This time shall also be used to make any adjustments that the Owner requests for easier or more convenient operator use of the system. The follow-up training sessions are described below:

- Follow-up 4-hour training/system adjustment session 6 months after startup.

- Follow-up 4-hour training/system adjustment session 12 to 24 months after startup, when requested by the Owner for startup of future WWTP modifications.

The cost of all of the services described above shall be included in the bid price.

***** END OF SECTION *****

SECTION 11520

COMPOSITE SAMPLERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new automatic, refrigerated composite samplers as shown on the Plans and specified herein. The samplers shall include an integral refrigerated compartment for sample storage.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions
Division 15	Mechanical
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Influent Sampler	02 IS 01
Effluent Sampler	01 ES 01

1.4 PERFORMANCE REQUIREMENTS

The samplers shall be equipped to be capable of flow pacing based on an analog signal for flow from the plant control system, to cause a sample to be taken and/or to register a flow pulse for sampling.

The composite samplers shall be capable of collecting repeated sample increments and depositing them in a single polyethylene container, according to the following criteria.

Parameter	Performance Requirement
Sampler storage container capacity (liter)	10
Sampler volume increment range (mL)	10 – 9,990
Sample Volume Accuracy (mL)	10 (or 10%)
Sample Volume Repeatability (mL)	5 (or 5%)

Parameter	Performance Requirement
Sample Time Increment Range (minutes)	1 – 5,999
Peristaltic Pump Capacity @ 25' head (l/min.)	2.8
Peristaltic Pump Maximum Suction Lift (feet)	28

1.5 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The new composite samplers shall be Teledyne ISCO Model 5800, or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Teledyne. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All

necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 FUNCTIONAL DESIGN

The automatic refrigerated wastewater samplers shall be furnished for sequential and composite sampling applications and shall be suitable for indoor or outdoor installation without the requirements for additional enclosures for weather protection. The samplers shall be capable of collecting samples from a variety of liquid sources including open channels, sewers, and stormwater conduits. The samplers will route samples to storage containers for collection and off-site analysis. The sample stream will be a direct path from sample source to sample bottle. Samples will not pass through metering chambers or other diversions. The samplers shall be suited to collect priority pollutant or general-purpose samples in multiple bottles or a single bottle. The samplers will be line (ac) powered 115 volt 60 hz.

A. REFRIGERATOR

The refrigerator shall cool to a setpoint selectable from 34 to 48°F (1 to 9°C), with a setpoint stability of ± 1°C over a 48 hour period.

1. The refrigerator shall have a 5 minute typical recovery time to return to 39°F (4°C) after the door has been opened for 1 minute in 75°F (24°C) ambient conditions.

2. The collected samples shall be stored in an enclosure capable of operating in ambient temperatures from -20°to 120°F (-29° to 49°C).

3. Built-in heaters shall prevent collected samples from freezing if the ambient air temperature drops below freezing.

4. For single bottle composite sampling only, the refrigerator can, upon program initiation, drop the temperature within the sample compartment by 2.5° C below the set temperature for the first 24 hours of operation before resuming normal operation.

B. CONTROLLER

1. The samplers' memory shall maintain the program settings, stored programs, and the results of the last two sampling sequences when the samplers are turned off or an external power interruption occurs.

2. A user-initiated diagnostics routine shall indicate the operational status of the samplers. The controller will display any error conditions detected by the diagnostic routines.

3. The current refrigeration temperature shall appear on the samplers' display, and temperature readings shall be stored in a report.

4. The controller shall be able to automatically switch input power to a connected ISCO battery in the event of a loss of AC power.

5. Sample volumes shall be selectable between 10 and 9,990 ml in 1ml increments.

6. The samplers shall be capable of being programmed to rinse the suction line with the source liquid up to three times.

7. The samplers shall typically deliver sample volumes with an accuracy of ±10 ml or ±10 percent, whichever is greater, of the programmed value. The typical sample volume repeatability shall be ±5 ml or ±5 percent, whichever is greater, of the average of the maximum and minimum sample volume in the sample set.

8. The samplers shall collect sequential or composite samples at user-definable intervals and volumes. A delay to the first sample collection shall be programmable by the real-time clock.

    a. Time Pacing

        The samplers will use an internal real-time clock to provide time and date information. Uniform time-paced samples shall be collected at regular time intervals from 1 minute to 99 hours 59 minutes. Sample volumes may be equal or variable in proportion to flow.

    b. Flow Pacing, DC Pulse

        The samplers shall accept a 5 to 15 VDC flow proportional pulse or isolated dry contact closure, at least 25 ms in duration, from an external flow meter for flow pacing. Samples shall be equal in volume and shall be taken at variable times proportional to flow. The number of flow pulses shall be selectable, from 1 to 9,999 pulses, as the flow interval for each sample collection.

c. Flow Pacing, Analog Input

The samplers shall have a standard 4-20mA flow proportional input compatible with most flow meters without additional interfacing. Samples shall be equal in volume and shall be taken at variable times proportional to flow.

d. Flow-Weighted Volumes, DC Pulse

The samplers shall accept a 5 to 15 VDC flow proportional pulse or isolated dry contact closure, at least 25 ms in duration, from an external flow meter. Samples shall be taken at equal time intervals, and variable sample volumes shall be proportional to cumulative flow.

e. Flow-Weighted Volumes, Analog Input

The samplers shall have a standard 4-20 mA flow proportional input compatible with most flow meters without additional interfacing. Samples shall be taken at equal time intervals, and variable sample volumes shall be proportional to cumulative flow.

9. The samplers shall have 3 selectable modes of sample distribution.

a. Samples per bottle mode: The samplers shall be capable of placing a sample volume from one or more sample events in a bottle.

b. Bottles per sample mode: The samplers shall be capable of filling all sample bottles with a single initiation.

c. Multiple bottle composite mode: The samplers shall be able to simultaneously create a user-selected set of bottles for depositing of multiple samples, switching bottles after a programmed period of time has elapsed, or a programmed number of samples has been collected.

10. Sampler Outputs

a. The samplers shall have four standard digital alarm outputs capable of direct wiring to a Programmable Logic Controller (PLC) or data logger (5 volt, 100 mA).

b. Output alarms shall include: Program started, Program completed, Pump error, Distributor jammed, 3-way valve control, Taking sample, Pumping forward, Powered up, Pumping reverse, Bottle full, and Delay before sample.

c. The samplers shall output an event mark of 12VDC for a duration of 3 seconds, beginning at the start of forward pumping, from the flow meter connector.

d. The samplers shall store a one-minute temperature data report retrievable by an IBM-compatible computer using a terminal emulator tool such as Tera Term (not provided by Teledyne ISCO). The program shall include failsafe loading with site ID codes to prevent field errors due to multiple files.

11. Pump

Samples will be collected via a peristaltic pump. This pump shall produce typical line velocities of 3.0 feet per second in a 3/8 inch (0.95 cm) ID suction line at 3 feet (1 m) of head. At 25 feet (7.6 m) of head, the pump shall typically produce a line velocity of 2.2 feet (0.67 m) per second. The pump shall be capable of lifting a sample a maximum of 28 feet (8.5 m).

a. Before and after each sample is collected, the pump shall air-purge the suction line. Pre-purges and post-purges will be automatically controlled, and no pre-calibration adjustments are required.

b. With the opening of the pump's latch and band, all power will be removed from the sampler's pump motor, to eliminate the possibility of a pump activation injuring personnel.

c. The liquid detection system shall minimize the effects of changing head, intermittent flow in the suction line, or variable battery conditions on sample volume.

d. After initial detection of liquid, the sensor shall monitor for the presence of liquid during the sample collection sequence. In composite mode without use of a distributor arm, this feature can be used for full bottle detection during the post-purge cycle.

e. The liquid detector shall monitor for anomalies in the sample collection process. If no liquid is detected, the sampler shall be capable of retrying the sampling sequence up to three times.

f. After liquid detection, the pump revolution counter shall count actual pump revolutions to determine sample volume delivery to the storage containers. If liquid flow is interrupted during the sample collection sequence, the detector shall inhibit the pump revolution counter from incrementing until liquid flow is restored. Automatic compensations for air slugs in the sample shall be made by the delivery system. Additionally, the pump revolution counter shall monitor the total number of pump revolutions and alert the user when a pre-selected number of counts has been reached to alert the user of the need for pump tubing replacement. One pump revolution is equivalent to 12 pump counts. This indicator shall appear on the controller display screen.

2.3 EQUIPMENT DESCRIPTION

A. SAMPLERS

1. The top section housing the control panel, pump, distributor electronics, and power supply box shall be rated NEMA 4X, 6, and IP 67.

2. The samplers shall include long-life electronic temperature sensing devices that measure the refrigeration compartment and evaporator plate temperatures. A microprocessor will utilize this sensor to control operation of the compressor, built-in heaters, and the self-defrosting cycle of the evaporator plate.

B. REFRIGERATOR

The shell of the refrigerator shall be constructed of rotationally molded UV-resistant polyethylene with molded-in-place thermal insulation, providing exceptional resistance to corrosion and weathering. The top of the refrigerator door shall be recessed for ease of access from above. For 24 bottle configurations, the bottle rack shall slide out for ease of sample recovery. The condenser and evaporator coils shall be constructed of 316 stainless steel and e-coated. Additionally, the copper refrigeration lines, condenser, and evaporator coils and filter dryer will be powder-coated with heat-treated polyester for corrosion resistance.

1. The refrigerator's door shall have hasps capable of accepting a padlock to prevent unauthorized tampering with the sample compartment contents. A compression gasket will be used to seal the refrigerator door. Protective plates both on the unit's bottom and covering the condenser shall prevent damage during handling. The refrigerator power supply and solid-state thermostat shall be contained in an enclosure housed in a discrete compartment of the sampler's molded frame. All exposed metal components used in the construction of the refrigeration system shall be either plated aluminum or stainless steel.

2. The refrigerator will use a condensing coil with forced-air cooling.

3. The compressor shall be rated at 1/5 hp.

4. The compressor shall use a polyband flexible crankcase heater to ensure no refrigerant is dissolved in the compressor oil.

5. The refrigeration system will contain HFC-134a refrigerant, a non-CFC refrigerant with an ozone depletion potential of zero.

C. CONTROLLER

1. The controller shall be housed in a discrete compartment of the samplers' molded frame beneath a padlockable flip cover.

2. The controller will show sampler status and program information via a 2-row, 20-column, 40 total character display. This display shall be angled for easy viewing, and backlit for easy use in all light conditions. All programming and manual control of the sampler will be entered via an 18-position keypad.

3. The controller shall not require a separate heater.

4. Pump

   a. The modular peristaltic pump shall be housed in a discrete compartment of the sampler's molded frame, beneath a latched padlockable cover. The pump casing shall be constructed of high strength Noryl plastic and designed for corrosion resistance.

b. The pump shall include a latched housing cover and thumbscrew opening for the replacement of pump tubing. The pump shall include a built-in magnetic safety interlock.

c. The pump shall include an optional heater, housed beneath the pump cover, for the prevention of liquid freezing inside the pump under extremely cold conditions. A heater shall be available for both 115VAC and 230VAC samplers.

d. Liquid Detector

The sampler will sense the presence of the liquid via a non-wetted, non-conductive detector. The sensor shall not be dependent on, or affected by, any chemical or physical property of the liquid or its contents. The sensor shall not require routine maintenance or cleaning.

e. The pump tubing used shall be specially formulated to minimize water extractable pollutants. Specially designed bands shall indicate the correct placement of the tubing inside the pump. The tubing shall typically last for a minimum of 1,000,000 pump counts.

D. DISTRIBUTOR

The modular distributor shall be housed in a discrete compartment of the refrigerator's molded frame. Sample distribution will be belt-driven by a stepper motor. Positive location of the distributor arm will be achieved using an optical sensor. One of two available fixed-length distributor arms will be used for all bottle configurations and sampler mounting possibilities. The distributor arm may be moved by hand for ease of sample recovery and shall relocate itself before the next sample is taken.

E. SUCTION LINES AND STRAINERS

The samplers shall be equipped with a suction line and strainer for taking samples. The suction line shall be made of 3/8-inch (.95 cm) ID vinyl with a length of 20 feet. The suction line shall have a factory-installed standard 3/8 inch all 316 stainless steel strainer for 3/8-inch (0.95cm) line.

2.4 SPARE PARTS

The Contractor shall provide the manufacturer’s recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or

a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Silicone rubber pump tubing	50 feet
Vinyl tubing for sample suction lines	50 feet
Desiccant cartridge for the sampler	1 each
10-liter polyethylene round sample bottle	1 each
PTFE-lined sample bottle caps	2 each
Sample bottle locating base	1 each
Sample bottle discharge tubes	2 each

2.5 FACTORY TESTING

The equipment shall be fully tested on water at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under field conditions. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The samplers shall be installed as shown on the Plans and in accordance with the Manufacturer's recommendations and instructions.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Testing shall demonstrate that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pump manufacturer shall be provided. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11600

LABORATORY EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing laboratory equipment, as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
11000	Equipment General Provisions
\Division 16	Electrical

1.3 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.4 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 GENERAL

All electrical equipment shall be equipped with proper electrical #12 AWG SO cords and NEMA 5-15P or NEMA 5-20P plugs. All electrical equipment shall be suitable for 120 volts AC, single-phase, 60 Hz electrical power.

2.2 SCHEDULE OF EQUIPMENT

The following items are referenced to VWR catalog numbers to indicate the required type and quantity.

VWR	Quantity		Description
10014-938	1	Each	Orion Dualstar pH/Ammonia Meter w/pH and Ammonia electrode
75871-664	1	each	Desiccator
75802-870	1	each	VWR B2-Series Analytical 120g Balance
12570-378	1	each	Vibration Dampening Mount
89094-592	1	case	Weigh Boats case of 500
22890-229	2	each	Drierite ea
EM-DX2515-1	2	each	Drierite, Indicating ea
89511-404	1	each	Oven, Drying Gravity

2.3 EQUIPMENT SAFETY

The Contractor shall supply Material Safety Data Sheets (MSDS) for all applicable pieces of equipment. At a minimum, this shall include all chemicals and standards, (wet or dry), and all equipment that poses a potential health hazard to laboratory personnel. MSDSs shall be placed neatly into a three ring binder that shall remain with the Owner.

The Contractor shall also provide operations manuals for all electronic or measuring equipment as specified in Section 11000. These manuals shall be placed neatly into a three-ring binder that shall remain with the Owner.

PART 3 EXECUTION

3.1 GENERAL

Coordinate delivery and installation of equipment with the Engineer.

All laboratory equipment items shall be delivered in original containers. The Contractor shall check for shipping damage and verify that all items have been received before turning the equipment over to the Owner who will verify that all items have been received and are in an acceptable condition.

Laboratory equipment shall not be delivered to the job site until the Operations Building is sufficiently completed to provide for proper storage in a heated, clean, and dry location and the Owner agrees with the proposed delivery time.

Chemicals shall not be delivered to the project site earlier than 30 days before plant startup and shall have a minimum of 6 months shelf life remaining at the time of project acceptance.

Where apparatus and appliances, which require electrical service, are supplied without line cords, the Contractor shall furnish a line cord and plug which is compatible with the service required and/or available outlets.

Unless specifically directed otherwise, remove all crates and other packing material from jobsite.

3.2 MANUFACTURER'S SERVICES

The services of factory-trained representatives of equipment manufacturers shall be provided by the Contractor, for laboratory equipment items requiring assembly, calibration, or other procedures for proper operation and maintenance. For each pieces of such equipment services shall include 1 day (4 hours) onsite for instruction of the Owner's personnel in the operation and maintenance of the equipment. Instruction and training of the Owner's personnel shall not take place until the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11960

CARBON MEDIA ODOR CONTROL SYSTEM

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of furnishing and installation of a carbon media odor control system, associated fan, instruments, sound/weather enclosure, outlet silencer/stack and accessories as shown on the plans and as specified herein.

The odor control equipment supplier shall provide the carbon media odor control system, associated fan, instruments, sound/weather enclosure, outlet silencer/stack and accessories. The Contractor shall supply all odor control duct, balancing dampeners, and system air balancing as shown on the plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitation
15050	Piping Systems
Division 16	Electrical

1.3 QUALITY ASSURANCE

A. The system supplier shall have process design experience in carbon adsorption systems for wastewater, demonstrating at least 10 years' experience. At least five systems shall have been in operation for over 5 years. Experience should be specific to process design and not component (FRP Vessel) fabrication.

B. FABRICATOR'S QA SUPERVISOR

Minimum of 10 years' experience in fabrication of fiberglass structures.

C. DESIGNER

Registered professional engineer.

1.4 REFERENCES

A. ASTM INTERNATIONAL

D2563	Standard Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
D2584	Standard Test Method for Ignition Loss of Cured Reinforced Resins.
D2854	Standard Test Method for Apparent Density of Activated Carbon.
D2867	Standard Test Methods for Moisture in Activated Carbon.
D3299	Standard Specifications for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
D3467	Standard Test Method for Carbon Tetrachloride Activity of Activated Carbon.
D3802	Standard Test Method for Ball-Pan Hardness for Activated Carbon.
D4097	Standard Specification for contact-molded glass-fiber-reinforced Thermoset Resin Corrosion-Resistant Tanks.
D3982	Flanges

B. NATIONAL BUREAU OF STANDARDS (NBS)

PS 15-69	Custom molded reinforced polyester for chemical resistant process equipment

1.5 SUBMITTALS

Submittals shall be provided as described in Section 01300 – Submittals, and as listed below.

A. Vessel fabrication details and materials of the components shall be included in shop drawings, and submitted for approval before fabrication.

B. Carbon Specifications: Furnish with 60 days after contract execution, a certificate from the carbon manufacturer certifying that the proposed activated carbon will meet the carbon media specifications. Provide a 1-gallon representative carbon sample and specification sheet of the carbon that will be provided.

C. Catalog information, descriptions, specifications layouts, sketches and other information sufficient to clearly and readily demonstrate compliance with all parts of the specifications and drawings.

D. Dimensional and weight information. Include empty weight and operating weight with carbon.

E. A list of three recent installations where similar equipment by the manufacturer is currently in service; include contact name, telephone number, mailing address, and the names of the engineer, owner, and installation contractor. Additionally, a list of similar installations shall be provided that shows the supplier has experience in carbon adsorption systems in odor control applications.

F. Resin manufacturer's certificate listing the nomenclature, composition, and characteristics of the resin shall be furnished with the vessel if the vessel is constructed of fiberglass-reinforced plastic (FRP).

G. Letter from the resin manufacturer stating recommended corrosion liner for service outlined in this specification.

H. Activated carbon manufacturer's certificate.

I. Vessel fabricator's certificate of compliance with fabrication requirements.

J. Copy of fabricator's quality assurance (QA) program.

K. Special shipping, storage, and protection, and handling instruct ruction.

L. P.E. stamped calculating for tie down lugs and lifting lugs.

M. Suggested spare parts list to maintain the equipment in service for a period of 1 year.

N. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

O. Manufacturer certification of American Iron and Steel (AIS) compliance.

1.6 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Odor Control Unit	02 OCU 01

1.7 NFPA 820

A. The system shall be designed and fabricated in compliance with the National Fire and Protection Agency Code 820 (NFPA 820). The vessel and ductwork shall be manufactured using a vinyl resin system that achieves a Class I flame spread rating. The resin system shall be AOC K022, or equal.

B. All motors and equipment within three feet of the air stream shall be rated for Class 1, Division 2, Group D per NFPA 820.

C. The local control panel will be mounted remotely from the adsorber system and shipped separately. The installation and wiring of the remote-mounted control panel to the fan will be the responsibility of the Contractor.

1.8 PERFORMANCE REQUIREMENTS

A. The odor control system shall be designed to remove the odorous constituents from the process air stream under the following operating conditions:

Process Parameter	Value
Duty	Continuous
Elevation Above Sea Level	80 feet
Location	Outdoors
Inlet Air Temp	40 to 120 degrees F
Inlet Relative Humidity	30% to 90%
Total Air Volume	400 cfm
H_2S Loading	Avg 6 ppm/Peak 30 ppm
Removal Required	H_2S: 99% removal

B. The carbon vessel shall conform to the following parameters:

Process Parameter	Value
Vessel Type	Single Bed/Top Mounted Fan
Vessel Material of Construction	FRP
Airflow	400 cfm
Pressure Drop (Max)	Vessel (Inlet to Outlet): 6" w.c.
Carbon contact time (Min)	3-seconds
Max Bed Velocity	42 FPM
Vessel Dimensions	Inside diameter (min): 42 inches, Height (min): 64 inches
Pressure Rating	+/- 10" w.c.
Carbon Capacity	29 CF

1.9 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment. The mist/grease eliminator shall be shipped separately for installation by Contractor.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.10 WARRANTY

The warranty shall be provided in accordance with the General Conditions. The warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

PART 2 PRODUCTS

2.1 GENERAL

A. The system supplier shall furnish all of the items required to provide a properly functioning system for the service conditions listed herein, including but not limited to the carbon vessel , and activated carbon, fan, controls, and all appurtenances necessary for a complete system

B. The products shall be the end products of one responsible system supplier in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

C. Basis of design is the ECS 60-Series V1-500-TM.

2.2 SYSTEM SUPPLIERS

A. ECS Environmental Solutions or approved equal.

B. Or equal as manufactured by PureAir Filtration. No other manufacturers shall be accepted.

C. The structural, mechanical, and electrical designs shown on the Plans are based on the equipment manufactured by ECS Environmental Solutions. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.3 ADSORBER VESSEL

A. The FRP adsorber vessel shall be filament-wound, manufactured in accordance with ASTM D3299. The visual defects, per ASTM D2563, shall not exceed Level II on the vessel interior and Level III on the vessel exterior. The resin used shall be Dow 510, AOC K022, or approved equal suitable for continuous exposure to saturated water vapor, hydrogen sulfide gas, and their associated acidic products. The resin system should provide a class 1 flame spread rating. Antimony, Nyacol or any other additives are not allowed. A permanent wax containing resin coating, formulated according to the resin manufacturer's most recent recommendations (or other Engineer-approved method) shall be used for surface protection and to prevent air inhibition of resin curing. Contact molded accessories shall be manufactured in accordance with NBS PS15. The completed vessel shall be translucent until it is gel coated. The final gel coat color shall be selected by the owner or engineer. A certificate from the resin manufacturer listing the nomenclature, composition, and characteristics of the resin shall be furnished with the vessel.

B. An inner corrosion barrier shall be provided consisting of no less than three laminated layers. The inner corrosion layer shall be resin rich, not to exceed 20 percent plus or minus 5 percent glass by weight, and a minimum thickness of 10 to 15 mils. The inner corrosion layer shall be followed by at least two layers of chopped-strand mat or two passes of chopped roving to a total of 3 ounces per foot. Should the chopped roving

technique be employed, the chopped fibers shall be 1/2 inch to 2 inches in length. The total corrosion barrier shall total 100 mils minimum and be 27 percent plus or minus 5 percent glass by weight.

C. The structural aspects of the vessel shall be sufficient to meet recommended requirements, including seismic requirements for all conditions during the design life. Manufacturer shall include with the shop drawings, detailed calculations illustrating the seismic characteristics of the proposed vessels. Calculations shall be signed and stamped by a registered mechanical engineer.

D. In addition to the above requirements, the adsorber vessel shall have an average glass content of 55 percent plus or minus 5 percent by weight per ASTM D2584.

E. Tie down lugs and lifting lugs shall be 316 stainless steel. Quantity and design shall be determined in the PE stamped vessel calculations.

F. Vessel and all accessories shall be mounted on an epoxy-coated steel skid.

G. The adsorber vessel shall be complete with integral carbon screen support structure, access manways, air inlet connection, air outlet, no-loss discharge stack, pressure differential assembly, a fill connection, a drain connection, sample port nozzles, 316 stainless grounding rod and all necessary accessories as shown on the Drawings and/or specified within. All exhaust air shall leave the vessel at the top. Provide sufficient access manway so that all internal parts can be easily removed from the vessel. All metal parts shall be Type 316 stainless steel with no metallic parts contacting the carbon except for grounding purposes.

H. Access manway covers shall be airtight at the pressure equal to or higher than the corresponding fan static pressure. The fabrication details and materials of the components shall be included in shop drawings, and submitted for approval before fabrication.

I. Housing shall have a differential gauge bracket and be supplied with a Dwyer Magnehelic pressure gauge and connections for gauge on either side of filter pad. Unit shall come complete from the factory with all DP equipment pre-assembled and installed.

J. Vessel design and airflow configuration shall be furnished to accommodate a single bed activated carbon layer.

1. Single Bed Requirements

a. The bed and vessel configuration is to be conducive to easy carbon replacement.

b. The bed shall be supported on a polypropylene screen and fiberglass grating.

c. Screen and grating must be removable through access and manway.

d. The grating and its support ledge shall be capable of supporting the load imposed by the depth of activated carbon specified, plus a person load of 200 pounds located anywhere on the grating.

e. No pultruded parts are allowed on the interior of the vessel. Carbon support beams, structure or otherwise shall all be manufactured using the same resin as specified in the vessel construction. All components shall have a 100-mil corrosion barrier applied to any surfaces exposed to the corrosive airstream.

2. Each activated carbon bed shall be grounded with a 316 stainless steel rod to prevent static electricity from accumulating. Connection to grounding system will be by others.

3. All cut-walls from tank wall nozzle cutouts shall be reinforced as required by service conditions. Press molded or compression molded flanged nozzles are not acceptable.

4. Add ultraviolet absorbers to surfacing to improve weather resistance.

5. No dyes, pigments or colorants except in exterior gel coating.

2.4 CARBON MEDIA

A. TYPE: Product shall be ECS-LC/G.06C type carbon, or equal.

B. Sufficient activated carbon shall be provided to fill the reactor vessel to the height of the vessel. The activated carbon shall be virgin granular activated carbon. The activated carbon shall be suitable for the vapor phase adsorption of sewage treatment odors. No chemical impregnation of the activated carbon is permitted. The activated carbon shall have the following specifications:

1.	Iodine Number min	1,200 mg/g
2.	Moisture, weight % as packed	5% max
3.	Hardness No.	99 min
4.	Apparent Density, g/ml	0.45 min
5.	Screen Size by Weight, US Sieve Series	5% on 4 mesh
6.	H2S Breakthrough Capacity, g H2S removed/cc Carbon[1]	0.06 min
7.	CTC by Weight	60% min

[1]The determination of H2S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H2S at a rate of 1,450 cc/min. through a 1 inch diameter by 9 inch deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H2S removed per cc of carbon. Test shall be performed per ASTM Test method D-6646, without modification or addition.

2.5 FAN

A. The fan shall be a centrifugal industrial fan of aluminum and epoxy coated construction. Wheel shall be aluminum forward curved electrically and dynamically balanced. All parts of the fan that are exposed to the airstream shall be encapsulated in FRP with graphite impregnation to insure corrosion resistance and spark proof operation.

B. All fans shall be equipped with the following features and accessories:

1. Arrangement 4HM

2. Fan Mounted on vessel lid

3. Fan outlet damper

C. Fan shall be manufactured by ECH, New York Blower, Hartzell or Verantis without exception

D. The fan shall be rated for 400 cfm @ 6" w.c.

E. The motor shall be as specified herein.

2.6 SOUND ATTENUATION PACKAGE

A. A FRP sound enclosure shall be provided by the system supplier. Construction and performance shall be as follows:

1. Walls shall be vacuum-formed construction with two layers of FRP over a honey-comb core.

2. Resin, liner, color and exterior coating system shall be the same as specified for the adsorber vessel.

3. Enclosure shall have four ventilation louvers installed.

4. Enclosure shall be manufactured so that it can be easily removed for maintenance.

5. Enclosure shall be single-piece construction. No seams or joints are allowed. Bolt-together kit enclosures are not acceptable.

6. Enclosure shall have 2" of ECS Sound-adsorb lining all internal surfaces.

7. Performance of the enclosure design should produce a 20 Db insertion loss at 3'.

2.7 INSTRUMENTATION

A. Pressure differential instruments (two total) shall be provided and include Magnehelic style pressure gauges allowing determination of the pressure loss in inches of water column across the carbon in the absorption vessel and across the pre-filter. The range shall be 0-10 inches of water. Tubing shall be bonded to a solid acrylic plastic block that contains safety traps. Magnehelic shall be Dwyer or equal.

B. Sampling Ports: Each adsorption unit shall have three 2-inch diameter sample ports which extend into the carbon bed 1 foot minimum, suitable for extracting carbon samples. Provide one grain thief that is capable of extracting a core sample of the in-place carbon through the sample ports. Ports shall be adequate to provide suitable extraction of air samples from the carbon bed and be nonbinding. Each port nozzle shall extend outside the vessel wall and be blocked off with a 2-inch ball valve. One additional air sampling port shall be provided above the carbon bed.

2.8 PRE-FILTER

A. Prefilter shall be provided to collect airflow, remove moisture / particulate and direct it into a fan.

B. HOUSING

Housing shall be manufactured using fiberglass reinforced plastic. Stainless or alternate plastic materials are not acceptable. Manufacture shall have a minimum of 10 year' experience in the design and supply of similar equipment. Manufacturer shall retain the services of an independent inspector who is responsible to confirm the prefilter has been manufactured in accordance with this specification and all FRP work meets or exceeds ASME RTP-1 level 2 visual inspection criteria.

1. Resin system shall be a corrosion resistant vinyl ester with a Class 1 flame spread rating. Acceptable products are AOC K022-AC or Dow Derakane 510-B series. Resin system shall not require any additives such as nyacol or antimony to achieve the class 1 flame spread rating. Finished laminate including liner and structure shall be translucent.

2. All internal surfaces shall have a 100-mil corrosion liner made up of a single nexus veil followed by two layers of 1.5 oz chopped strand matt.

3. All exterior surfaces shall have gelcoat applied. This coating shall contain UV inhibitors, color to be selected by the Owner.

4. Housing shall have machined UMHW guides to prevent stainless frame on filter pad from scratching or damaging the corrosion liner.

5. Filter housing shall be designed for 12-inch positive and negative pressure with a maximum of 1/8-inch deflection.

6. Housing shall have an access door for pad removal complete with EPDM gasket and 316 Stainless hinges/quick latches. For filter housings larger than 3' across, two access doors shall be provided. Access doors shall have stainless toggle clamps for easy pad access. Bolt-on access doors are not acceptable.

7. Housing shall be provided with a 2-inch drain connection at the base, and come from the manufacturer complete with ball valve.

8. Housing shall have a differential gauge bracket and be supplied with a Dwyer Magnehelic pressure gauge and connections for gauge on either side of filter pad. Unit shall come complete from the factory with all DP equipment pre-assembled and installed.

9. For installation, housing shall have (2) 8-inch diameter FRP legs. Length of legs shall be coordinated with the contactor. Housing shall be supported by these legs independent of the connecting ductwork, anchored with stainless steel HILTI bolts.

C. FILTER PAD

1. Pad shall have 2 inches of stainless mesh followed by 4 inches of poly mesh. Mesh shall be held together by a stainless steel frame. Total pad width including pads and frame shall be 8 inch.

2. Maximum pad segment width of pads is 24 inches. Pads larger than 24 inch wide must be segmented to allow easy removal by the owner. Segment width should not exceed 24 inches.

D. DIMENSIONS/DESIGN

1. End connections shall be sized for a maximum air velocity of 2,500 f/m. Flange dimensions shall match the connecting ductwork. Flange thickness shall not be less than that listed in ASTM 3982.

2. Inlet cone shall be designed so that the airstream can spread evenly over the pad surface. Cone angle shall be no less than 60 degrees.

3. Housing shall be sized so that air velocity through the filter pad is 400 f/m.

4. Particle removal efficiency shall be 99 percent of particles 10 microns or larger.

2.9 ADSORBER VESSEL ACCESSORIES

A. 16 gauge SST name plate with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.

B. 316 SST lifting lugs

C. 316 SST anchor bolts sized by the equipment manufacturer (1/2" minimum) and supplied by contractor

D. SUBMITTAL

1. Fabrication drawing showing connection sizes, locations, plastic guide details and general unit dimensions.

2. Removal efficiency calculations.

3. Detailed construction including information on resin system and reinforcements.

4. Installation instructions.

5. Detailed construction drawing and performance information on the filter pad.

6. Qualification of the independent inspector showing a minimum of 10-years of experience in the FRP industry.

2.10 PVC DUCTWORK

PVC ductwork shall be round with a wall thickness of at least 1/8 inch. PVC ductwork shall be extruded from Type I, Grade I PVC material conforming to ASTM D 1784. PVC duct shall have a flame spread rating of 25 or less per ULC S102.2. Fittings shall be constructed with thermally fused seams. Joining shall be by solvent cement. Ductwork shall be designed to meet SMACNA requirements. PVC ductwork shall be Harvel Plastics Inc., General Plastics, or equal.

2.11 DAMPERS

Isolation and balancing dampers shall be of the butterfly type used for isolation and throttling. Dampers shall be designed for installation either in the vertical or horizontal position.

All dampers shall be FRP or PVC construction, manufactured in accordance with NBS PS 15-69 standards. Each damper shall be furnished with Type 316 stainless steel metal parts and neoprene/teflon gaskets and seals. Minimum thickness of any metal part shall be 10 gauge. The dampers shall have a vinyl ester flange mount channel frame with reinforced bearing pad. The dampers shall have molded synthetic bearings.

The damper shaft shall extend the full length of the blade and 6 inches beyond the frame. The damper shaft shall be 316 stainless steel. The damper blade shall be

laminated to the central shaft. Shaft penetrations in the body shall be fitted with corrosion-resistant bushings and shall be sealed against gas leakage.

All dampers shall be designed to withstand 18-inch WC pressure and shall be able to operate in a partially closed position at a differential pressure of 4-inches WC. All dampers shall be furnished with a full circumference blade seal to limit leakage to less than 3 cfm per square foot at 10-inch WC. Submit leakage test and performance data from an AMCA-approved testing laboratory.

Balancing dampers shall have heavy duty manual locking hard quadrants constructed of 316 stainless steel.

Balancing dampers shall be drilled and bolted in their final balanced position. The isolation dampers shall be permanently locked in their final balanced position.

All dampers shall be manufactured by Spunstrand, Ruskin, Harrison Machine & Plastic Corp., or equal.

2.12 MOTOR

Motors shall be by Baldor, US Motors, Reliance, or Toshiba/Houston. No other manufacturers shall be accepted.

The motors shall be a vertical hollow-shaft TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI IEEE standards. Motors shall be constructed with Class F insulated windings, Design B, 30,000 anti-friction AFBMA hour rated bearings, cast iron frame and end bells.

The motor shall be rated at a minimum of 1.5 hp, 460 volts AC, 3 phase 60 Hz, 1,800 rpm synchronous speed (4 pole), continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor. These motors shall be suitable for installation in a Class I, Division 2 hazardous location.

Motors shall be mounted in a manner that permits conduit connection to the motor terminal box directly using straight lengths of flexible metal conduit (i.e., without offsets or dog legs).

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the windings. Detectors shall be suitable for operation with 120 volt AC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Provide breather and drain to vent enclosure and drain condensation. Provide grounding terminal box.

Motors shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment."

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11C Table C408.8(1)), regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

The motors shall be recognized or labeled by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motors shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

2.13 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. The list shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the motor information for the submitted equipment.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.14 AIR BALANCING

A. Furnish all materials, tools, equipment, and instrumentation required to perform the air and water system balancing as described in this section.

B. Utilize instruments on this project that have been calibrated within 6 months of this use.

C. Adjust and balance air systems in accordance with standard procedures and recognized practices of the Association of Air Balance Council, National Environmental Balancing Bureau or the SMACNA "HVAC Testing, Adjusting, and Balancing Manual."

D. The air balancing company shall be responsible for locating and providing ports for inserting calibration equipment into FRP ducts. Penetrations shall be performed in accordance with FRP duct manufacturer's recommendations. Penetrations shall be sealed after use.

E. Balance the odor control system duct dampers to provide the specified flow from the facilities to the odor control unit flow rates are shown on the Drawings.

2.15 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.16 FACTORY TESTING

The fans shall be fully tested at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

2.17 FIELD TESTING

After completion of the installation, equipment and systems shall be tested for satisfactory operation without noise, vibration, and overheating. Equipment must be adjusted and checked for misalignment, clearances, supports, and adherence to safety standards by the Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment, carbon media and ductwork shall be installed per the manufacturer's recommendations, as shown on the Plans and specified herein to provide complete and operational carbon media odor control system.

All anchor bolts and bolts, nuts and washers for equipment and ductwork shall be Type 316 stainless steel and shall be furnished by the manufacturer, unless otherwise noted.

Proper clothing, gloves, safety goggles and respirator should be worn while loading carbon media into the carbon filter unit. The Contractor shall pay close attention to the manufacturer's procedures and safety precautions while handling the carbon media. Carbon media shall not be loaded until fan has been checked and proven to be operational.

Manufacturer shall provide warning labels where applicable on the odor control system components.

3.2 FUNCTIONAL TESTING

A. Functional testing shall be conducted after the installation of the carbon vessels and all appurtenances and the equipment has been operated for a sufficient period to make any corrections or adjustments. Each carbon vessel shall be subject to field functional tests under actual operating conditions to determine that operation is satisfactory and in compliance with the Specifications.

B. The Contractor will provide, calibrate, and install all temporary gauges and meters, and install all temporary piping and wiring required for the functional tests.

C. The functional tests shall include the following:

1. Alignment: Test complete assemblies for correct and proper alignment and connection, and quite operation.

2. Flow Throughput: Measured by system or temporary instrumentation.

3. Discharge and Inlet Static Pressure: Measured by system instrumentation or temporary measurement devices.

4. Test all system components for proper adjustment and operation in both manual and automatic operating modes.

D. System Startup shall be performed by qualified representative of the manufacturer.

3.3 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The odor control system shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.4 AIR BALANCING

Adjust air volumes on supply and exhaust ducts to the quantity shown on the contract drawing and specified herein with allowable variation of +10/-5 percent.

In each system at least one air path from fan to final branch duct termination shall have all dampers fully open. Achieve final air quantities by adjusting fan speed.

A. ADJUST FAN AIR VOLUMES

1. Adjust fan speeds and motor drives after carbonmedia installation for the required air volumes, with allowable variation of +10/-5 percent.

2. After final adjustments, do not operate motor above nameplate amperage on any phase.

3. Perform airflow test readings under simulated or actual conditions for the flows shown on the drawings.

Read and record static pressures at unit inlet and discharge dampers and plenums on each system.

B. ELIMINATE DRAFTS AND NOISES WHERE POSSIBLE

1. Final Adjustments

a. Mark final positions of all balancing dampers with red felt pen.

b. Recommend to the Engineer any dampers that must be added or replaced in order to obtain proper air control.

c. When adjustments are made to a portion of any fan system, reread all other portions of that same system to determine the effects imposed by the adjustments.

d. After balancing an air system, lock dampers in their final balanced position.

3.5 MANUFACTURER'S REPRESENTATIVE

The services of a factory-trained representative of the odor control system manufacturer shall be provided. Services shall include 2 days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

DIVISION 12

FURNISHINGS

SECTION 12356

PLASTIC LAMINATE FACED CASEWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing plastic laminate faced casework and accessories as shown on the Plans, and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
12452	Appliances
Division 16	Electrical

1.3 SUMMARY

A. This Section includes the following:

1. Plastic laminate-faced cabinets.

2. Plastic laminate-faced countertops and worktops.

3. Plastic-laminate-faced windowsills.

4. Epoxy resin countertops and sinks.

5. Hardware.

6. All accessory items noted on details or specified in manufacturer's latest specifications to provide a complete assembly.

1.4 DEFINITIONS

A. EXPOSED SURFACES OF CABINETS

Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. SEMI-EXPOSED SURFACES OF CABINETS

Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semi-exposed."

C. CONCEALED SURFACES OF CABINETS

Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.5 SUBMITTALS

A. PRODUCT DATA

For the following:

1. Casework.

2. Countertops, worktops, sills.

3. Hardware.

B. SHOP DRAWINGS

For all fabrications, include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, grommets, and cut-outs for plumbing fixtures.

C. SAMPLES FOR INITIAL SELECTION

Manufacturer's color charts consisting of units or section of units showing the full range of colors. Textures and patterns available for each type of material exposed to view.

D. SAMPLES FOR VERIFICATION

The Contractor shall submit actual product samples for the Owner's verification. Samples shall include 8-inch by 10-inch fabrications of all proposed finished surfaces.

1.6 QUALITY ASSURANCE

A. SOURCE LIMITATIONS FOR CABINETS

Obtain cabinets through one source from a single manufacturer.

B. QUALITY CERTIFICATION

Casework manufacturer shall be a member in good standing of the Architectural Woodwork Institute (AWI), or other industry recognized certification body. All shop drawings and installed products shall include designated labels as required by the certification program.

1.7 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS

Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. ESTABLISHED DIMENSIONS

Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

1.8 COORDINATION

Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:

1. Plastic Laminate Surfacing

    a. Formica Corp.

    b. Wilsonart.

    c. Nevamar Corp.

2. Epoxy Resin Countertops

    a. Prime Industries, Inc.

    b. Or equal

3. Cabinets

    a. Pacific Cabinets, Inc.

    b. Genothen Casework

    c. Valley Cabinets, Inc.

    d. Northwest Woodworks

    e. Fremont Millwork Co.

    f. Or equal

2.2 COLORS, TEXTURES AND PATTERNS

A. Colors, Textures and Patterns: As selected by Engineer from manufacturer's full range of laminates including premium grades.

B. Allow for a selection of up to seven plastic laminates of distinct color, texture and pattern.

2.3 CABINET MATERIALS

A. EXPOSED MATERIALS

1. Plastic Laminate

    High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

B. SEMI-EXPOSED MATERIALS

Unless otherwise indicated, provide the following:

1. Plastic Laminate

High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

2. Cabinet Liners

High-pressure melamine laminate, .027 thickness.

C. CONCEALED MATERIALS

Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility.

D. EDGE BAND

High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

2.4 COUNTERTOP MATERIALS

A. PLASTIC LAMINATE

High-pressure decorative laminate complying with NEMA LD 3, Grade HGS.

B. PLYWOOD

Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded. For countertops at sinks and lavatories, use phenolic-resin particleboard or exterior-grade plywood.

C. EPOXY RESIN

The counter tops, back splash and side splash plates shall be 1-inch solid, acid resistant finish, Modified epoxy resin, with 4-inch applied curb and integral single basin sink.

2.5 CABINET HARDWARE

A. GENERAL

Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Engineer from manufacturer's full range.

B. DRAWER AND DOOR PULLS

Manufacturer's standard brushed stainless steel wire pull.

C. HINGES

Concealed, 170 degree, European-style hinges. Blum Blumotion, or equal.

D. DRAWER GUIDES

Epoxy-coated-metal, soft-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers. Accuride, Blum, or equal, 100 lb rating typical.

E. HARDWARE

Concealed where possible.

F. GROMMETS

One-inch-diameter vinyl with removable cap. Color as selected from manufacturer's standard colors.

G. SHELF PINS

All shelf pins to be seismic double pin captive shelf support.

H. SUPPORT BRACKETS

Extra heavy duty, 18″x24″ T-bar countertop support brackets. Rakks "EH" Series by the Rangine Corporation or equal. Colors as selected from manufacturer's standard colors.

2.6 CABINET CONSTRUCTION

A. FACE STYLE

Flush overlay; door and drawer faces cover cabinet body members or face frames with only enough space between faces for operating clearance.

B. DOOR AND DRAWER FRONTS

11/16-inch-thick plywood with plastic laminate faces, backs and 3mm PVC edge banding. Provide same grade, pattern, color and texture of plastic laminate for backs as for faces.

C. EXPOSED CABINET ENDS

3/4-inch plywood, plastic laminate faced.

D. CABINET ENDS

3/4-inch plywood, plastic laminate faced.

E. CABINET TOPS AND BOTTOMS

1/2-inch plywood, plastic laminate faced.

F. WALL-HUNG UNIT BACK PANELS

1/2-inch plywood, back panel to receive plastic laminate.

G. BASE UNIT BACK PANELS

1/2-inch plywood, back panel to receive plastic laminate.

H. DRAWERS

Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.

1. Bottoms: 1/2-inch plywood.

2. Boxes: 1/2-inch plywood, plastic laminate faced with 3 mm PVC edge banding.

I. SHELVES

1. 3/4-inch plywood, plastic laminate faced.

2. All shelves shall have 3-mm PVC edge banding.

J. FACTORY FINISHING

To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.

K. SEISMIC

All upper and tall casework construction to meet seismic requirements per WIC (Woodworking Institute of California).

2.7 COUNTERTOP CONSTRUCTION

A. CONFIGURATION

Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and end-splash style:

1. Fronts

Rolled edge at wet counters. Premium grade square edge at work-tops.

2. Backsplashes and Endsplashes

Integrally coved splash at wet counters. Butt splash at worktops.

B. PLASTIC LAMINATE SUBSTRATE

3/4-inch plywood, individual layers laminated together as required to achieve ultimate thickness.

2.8 PLASTIC LAMINATE SILLS

A. WINDOWSILLS

1/2-inch plywood, plastic laminate faced.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets and base cabinets through back, near top and bottom, at ends and not less than 24-inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24-inches o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.

1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.

2. Seal edges of cutouts by saturating with varnish.

F. Anchor windowsills securely to framing as required. Caulk space between window/gypsum wallboard and sill/cap ends with laminate.

G. Verify all appliance sizes prior to fabrication.

3.2 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

***** END OF SECTION *****

SECTION 12400

FURNISHINGS AND ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of furnishings and accessories, as shown on the Plans and as specified herein.

1.2 RELATED SECTIONS

Section	Item
01300	Submittals
09250	Gypsum Wallboard

1.3 WARRANTY

The warranty shall be provided in accordance with the General Conditions. The warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Horizontal blinds shall be 1-inch-wide rigid louvers of aluminum with a matching 1-inch-deep valance. The headrail and bottom rail shall be formed steel or extruded aluminum. The blinds shall be mounted on the inside of the window opening and shall have a side draw and tilt. Provide wand for tilt operation, locks for cord to stop blind in any position. Size to fit between jambs and between head and sill. The Contractor shall submit color samples for approval and selection by the Owner. Bali, or approved equal.

A Provide blinds at buildings as noted below:

1. Operations Building

    a. Lab/Office window

2.2 BUILDING SIGNAGE

A ROOM IDENTIFICATION SIGNS

Provide ES Plastic (high pressure plastic laminate or polymer with contrasting color core, with 1/32-inch-high raised tactile lettering and Grade 2 Braille. Plaque shall be 1/8-inch thick. Color to be selected by the Architect. ASI Sign System, or approved.

Letters to be in Helvetica medium Style, all in caps. Letter size shall be 3/4-inch-high, centered in the plate. Length shall be as required but not to exceed 16 inch on one line. Background shall be removed from the medium to expose the contrasting core color.

Provide room identification signs at doors as noted below. Provide an additional ten signs with labels to be determined by Owner upon receipt of identification sign submittal.

1. Operations Building

    a. "Electrical Room" at door 1

    b. "Process Room" at door 2

    c. "Control Room" at door 3

2.3 FURNITURE

Furniture references are to Hon models/part numbers to establish type and quality. Provide furniture as noted below:

A OPERATIONS BUILDING

1. Work Chair – Hon Ignition Series, mesh-back, fully adjustable, caster base

    a. HON HIWM1

    b. Provide 1

2. File – vertical, 2 drawer, letter, 15 x 25 x 29

    a. HON 310

b. Provide 1

PART 3 EXECUTION

3.1 GENERAL

Mount surface mounted accessories on concealed backplates, except where shown otherwise. Accessory backplates shall have concealed fasteners. Install accessories except if indicated otherwise, with sheet metal screws or wood screws in teflon or neoprene sleeves and expansion shields with toggle bolts, or other approved fasteners. Install on back plates in same manner. All accessories mounted on gypsum board walls without solid backing shall be fastened into metal backplates secured to studs.

Exact locations for fixtures and equipment shall be determined on the job to suit the actual conditions.

Any discrepancies between the Drawings and actual field conditions shall be brought to the attention of the Engineer for a decision. Changes in the work because of failure to do so shall be made by the Contractor at no additional cost to the Owner.

3.2 FURNISHINGS

The furnishings specified herein and shown on the Drawings shall be installed in locations shown, and in accordance with the Manufacturer's recommendations.

3.3 SIGNAGE

A ROOM IDENTIFICATION SIGNS

Mount on the wall at the latch side of the door, at 5'-0" height above floor level. Use adhesive attachment at interior and screw attachment at exterior wall conditions.

***** END OF SECTION *****

SECTION 12452

APPLIANCES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of furnishings and accessories, as shown on the Plans and as specified herein.

1.2 RELATED SECTIONS

Section	Item
01300	Submittals
Division 15	Mechanical
Division 16	Electrical

PART 2 PRODUCTS

2.1 REFRIGERATOR

Provide one under counter refrigerator, no-frost, top freezer, 16.5 cubic foot minimum, Energy Star, G.E. model GCE06GSHSB, or approved equal. Power requirements shall be 115 volt, 60 Hertz, 15 amp maximum. The color shall be stainless steel. It shall be provided with a cord and attachment plug cap (NEMA 5-15 or 5-20P).

2.2 DISHWASHER

Provide one dishwasher fully automatic, front-loading type, G.E. model GDT635HSRSS, or approved equal. Power requirements shall be 120 V, 60 Hertz. It shall be provided with a cord and cap (NEMA 5-15 or 5-20P). The color shall be stainless steel.

PART 3 EXECUTION

The furnishings specified herein and shown on the Plans shall be installed in locations shown, and in accordance with the Manufacturer's recommendations.

Mount appliances in locations as shown on the Plans; fully connect to mechanical and electrical services. The accessory manufacturer's mounting details shall be coordinated with other trades as the work progresses. All brackets, plates, anchoring devices and similar items used for mounting in wet areas shall be

bedded in a silicone or other sealant as they are set to provide a watertight installation.

Mount surface mounted accessories on concealed backplates, except where shown otherwise. Accessory backplates shall have concealed fasteners. Install accessories except if indicated otherwise, with sheet metal screws or wood screws in teflon or neoprene sleeves and expansion shields with toggle bolts, or other approved fasteners. Install on back plates in same manner. All accessories mounted on gypsum board walls without solid backing shall be fastened into metal backplates secured to studs.

Exact locations for fixtures and equipment shall be determined on the job to suit the actual conditions.

Any discrepancies between the Plans and actual field conditions shall be brought to the attention of the Engineer for a decision. Changes in the work because of failure to do so shall be made by the Contractor at no additional cost to the Owner.

***** END OF SECTION *****

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13205

VERTICAL POLYETHYLENE TANKS

PART 1 GENERAL

1.1 SCOPE

There shall be furnished and installed one polyethylene non-potable water tank and one polyethylene waste activated sludge (WAS) storage tank, and all associated piping, flex couplers, seismic tie-downs, tank attachments and fittings, and accessories required for a complete and operable tank as shown on the Drawings and specified herein. The Contractor shall supply and install the seismic anchor plates, anchor bolts, and cable tie-downs as recommended by the vertical polyethylene tank manufacturer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01800	Testing, Commissioning and Training
09900	Painting
11000	General Requirements for Equipment
15050	Piping Systems
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Non-Potable Water Tank	01 NPT 01
WAS Storage Tank	02 WST 01

1.4 WARRANTY

The warranty shall be provided in accordance with the General Conditions. The warranty shall be valid for a period of 2 years, beginning on the date of substantial completion.

1.5 PAYMENT

No separate or additional payment will be made for the work and materials specified herein. All costs for the vertical polyethylene tanks, as shown on the

Drawings and as specified herein, shall be included in the appropriate unit and lump sum bid items.

1.6 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. The vertical polyethylene tanks shall be by Snyder Industries Inc., Poly Processing Inc., or Assmann Corporation. No other manufacturers shall be accepted.

The structural, mechanical and electrical designs shown on the drawings are based on equipment manufactured by Snyder Industries Inc. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall at made at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 POLYETHYLENE STORAGE TANK

A. STANDARDS, SPECIFICATIONS, AND CODES

1. Tank and equipment shall be designed, fabricated, tested inspected and delivered in accordance with the latest issue of the following Standards:

a. ASTM (American Society for Testing and Materials) Standards

i. D618 Conditioning Plastics and Electrical Insulating Materials for Testing

ii. D638 Tensile Properties of Plastics

iii. D790 Flexural Properties of Unreinforced and Reinforced Plastics and

iv. Electrical Insulating Materials

v. D883 Definitions of Terms Relating to Plastics

vi. D1505 Density of Plastics by the Density-Gradient Technique

vii. D1525 Test Method for Vicat Softening Temperature of Plastics

viii. D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics

ix. D1998 Standard Specification for Polyethylene Upright Storage Tanks

x. D2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

xi. D3892 Practice for Packaging/Packing of Plastics

xii. F412 Definitions of Terms Relating to Plastic Piping Systems

b. ARM (Association of Rotational Molders) Standards

Low Temperature Impact Resistance (Falling Dart Test Procedure)

c. ANSI Standards

B-16.5 Pipe Flanges and Flanged Fittings

d. OSHA Standards

29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids

B. QUALITY CONTROL PROGRAM

1. Tank shall be manufactured under the following minimum quality control program:

   a. Employment of a quality control manager with at least 10-years experience in the polyethylene storage tank industry.

   b. The quality control manager shall be independent of manufacturing production personnel.

   c. All steps of the tank fabrication shall be witnessed by either the quality control manager of his directly and solely supervised staff.

   d. A manufacturer's log of each tank's fabrication shall be kept that includes at a minimum:

      i. The start of fabrication and other production milestones.

      ii. The production personnel who worked on the tank.

      iii. The quantity and type of materials used for the tank construction.

      iv. The settings used for the production equipment during fabrication.

      v. The visual inspection results for individual tank components before and after final assembly.

      vi. Test results for completed tanks.

   e. The quality control manager shall have a current production schedule available for inspection that identifies the tank fabrication or storage location, current status, and expected completion date for the tank.

   f. Upon delivery to the jobsite, the tank shall be accompanied by a signed letter from the quality control manager that the tank was manufactured in accordance with these Specifications. This letter shall be accompanied with test

data and with the manufacturer's log. The tank will not be accepted at the jobsite without this documentation.

C. SERVICE CONDITIONS

1. Design Conditions

a. Tanks, fabricated to this Specification, shall operate at temperatures less than 150 degrees F and shall be suitable for atmospheric pressure only.

b. All tanks shall be fully vented to atmosphere.

c. All tanks will be subjected to the following conditions and shall be designed to withstand all stated conditions.

i. Design Temperature: See ambient temperature.

ii. Operating Pressure: Atmospheric.

iii. Chemical Composition of Fluids: Non-potable water.

iv. Specific Gravity: 1.00 – 1.1

v. Viscosity: 0.7 – 1.5 cps

vi. Ambient Temperature: 20 to 100 degrees F.

vii. External Loads: 20 psf plus live load and dead load.

d. Non-Potable Water Tank

i. Nominal Capacity: 1,550 gallons.

ii. Vertical installation, upright, single wall, flat bottom.

iii. Diameter: 64-inch.

iv. Minimum Straight Side Length: 111 inches.

v. Top: closed top.

vi. Bottom: Flat.

vii. Location: Outdoor.

viii. Color: Black with UV inhibiter.

ix. Manway: 18-inch, threaded, vented.

x. Tank Connections:

Sidewall double flanged connections:

- 3-inch PER flanged inlet (side at top);
- 3-inch FE flanged outlet (side at top);
- 3-inch NPW flanged outlet (side at bottom);

Tank cover bulkhead connections:

- 3-inch U-vent;
- 4-inch flange for radar level sensor mount;
- 4-inch flange for float switch insertion and mount with blind flange to be modified in field.

e. WAS Storage Tank

xi. Nominal Capacity: 10,400 gallons.

xii. Vertical installation, upright, single wall, flat bottom.

xiii. Diameter: 142 inch.

xiv. Minimum Straight Side Length: 177 inches.

xv. Top: closed top.

xvi. Bottom: Flat.

xvii. Location: Outdoor.

xviii. Color: Color: Black with UV inhibiter.

xix. Manway: 18-inch, threaded, vented.

xx. OSHA-approved FRP ladder and cage assembly.

xxi. Tank Connections:

Sidewall double flanged connections:

- Three 3-inch D flanged outlet (side);
- 4-inch OF outlet (side at top);
- 3-inch WS outlet (side at bottom);
- Two internal down pipe supports for Contractor connection to 3" Schedule 10S stainless steel air pipe (3" ALP). Contractor shall provide and install the 3" ALP pipe to the new air diffusion system.

Tank cover bulkhead connections:

- 3-inch WAS flanged inlet;
- 4-inch OCD flanged outlet;
- 3-inch ALP internal down pipe entry: Manufacturer shall provide a 7.5-inch diameter top opening with a 3-inch Schedule 40, CPVC (suitable for 200°F) down pipe with supports. Down pipe shall be centered on the a 7.5-inch opening with a top flange connection 6 inches below the top of tank and a bottom plain end connection 2 feet above the tank floor. Contractor shall install flanged upper connection to the 3-inch ALP air supply line. Coarse bubble diffuser manufacturer shall provide bottom connection air manifold. Contractor shall install an EPDM pipe boot connection to the 3-inch ALP and sealed to the tank top to seal the annular space around the pipe from insect intrusion;
- 4-inch flanged U-vent;
- 4-inch flange for radar level sensor mount;
- 4-inch flange for float switch insertion and mount with blind flange to be modified in field.

External pipe connections flexible couplers:

- Contractor shall provide and install flexmaster expansion joint to 3-inch WS side outlet connection to WAS pump;

f. General Requirements

The Contractor shall coordinate the location of the sidewall connections and tank cover bulkhead connections as shown on the plans and as specified herein. The Contractor shall coordinate the 6-inch cover connection instrument ports with the radar level sensor and float switch as specified in Sections 13425 and 13422, respectively.

The down pipe shall be supported at 5 foot maximum intervals with bulkhead fittings, schedule 80 pipe, and down pipe saddle clamps.

Provide tank cover connections with spool lengths as required for elevations shown on the Plans. Provide U-vent with mesh insect screening. Contractor shall provide and install PVC blind flange for 6-inch top cover connections, drilled and notched for installation of instrumentation wiring penetration to allow removal and installation of blind flange with instrument in place.

D. DESIGN REQUIREMENTS

1. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.187 in. thick.

T = P x O.D./2 SD = 0.433 x S.G. x H x O.D./2 SD

T = wall thickness
SD = hydrostatic design stress, PSI
P = pressure (.433 x S.G. x H), PSI
H = fluid head, ft.
S.G. = specific gravity, g/cm^3
O.D. = outside diameter, in.

a. The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 psi at 73 degrees F for Type I and Type II materials. In accordance with the formula in 6.1, the tank shall have a stratiform (tapered wall thickness) wall.

b. The hydrostatic design stress shall be derated for service above 100 degrees F and for mechanical loading of the tank.

c. The standard design specific gravity shall be 1.9. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support. Flat areas shall be provided to allow locating large fittings on the cylinder straight shell.

The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. The top head of tanks with 2,000 or more gallons of capacity shall be designed to provide a minimum of 1,300 square inches of flat area for fitting locations.

2. Tanks with 2,000 or more gallons of capacity shall have a minimum of three lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of an empty tank.

3. The tank shall be designed to provide a minimum of four tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage. The seismic tie down system base plates and anchor bolts shall be supplied and installed by the Contractor as recommended by the tank manufacturer per the approved structural calculations.

Supporting calculations for the tank seismic supports shall be supplied by the tank manufacturer. The tank and associated supports shall be designed and stamped by a structural engineer registered in the State of Washington and shall be designed for the seismic design parameters listed in Specification Section 11000.

E. EQUIPMENT

1. Like items of equipment provided hereunder although different services, shall be the end products of one manufacturer.

2. Provide anchor bolts, nuts, and anchor bolt templates for each piece of equipment furnished or specified herein, in accordance with Section 05500, Miscellaneous Metal Fabrications. Anchor bolts shall be designed to withstand all load conditions including seismic. No less than eight anchor lugs shall be provided. Details of anchors shall be shown on fabrication drawings.

3. Tank Identification: Identify each tank with the fabricator's name, capacity in gallons, design maximum temperature, design pressure, chemical service, specific gravity, design, minimum wall thickness, tank "tag" number, tank name resin type, percent composition and date of manufacture. Marking shall be on a 16-gauge stainless steel plate. Seal decals, labels, etc., into the laminate exterior with clear resin.

4. Lifting lugs shall be provided for all tanks weighing more than 100 pounds. Lifting lugs shall be of 316 stainless steel.

5. Tie down system components shall be 304 stainless steel.

6. All flanged nozzles on the tanks shall be rated at minimum 25 psi according to PS15-69. The flange outer diameters and drilling shall be per ANSI 16.5.

7. The back face of all flanges shall be spot-faced, flat and parallel to the flange face of sufficient diameter to accept a SAE metal washer under the bolt head or nut.

8. All tank nozzles shall be gusseted with conical type gussets in preference to plate type gussets.

9. Nozzles shall have a 6-inch projection as measured from the face of the flange to the closet point on the outside of the tank.

10. Double bolted flange fittings: Provide double bolted flange fitting outlets on all sidewall pipe connections consisting of a bolted double flange fitting. The bolted double flange fitting shall be constructed with 2 ea. 150 lb. flanges, 2 ea. 150 lb. flange gaskets,

and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I. Gaskets shall be a minimum of 1/4-inch thickness and constructed of 40 to 50 durometer EPDM. There shall be a minimum of 4 ea. full thread bolts. The bolts will have bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4 inch of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material (white - 316 Stainless Steel). Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange. Standard orientation of bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5 unless otherwise specified. Bottom fittings shall be an integral part of the tank and provide complete drainage of liquid through the sidewall of a flat bottom container without the use of a special support structure or concrete pad.

11. All tank fitting attachments shall be equipped with flexible couplers or other movement provisions. The tank will deflect based upon tank loading, chemical temperature, and storage time duration. Tank piping flexible couplers shall be designed to allow 4 percent design movement. Movement shall occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement. Flexible coupler for the WAS tank 3-inch WS bottom outlet connection shall be Snyder Flexmaster or approved equal. All other flexible couplers shall be 2-feet minimum length of flexible reinforced PVC hose.

F. MATERIALS

1. The material used shall be virgin polyethylene resin as compounded and certified by the manufacturer. Type II tanks shall be made from linear polyethylene resin as manufactured by Exxon Chemical, or resin of equal physical and chemical properties.

2. All polyethylene resin material shall contain a minimum of a U.V. 8 stabilizer as compounded by the resin manufacturer. Pigments may be added at the purchaser's request, but shall not exceed 0.25 percent (dry blended) of the total weight.

3. Resin for shall be suitable for the applications and shall be HDLPE, natural in color, 1.9 specific gravity, 600 psi hoop stress (meeting ASTM standards) by Snyder Industries or equal.

4. Mechanical Properties of Type II tank material:

Property	**ASTM**	**Value**
Density (Resin)	D1505	0.942-0.947 g/cc
Tensile (Yield Stress 2"/min)	D638	2700 PSI
Elongation at Break (2"/min.)	D638	350%
ESCR (100% Igepal, Cond. A, F50)	D1693	400-1,000 hours
ESCR (10% Igepal, Cond. A, F50)	D1693	200-500 hours
Vicat Softening F° Temperature	D1525	235
Flexural Modulus	D790	97,000-103,000 psi

G. TEST METHODS

1. Test specimens shall be taken from fitting location areas or piggy-back test molds.

2. Low Temperature Impact Test

   a. Test specimens should be conditioned at -40 degrees F for a minimum of 2 hours.

   b. The test specimens shall be impacted in accordance with the standard testing methods as found in ASTM D1998. Test specimens < 1/2-inch thickness shall be tested at 100 ft.-lb. Test specimens > 1/2-inch thickness shall be tested at 200 ft.-lb.

3. Ultrasonic Tank Thickness Test

   a. All tanks 2,000 gallons or larger shall be measured for tank wall thickness at 6 inches, 1 foot, 2 feet, and 3 feet on the tank sidewall height at 0° and 180° around the tank circumference with 0° being the tank manway and going counter-clockwise per ANSI standard drafting specifications. A copy of this test report shall be submitted for approval before shipment. All tanks shall meet design thickness requirements and tolerances.

4. Hydrostatic Water Test

   a. The hydrostatic water test shall consist of filling the tank to brim full capacity for a minimum of 4 hours and conducting a visual inspection for leaks. A hydrostatic water test shall be conducted and a report submitted for approval before shipment.

5. The tank shall be visually inspected to determine such qualities as are discussed below:

   a. The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the tank. Fine bubbles are acceptable with Type II tanks to the degree in which they do not interfere with proper fusion of the resin melt.

   b. All cut edges where openings are cut into the tanks shall be trimmed smooth.

PART 3 EXECUTION

3.1 GENERAL

A. The equipment shall be installed in accordance with the Manufacturer's recommendations and instructions and as shown on the Drawings.

B. Tanks shall be prepared and provided for shipment and shipped in conformance with ASTM D3299.

C. Installation, handling and storage of the tanks shall be in strict accordance with the manufacturer's printed instructions. Care shall be taken not to damage the tanks and the accessories.

D. Contractor shall coordinate shipment and installation of the tank connections and accessories with the tank manufacturer.

3.2 TANK INSPECTION

A. A clearance for shipment shall not relieve the Fabricator's responsibility as to performance guarantees, quality of materials, and workmanship, and dimensional conformity with the Drawings.

B. Engineer will be permitted access to the plant area at all times during fabrication and shall be notified 1 week prior to the estimated date of fabrication.

C. Repairs authorized by Engineer shall be reinspected before final acceptance unless specifically waived.

D. Noncompliance with this Specification or evidence of poor workmanship shall be cause for rejection.

E. FIELD TESTING/INSPECTION

Prior to final installation each tank shall be hydrostatically tested to detect any damage during shipment. There shall be no visible leakage in 24 hours. Any evidence of leakage shall be cause for rejection of the tank.

3.3 FIELD TESTS

A. FUNCTIONAL TEST

Prior to plant startup, all equipment described herein shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test. Provide certification of test results. Tests and certification shall be as specified in Section 01800, Testing, Commissioning, and Training.

B. PERFORMANCE TEST

The Contractor, assisted by the equipment manufacturer's representative, shall conduct field tests with the equipment in its installed position. Tests shall include a load test in compliance with OSHA requirements and demonstration to the Engineer that under this load condition the equipment will perform satisfactorily throughout the complete range of operation. All safety devices shall be successfully demonstrated. Test and reports shall be as specified in Section 01800, Testing, Commissioning, and Training.

3.4 MANUFACTURER'S REPRESENTATIVE

The tank manufacturer shall include the services of a factory-trained field engineer for the purposes of installation inspection, making field adjustments necessary to ensure proper system operation, equipment startup, performance testing, and training of plant personnel regarding proper operation and maintenance of the equipment. Manufacturer's services shall include 1 day for inspection,

certification, testing; startup, and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the non-potable water system is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13411

DISSOLVED OXYGEN METERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing one new dissolved oxygen meter at the Aeration Basin as shown on the Plans and specified herein. The dissolved oxygen meter shall be complete with sensor, probe, controller and all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	General Equipment Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Aeration Basin DO Meter	02 DO 01 (AE 241)
Aeration Basin DO Transmitter	AIT 241

1.4 PERFORMANCE REQUIREMENTS

Parameter	Performance Requirement
Accuracy @ DO<1ppm (ppm)	0.1
Accuracy @ DO>1 ppm (ppm)	0.2
Repeatability	0.1
Measurable range (ppm)	20

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Dissolved Oxygen Meter shall be HACH Co. Model LDO and the transmitter (controller) shall be HACH Co. Model SC4500, or approved equivalent equipment manufactured by Insite Instrumentation Group, Inc. No other manufacturers will be accepted.

2.2 GENERAL

One dissolved oxygen monitoring system shall consist of one sensor/probe for each controller and auxiliary equipment. The dissolved oxygen sensor shall be a continuous-reading probe that utilizes luminescent sensor technology.

2.3 SENSOR

The dissolved oxygen sensor shall be a continuous-reading probe that utilizes luminescent sensor technology.

The sensor shall be made of Polybutyl Methacrolate and shall screw on to the probe. The probe material shall be foamed Noryl and 316 stainless steel. All parts of the probe shall be corrosion resistant and fully immiscible. The probe shall provide electrolyte free operation without the requirements of sample

conditioning. The sensor cap shall be warranted for one year and shall be capable of being replaced quickly without the use of tools.

The sensor shall provide automatic temperature compensation and shall be capable of operating over a temperature range from 0 to 50 degrees Celsius.

The sensor shall encounter no interference from the presences of any of the following constituents:

A. Hydrogen sulfide, H_2S
B. pH
C. Potassium ion, K^{+1}
D. Sodium ion, Na^{+1}
E. Magnesium ion, Mg^{+2}
F. Calcium ion, Ca^{+2}
G. Ammonium ion, NH_4^{+2}
H. Aluminum ion, Al^{+3}
I. Lead ion, Pb^{+1} and Pb^{+2}
J. Cadmium ion, Cd^{+1} and Cd^{+2}
K. Zinc ion, Zn^{+1} and Zn^{+2}
L. Chromium ion, Cr (tot),
M. Iron ion, Fe^{+2} and Fe^{+3}
N. Manganese ion, Mn^{+2} and Mn^{+4}
O. Copper ion, Cu^{+2} and Cu^{+3}
P. Nickel ion, Ni^{+2} and Ni^{+4}
Q. Cobalt ion, Co^{+2} and Co^{+3}
R. Cyanide ion, CN^{-1}
S. Nitrate ion, NO_3^{-1}
T. Nitrite ion, NO_2^{-1}
U. Sulfate ion, SO_4^{-2}
V. Sulfur ion, S^{-2}
W. Phosphate ion, PO_4^{-2}
X. Chloride ion, Cl^{-1} and Cl_2^{-1}
Y. Anion Active Tensides
Z. Crude Oils

The probe and sensor shall be installed using a pole mount system allowing easy removal for cleaning and maintenance. The probe shall be supplied with a minimum of 30 feet of integral cable with a quick disconnect type of plug.

A stainless steel mounting bracket, suitable for mounting the ball float mount assembly from the aeration basin wall shall be supplied with each unit. The pole mount assembly shall include mounting bracket, swivel assembly, mounting pipe, ball float, position pin with lanyards, bolts, washers, lock washers, hex nuts, PVC

mounting pole with slot and 45 degree elbow. All mounting hardware shall be stainless steel. Six feet of extra cable shall be neatly coiled with plastic tie wraps and hook mounted on the handrail.

2.4 TRANSMITTER

Each transmitter (controller) shall be capable of receiving signals from two sensors.

The controller display shall be a graphic dot matrix LCD, 128 x 64 pixels with LED backlighting and shall indicate dissolved oxygen in ppm, temperature of the measuring media in degrees F and C, fault messages and alarm settings. The controller shall be supplied with three electromechanical relays; SPDT (Form C) contacts; UL rated 5A at 115V and two isolated 4-20 mA standard DC (direct current) analog outputs; each with a minimum 0.004 mA resolution and capability to drive up to 500 Ω loads.

Each output shall be capable of being assigned to represent the Sensor A measurement or temperature or the Sensor B measurement or temperature.

The controller accuracy shall be ±0.1 percent of span.

The controller shall contain settings for low alarm point, low alarm point dead band, high alarm point, high alarm point dead band, off and on delay.

The controller enclosure shall be NEMA 4X with polycarbonate face panel, epoxy-coated high-quality cast aluminum door and case, nylon mounting bracket, and 316 stainless steel hardware for mounting to a back plate.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor #18 gauge copper wire in the manner shown on the Plans.

The controller shall be powered from DC power nominally 24 VDC.

The units shall be labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries or for installation on this project.

2.5 WEATHER/SUNSHIELD

Each controller shall be provided with a weather and sunshield with a UV protection screen. The weather and sun shield shall be Hach Part No. 9220600 or equal.

2.6 SPARE PARTS AND TOOLS

The Contractor shall provide the Manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Spare DO sensor: One unit

PART 3 EXECUTION

3.1 INSTALLATION

The dissolved oxygen meters shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the dissolved oxygen meter manufacturer shall be provided. These services shall not be provided by the control panel manufacturer or electrical contractor. The manufacturer's representative shall be trained for the particular instruments installed on this

project and any associated configuration software. Services shall include a minimum of 3 days (three separate visits) on site for each installation. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance ready to start at each stage of the project. The first visit for each installation shall be for the inspection of the installation, initial configuration, programming, testing, and startup. The second visit for each installation shall be for the instruction of the Owner's personnel and adjustments to the initial configuration and programming. The third visit for each installation shall be for further instruction to the Owner and adjustments to the initial configuration and programming and shall occur between 30 days and 1 year after startup. Instruction and training of the Owner's personnel shall not take place until startup is completed and the dissolved oxygen meters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13417

PRESSURE GAUGES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new discharge pressure gauges, as shown on the Plans and specified herein. Discharge pressure gauges shall include all necessary connectors and hardware on all process piping for pumps at the various locations for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
15050	Process Piping Systems
Division 15	Mechanical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment No.	Diaphragm Seal/ Annual Isolation Ring
NPW Pump 1 Inlet Pressure Gauge	PI 143	NA (Snubber Only)
NPW Pump 2 Inlet Pressure Gauge	PI 144	NA (Snubber Only)
NPW Pump 1 Discharge Pressure Gauge	PI 145	NA (Snubber Only)
NPW Pump 2 Discharge Pressure Gauge	PI 146	NA (Snubber Only)
NPW Filter Discharge Pressure Gauge	PI 149	NA (Snubber Only)
NPW Irrigation System Pressure Gauge	PI 150	NA (Snubber Only)
Influent Pump 1 Discharge Pressure Gauge	PI 261	Diaphragm Seal
Influent Pump 2 Discharge Pressure Gauge	PI 262	Diaphragm Seal
RAS Pump 1 Discharge Pressure Gauge	PI 271	Diaphragm Seal
RAS Pump 2 Discharge Pressure Gauge	PI 272	Diaphragm Seal
WAS Pump Inlet Pressure Gauge	PI 233	Diaphragm Seal
WAS Pump Discharge Pressure Gauge	PI 234	Diaphragm Seal

All pressure gauges listed above shall be provided with flushing connection and diaphragm seals as noted above.

1.4 PERFORMANCE REQUIREMENTS

The suction and discharge pressure gauges shall be provided with the following pressure ranges.

Pressure Gauge	Pressure Range
PI 143	0 – 150 psi
PI 144	0 – 150 psi
PI 145	0 – 150 psi
PI 146	0 – 150 psi
PI 149	0 – 150 psi
PI 150	0 – 60 psi
PI 261	0 – 60 psi
PI 262	0 – 60 psi
PI 271	0 – 60 psi
PI 272	0 – 60 psi
PI 233	0 – 60 psi
PI 234	0 – 60 psi

Unless otherwise indicated, the discharge pressure gauge scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale.

Pressure gauges shall be shown on the detailed installation drawings of all piping and connected equipment as specified in Section 15050. Pressure scale range for each pressure gauge shall be in the form of a summary table including all process piping pressure gauges.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure gauges shall be Ashcroft Duragage 1279, or approved equal.

The diaphragm seals shall be Ashcroft Type 101, or approved equal.

2.2 GENERAL

The pressure gauges shall be glycerin filled type and shall have all internal parts immersed. Pressure gauges shall be minimum 4 1/2-inch dial size, with 1/4-inch instrument connection, non-metallic case, stainless steel bourdon tube with plastic bushings and pinion, and stainless steel selector. Gauges shall be ANSI grade A or better with an accuracy of ±0.5 percent.

Gauges measuring liquids shall be supplied with bronze pressure snubber and diaphragm seal as noted. Diaphragm seals shall have silicone DC200 fluid fill and shall have a Type 316 stainless steel body, with 1/4-inch flushing connection, 1/4-inch instrument connection, and 1/2-inch process connection.

2.3 SPARE PARTS

The Contractor shall provide one spare pressure gauge and diaphragm seal for the pressure range stipulated in Part 1.4, we well as, the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure gauges and accessories shall be installed as shown on the Plans and as specified herein and in accordance with the manufacturer's instructions.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

***** END OF SECTION *****

SECTION 13419

PRESSURE TRANSMITTER

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing gauge pressure transmitters, as shown on the Plans and as specified herein. The pressure transmitter shall include all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions

1.3 EQUIPMENT LIST

Equipment number is as follows:

Item	Equipment Number
Non-Potable Water System Pressure Transmitter	01 PTR 03

1.4 PERFORMANCE REQUIREMENTS

The pressure transmitter shall be provided with the following pressure range for the specified application.

Parameter	Value
Non-Potable Water System	
Reference Accuracy (percent of span)	0.075%
Long Term Stability (2 year max, percent)	0.1% of URL
Span Drift (percent)	None measurable
Turndown Capacity	100:1
Total Response Time	100 ms
Pressure Range (psig)	0 – 150 psig
Measurement Media	Non-Potable Water

If the manufacturer's rated maximum process temperature in the measuring cell is less than the Maximum Media Temperature listed above, the Contractor shall

provide a process connection pipe/hose of sufficient length to provide ambient coating so that the maximum measuring cell temperature is not exceeded.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure transmitter shall be Emerson Rosemount Model 2051T, Siemens SITRANS P DS III, or Endress and Hauser Deltabar S PMD75, with a block and bleed valve manifold provided. No other manufacturers or models shall be accepted.

2.2 PRESSURE TRANSMITTER

The pressure transmitter shall be a digital transmitter with piezoresistive or capacitance-based sensor and Type 316 stainless steel diaphragm seal. The pressure sensitive element shall be Type 316 stainless steel, silicone filled, and shall be calibrated for the range as specified in the Performance Requirements.

The transmitter pressure sensor shall be protected from the effects of pressure swings and spikes up to the maximum working pressure (body rating) of the pressure capsule. The process connection for the non-potable water system and the blower air headers shall be Type 316 stainless steel, 1/2-inch diameter, NPT 14 thread. The process connection for air and the non-potable water system shall be connected to a Type 316 stainless steel block-and-bleed manifold with a Type 316 stainless steel isolation valve and a bleed vent. The manifold shall permit removal of the sensor for maintenance or replacement with minimal leakage of process air during compression removal of the sensor.

The process connection for the screw press shall be Type 316 stainless steel, 3-inch diameter, ANSI B16, Class 125, with an integral flush mounted Type 316 stainless steel diaphragm.

The transmitter shall be a true two-wire loop-powered device, 24 VDC, without the requirement of a separate power supply at the transmitter. The unit shall be modular plug-in design.

The non-wetted transmitter housing shall be aluminum or stainless steel and shall meet NEMA 4X standards. The pressure transmitter shall display the measured pressure on the front of the unit enclosure and all units shall have a menu-driven keyboard on the front panel of the transmitter. The transmitter shall have an LCD display for indicating the pressure in real engineering units (feet WC for the screw press and psig for the blower headers and non-potable water system). The display shall be rotatable in 90 degree increments. The unit shall be capable of recalibration in the field by the menu-driven keyboard. The keyboard shall allow for viewing control of results, the error messages, the operating modes, and the digital display.

The controller shall be supplied with one isolated 0/4-20 mA standard DC (direct current) analog output; with 0.004 mA (12-bit) resolution and capability to drive up to 500 Ω loads.

The digital information shall be evaluated in the microcontroller, its linearity and temperature response corrected and converted in a digital-to-analog converter into an analog output current.

The transmitter shall have the ability to electronically compensate for the effects of mounting position on the sensor. Furthermore, the transmitter shall be able to force the loop current to various values to aid in loop setup and testing.

The transmitter shall have online diagnostics and registers to detect and store various parameters such as min/max electronics temperature, min/max pressure, capsule temperature, and min/max process pressure to help diagnose process problems. The transmitter shall also have dual timer registers that allow the

transmitter to signal when a settable time has elapsed for preventative maintenance or calibration.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded copper wire in the manner shown on the Plans.

The pressure transmitter shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

2.3 SPARE PARTS

The manufacturer shall provide the manufacturer's recommended spare parts and special tools. All spare parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's factory before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure transmitter shall be installed at the locations shown on the Plans in accordance with manufacturer's recommendations.

All mounting hardware and supports shall be provided by the Contractor.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall ensure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment of failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pressure transmitter manufacturer shall be provided. Services shall include a minimum of 1 day on site. Services shall include inspection and supervision of installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance for the pressure transmitter, in accordance with Specification Section 01800. Instruction and training of the Owner's personnel shall not take place until startup is complete and the pressure transmitter is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13422

FLOAT SWITCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing float switches and associated equipment as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
NPW Tank On/High Level Alarm Float	01 LS 01
Influent P.S. Pump 1 On/High Level Alarm Float	02 LS 01
Influent P.S. Pump 2 On/High Level Alarm Float	02 LS 02
RAS P.S. Pump 1 On/High Level Alarm Float	02 LS 07
RAS P.S. Pump 2 On/High Level Alarm Float	02 LS 08
WAS Tank On/High Level Alarm Float	02 LS 09

1.4 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.6 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The float switches shall be Flygt Model ENM-10 or equivalent equipment manufactured by Warrick Controls, Hydr-O-Matic, or Anchor Scientific.

2.2 FLOAT SWITCHES

Float switches shall be the tilting, non-mercury type. Mercury switches are not acceptable. The switch(es) shall be enclosed in a liquid-tight plastic casing with a cable of sufficient length to reach to the terminating device. Tilting float switches shall have either single pole double throw contacts, or single pole single throw contacts. Pole and throw contact number will be determined based on recommendations of the manufacturer as well as the application for which it will be used.

2.3 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 FLOAT SWITCH INSTALLATION

The float switches shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations. The switch(es) shall be mounted and positioned according to the manufacturer's approved method and at heights as directed by the Engineer unless noted otherwise on the Plans. It shall be suspended at the proper position to hang or float, depending on the liquid level.

The electrical cable, supplied with the float, shall be connected from the float to the terminating device terminal.

3.3 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000. The field test shall ensure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing. Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.4 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the float switch Manufacturer shall be provided. Services shall include up to 1 day onsite and shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the float switches are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13424

PRESSURE (LEVEL) TRANSMITTERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing pressure submersible level transmitters as shown on the Plans and as specified herein. The pressure transmitters shall include all necessary associated equipment, accessories, and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Influent Pump Station Submersible Level Sensor	02 SLS 01

1.4 PERFORMANCE REQUIREMENTS

The submersible level transmitter and transducer level signal shall indicate to ±1 percent of value from 10 percent to 100 percent of scale and shall be within ±1 percent of span below 10 percent of scale.

The analog instrumentation shall have an accuracy of ±0.5 percent of full scale output.

The pressure transmitters shall be provided with the following pressure range for the specified application and location.

Pressure Transmitter	Pressure Range
02 SLS 01	0 – 34 feet

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Submersible Level Sensor shall be as manufactured by Siemens Control Systems Model A1000i, Endress and Hauser Model FMX21, or equivalent equipment manufactured by Contegra, Inc. No other manufacturers or models shall be accepted.

2.2 PRESSURE TRANSDUCER

The submersible level transducer shall be a two-wire type and shall operate from a supply voltage of 9 to 30 VDC and produce a 4-20 mA signal in direct proportion to the measured level excursion over a pre-calibrated range per Part 1.4. The unit shall have ample instrument loop load capacity and shall be able to drive a minimum load of 750 Ohms @ 24 Vdc loop power. The sensor technology shall be based on the use of a highly reliable and stable piezo-resistive pressure element with a 0.25 percent full scale accuracy with compensation for non-linearity, hysteresis and repeatability. The unit shall operate between –40 and 185 degrees F and shall have no more than a 3 percent full scale error over a –4 to 180 degrees F range.

The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures two times the full-scale range being sensed. Sensing principles employing less reliable technologies including LVDTs, capacitance or pneumatic elements shall not be acceptable. Metallic diaphragms are not acceptable.

The transducer shall be suitable for continuous submergence and operation.

The transducer shall be rated for a Class 1 Division 1 hazardous environment.

The transducer housing shall be fabricated of Type 316 stainless steel with a 2-5/8-inch-diameter bottom diaphragm of heavy-duty, limp, foul-free, molded Teflon (TM) bonded to a synthetic rubber back/seal.

Transducers/transmitters that have the span and offset adjustments and electronics in the lower sensing portion of the transducer are not acceptable.

The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in a weatherproof, fiberglass upper assembly. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.

The sensor shall be suspension-mounted using a Siemens cable suspension mounting kit or approved equivalent, consisting of a 2-foot-long, 1-inch NPT Type 316 stainless steel pipe with coupling, bolt, cable clamps and hardware along with the required length of 1/8-inch diameter 7 x 19 stainless steel cable.

The level sensor shall be listed and labeled by a recognized electrical testing laboratory or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

2.3 SPARE PARTS

The manufacturer shall supply one spare transmitter that will be identical to the equipment specified above. All spare parts shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The equipment specified in this Section shall be installed as shown on the Plans and in accordance with the manufacturer's instructions and recommendations.

The level transducer shall be permanently mounted at the measuring site and positioned according to the Manufacturer's approved method. The bottom diaphragm face of the sensor shall be installed 6 inches above the bottom of the wet well/vessel, unless otherwise shown on the Plans. The sensor shall be mounted using the stainless steel cable system as shown on the Plans.

The electrical signaling cable, supplied by the sensor, shall be connected from the sensor to the transmitter housing with an additional length of 5 feet to be coiled at the access hatch. No splices shall be allowed to the manufacturer's cable.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S REPRESENTATIVE

The services of a factory-trained representative of the pressure transmitter manufacturer shall be provided. Services shall include a minimum of 1 day on site for each type of pressure transmitter. Services shall include inspection of the installation, initial configuration, startup, testing, adjustments and instruction of the Owner's personnel in operation and maintenance for the pressure transmitters. Instruction and training of the Owner's personnel shall not take place until startup

is completed and the pressure transmitters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13425

RADAR LEVEL SENSORS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing radar level sensors and associated equipment as shown on the Plans and as specified herein. The radar level sensors shall include all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
NPW Tank Radar Level Sensor	01 RLS 01
WAS Tank Radar Level Sensor	02 RLS 01

1.4 PERFORMANCE REQUIREMENTS

The radar transmitter signal shall indicate to ±0.08 inch or ±0.1 percent resolution of tank height.

The radar level sensors shall be supplied with the following enclosure requirements.

Radar Level Sensor	Enclosure Rating
01 RLS 01	Unclassified
02 RLS 01	Class 1 Div. 1

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The radar level sensors shall be Endress & Hauser Micropilot FMR20 or approved equal.

2.2 RADAR LEVEL SENSOR AND TRANSMITTER

The pulsed time of flight radar transmitter shall operate at 26 GHz using 2-wire technology for level measurement and/or open channel flow measurement.

The radar level sensor accuracy shall be +/- 0.08", maximum measurement distance shall be 0 - 66 ft., process temperature range shall be -40 to 176 degrees F and pressure range shall be from -14.5 to 43 psi.

The unit provides diagnosis information according to NAMUR NE107 with clear text messages to remedy.

It must be possible to view a graphical representation of the actual signal and envelope curve on the display.

The process connection shall be 1” NPT, 1.5” NPT, 2” NTP or 3”-6” ANSI flange connection by application.

The radar output signal shall be 4-20 mA dc loop powered. The radar signal on alarm shall be 22.5mA.

The radar device shall have Bluetooth wireless technology interface and can be operated and configured via this interface using the SmartBlue app. The range under reference conditions is 33ft. The Bluetooth shall have both encrypted communication and password encryption for security purposes. The Bluetooth wireless technology interface can be deactivated.

The radar shall have a linearization function with up to 32 value pairs entered allowing conversion of the measured value into any unit of length, weight, flow or volume.

The radar unit shall be rated for IP66/68 or NEMA4X/6P.

The radar sensor body material shall be made of PVDF.

The radar sensor must have hermetically sealed wiring and fully potted electronics eliminating water ingress.

The radar level sensors shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

2.3 ACCESSORIES

Weather protection cover in PVDF
Adjustable Mounting Bracket in 316L

Display units supplied with the sensors listed in Section 1.4 shall be loop powered, 4-20 mA process display units with a 5-digit LCD display of 4-20 mA input and shall be rated IP66. Display units shall be Endress + Hauser RIA15, or equal.

2.4 SOURCE QUALITY CONTROL AND CALIBRATION

Provide ISA data sheet ISA-TR20.00.01. Use the latest revision of form 20F2321. Complete the form with all known data, and dash out the inapplicable fields. Incomplete data sheets submitted will be result in a rejected submittal. Provide complete documentation covering the calibration during manufacturing.

2.5 SAFETY

All electrical equipment shall meet the requirements of ANSI/NFPA 70, NATIONAL ELECTRIC CODE, latest addition.

All devices shall be capable of being certified for use in hazardous areas: Class I, II, III, Div. 2, Groups A-G.

All devices shall be suitable for use as non-incentive devices when used with appropriate non-incentive associated equipment. Devices with intrinsically safe ratings will normally be acceptable with vendor's approval.

Transmitter housing shall conform to NEMA 4x classification.

Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as FM, UL, ETL, CSA, etc. for the specified electrical area classification.

Electrical equipment specified as intrinsically safe shall qualify as "simple apparatus" or NTRL approved intrinsically safe equipment per ANSI/ISA-RP12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations", latest edition.

2.6 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The radar level sensor shall be installed as shown on the Plans and in strict accordance with Manufacturer's recommendations and written instructions.

Specific attention should be given to verifying the nozzle height, dimension, and location where the transmitter has been installed.

All mounting hardware and supports shall be provided by the Contractor.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the radar level sensor manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup. This visit shall include adjustments to the equipment as well as instruction of the Owner's personnel in operation and maintenance for each radar sensor (or group of sensors). Instruction and training of the Owner's personnel shall not take place until startup is completed and the radar sensors are fully operational and shall be at a time and location agreed to by the Owner.

The services of a factory-trained representative of the radar level sensor manufacturer shall also be provided between 30 days and 1 year after startup for further instruction to the Owner and adjustments to the initial configuration and programming.

The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13426

MAGNETIC FLOW METERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing magnetic flow meters as shown on the Plans and as specified herein. The flow meters shall include all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
15050	Piping Systems
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
NPW Flow Meter	01 MFM 03
Influent Flow Meter	02 MFM 01
RAS Flow Meter	02 MFM 02
WAS Flow Meter	02 MFM 03

1.4 PERFORMANCE REQUIREMENTS

The magnetic flow meters shall have an accuracy of ±0.25 percent of the actual flow rate at velocities of 1.5 ft/sec or greater.

The flow meters shall be provided with the following size and flow range for the specified application and location.

Flow Meter	Flange Diameter (inches)	Flow Range (gpm)	Sensor Rating
01 MFM 03	2	0 – 300	Unclassified
02 MFM 01	3	0 – 300	Class I, Div. 2
02 MFM 02	3	0 – 50	Class I, Div. 2
02 MFM 03	3	0 – 50	Class I, Div. 2

The liquids to be measured will be wastewater treatment effluent and non-potable water varying in temperature from 50 degrees F to 100 degrees F and in solids concentration from 0 to 0.1 percent.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In accordance with the warranty duration required in the Contract, the equipment manufacturer shall provide a warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.7 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The magnetic flow meters and transmitter shall be Endress & Hauser Proline Promag W 400 with heartbeat technology or equivalent equipment manufactured by Siemens or Khrone. No other manufacturers shall be accepted.

2.2 GENERAL

The magnetic flow meters shall be of the low frequency and short form coil design. The field principle of electromagnetic induction shall produce a positive DC pulsed signal directly and linearly proportional to the liquid flow rate. The metering tube shall be constructed of Type 316 stainless steel with Class 150 ANSI flanged end connections. Electrodes shall be protruding (bullet nose) made of Type 316 stainless steel or Alloy C22. The material of construction of the liner shall be PTFE, NBR hard rubber, or polyurethane. The meter shall secure its power from the transmitter. Transmitter shall be 24 VAC powered. No electronics shall be mounted in the metering tube of the magnetic flow meter.

The transmitters shall be integral to the flow head where specified in Part 1.4. Provisions for remotely mounting the transmitter shall be provided where the transmitter is specified to be remote. Remote transmitters shall be provided in a field mount enclosure suitable for surface mounting. Transmitter shall be interchangeable without reprogramming the meters or disconnecting the cables. The transmitters shall convert the output signal from the flow meters and transmit the signal via an isolated analog 4-20 mA signal directly proportional to flow rate. The transmitter shall have automatic zero correction.

The flow meter shall also have a dry contact or opto-isolated transistor pulse flow totalization signal suitable for use with a 24 VDC device discrete inputs (such as telemetry units) with an input impedance of at least 2 kΩ. The minimum pulse duty cycle shall be adjustable to be at least 250 ms.

The transmitters shall produce a totalization of flow dry contact output pulse signal that is directly and linearly proportional to total flow.

The magnetic flow meter tube and transmitter shall be NEMA 4X classified. The units shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

Each meter system shall be wet-calibrated at the manufacturer's facility against the master system. A calibration certificate shall be furnished for each meter.

Provide grounding rings or grounding electrodes with each flow meter as required to maintain the specified accuracy.

The flow meters shall be capable of accidental submergence to 3 feet for a period of 30 minutes.

2.3 ANALOG INSTRUMENTATION

The flow meters shall be of the manufacturer's latest design. The equipment shall have 4 to 20 milliamperes standard DC (direct current) isolated floating outputs and shall conform to ISA 50.1. Each output shall be provided with adjustments for gain and bias. The resultant output shall be 4-20 mA DC into approximately 750 ohms. Accuracy shall be ±0.25 percent of full scale output.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor #18 gauge copper wire in the manner shown on the Plans.

2.4 SPARE PARTS

The Contractor shall supply one spare transmitter.

All spare parts shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.5 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The flow meters shall be installed as shown on the Plans and in accordance with the Manufacturer's recommendations and instructions. If ground rings are required to maintain the specified accuracy, they shall be installed with the units and bonded to grounding conductor where recommended or required by the Manufacturer.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report

forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the magnetic flow meter manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the magnetic flow meters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13451

PLC PROGRAMMING – PROCESS CONTROL DESCRIPTION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes Programmable Logic Controller (PLC) programming requirements, internal testing, witness testing, commissioning, and training responsibilities for the Integrator subcontracted by the Contractor.

PLC programming shall be provided for the new WWTF PLC furnished and installed by the Contractor in the Operations Building. The MBR supplier will provide programming for the MBR PLC as shown on the P&ID drawings. The WWTF shall monitor and log all values shown in the "MBR PLC" layer of the P&ID drawings via the ethernet connection to the WWTF PLC. The PLC/HMI programmer shall coordinate two on-line meetings with the MBR supplier programmer and Engineer prior to beginning programming work.

Only a portion of the data and information that shall be transmitted to and from the plant SCADA system is summarized herein. All data and information shown in the PLC level on the Process and Instrumentation Drawings (P&ID's) on the Plans and in the specifications shall be relayed to and from the master SCADA computer by the master PLC.

The various reference and adjustable set point values will be determined during the submittal phase of the construction project.

The Contractor shall note that the control algorithms specified in Section 3.3 will be further detailed during the construction submittal phases. The Contractor/Programmer Integrator shall include additional final programming requirements as follows:

- Additional 3 discrete and analog data points for monitoring of equipment in each section and subsection in Section 3.3 below.

- For each section and subsection in Section 3.3 below, assume an addition of three simple permissive functions per motor (i.e., if x, motor shall not start).

- Provide additional programming for 3 new subsections equivalent to Section 3.3A-1 (Aeration System).

1.2 RELATED WORKS SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
13452	Human Machine Interface, Alarm Software and Process Computer
16910	PLC Hardware and Software Procurement
16920	HMI Hardware and Software Procurement

1.3 SYSTEM DESCRIPTION

A. DESIGN REQUIREMENTS

Reference Specification 16910 for PLC hardware and software procurement.

Reference Specification 13452 for HMI programming requirements.

The system includes programmed algorithms, which run on the PLC hardware, to provide a complete and functional process control system for the facility.

B. PERFORMANCE REQUIREMENTS

1. The installed system performs the functional and operational algorithms required for control of the process.

1.4 DEFINITIONS

A. ANALOG I/O

Analog I/O are PLC input/output electronic signals that are contiguous over time. Analog signals represent a large number of values within a specific range.

B. DIGITAL I/O

A single digital binary bit with one of a possible two states which may be represented as 1's or 0's, ON or OFF, YES or NO, TRUE or FALSE, etc. Digital I/O may also be called "discrete" I/O. Within this specification, both terms are synonymous.

C. HIM

Human Interface Module – A programmable operator interface directly associated with, or integral to, an electrical control device (such as a VFD or Soft Start drive). This interface displays device setpoints and status with a keypad for data entry.

D. HMI

Human Machine Interface – The way a person interacts with a computer or electronic device. It comprises the screen menus and icons, keyboard shortcuts, command language, and help functions. All input devices, such as mouse, keyboard, touch screen, and remote controls are also included. The HMI system is typically located in an office or lab environment.

E. I/O

Inputs/Outputs – Input and output signals into and out of a PLC or RTU.

F. OIM

Operator Interface Module – A programmable operator interface directly associated with, or integral to, an electrical device (such as a VFD or Soft Start drive). This interface displays device setpoints and status with a keypad for data entry.

G. OIU

Operator Interface Unit – A graphical display of industrial plant system variables and status. It may also allow for process control. Navigation of its programming may be via keypad, touch screen, or a combination of both. An OIU is typically located on a field control panel or control panel in an electrical equipment room.

H. PLC

Programmable Logic Controller – A device used to monitor and control system process. It can be used stand-alone or in conjunction with other systems such as SCADA. It may provide telemetric functions or interface with telemetric equipment.

I. RTU

Remote Telemetry Unit/Remote Terminal Unit – A device that reads the status of process devices and transmits them to another telemetric unit. RTUs may transmit a command from another source but will not alter or interpret the command. RTUs do not control the process.

J. SCADA

Supervisory Control and Data Acquisition (SCADA) systems are data monitoring and control stations that allow operators to visualize and adjust live process conditions at a centralized HMI. These systems often include process historical data tracking and alarming capabilities. SCADA systems can be used for data monitoring locally, remotely, or both.

K. TELEMETRY

Telemetry is the transfer of data between remote sites. Typical methods of data transfer are utility phone lines, radio transmission, and fiber optics.

1.5 SUBMITTALS

A. PLC PROGRAMMING SUBMITTALS

1. Schedule

Provide to the Engineer subsequent no less than 3 months prior to the control systems test.

2. Contents

The PLC programming submittals shall contain the following information:

a. For each PLC, include the project files created by the PLC programming software. The PLC code shall include provisions for communications with the plant SCADA system as described below and in Section 13452. These project files shall be sufficient to reload the operating and editable code to the PLC using the PLC programming software. The project files shall include annotation and commenting (in the English language) sufficient to allow a reviewer to follow the PLC logic.

b. For each PLC, include PLC tag names exported to a tab or comma delimited text file. This text file shall include all tag names accessible from a remote PLC or HMI. For each tag name, the text file shall include the name, description, data type, and any additional information required to retrieve the data remotely. Data to be communicated shall include but is not limited to the following:

i. Operational setpoints, biases, alarm settings.

ii. Process production and quality values (levels, flows, pressures, turbidity, etc.).

iii. Motor stops, starts, and run feedbacks.

iv. Alarms, permissives, and interlocks.

v. Communication error reporting (heartbeat and handshaking).

c. For each PLC, include a PDF of the PLC code. Create the PDF using the PLC programming software and a software based PDF creator. (For this item, a PDF created from scanned documents is not acceptable.) The PDF shall include the PLC configuration, a complete tag name cross-reference, and all of the PLC code.

d. For each PLC, include a separate cross reference list of PLC control tagname and the physical equipment tag number.

e. The files included in submittal may be provided as: Four copies each recorded to a finalized, single session write once optical media.

B. OPERATION AND MAINTENANCE MANUALS

1. See Section 01300 “Submittals.”

2. After acceptance of the final programmed product, provide the following:

a. Two electronic copies of the final annotated source code of system programming, final cross reference, and final I/O

and register lists. Provide this information on two USB memory sticks and CDs.

i. Annotations include the following:

(1) Description of each rung's intended function.

(2) Description of each coil, contact, timer, counter, or similar function block component.

ii. Aliasing section where each I/O point is aliased to a logical function name. Use dot fields if available.

iii. Schedule of system I/O including internal register address of each I/O point

iv. Listing of auxiliary registers and values such as setpoints, operating parameters, control loop tuning parameters, and similar registers or values used, including the following associated data:

(1) Each value or parameter with its register type, register address, descriptive name, and function in the program or algorithm.

b. Include information for obtaining assistance from the programmer.

3. Throughout the programming process, provide intermediate versions of the program to Engineering on request.

1.6 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Programmer has experience successfully programming the PLCs listed in specification 16910 for a minimum of two projects of similar size and complexity. Utilize one lead PLC programmer for the entire project.

1.7 SEQUENCING AND SCHEDULING

A. INSTALLATION AND STARTUP

1. Provide additional on-site visits and PLC programming modifications for a total period of 15 working days to be completed during startup and commissioning.

PART 2 PRODUCTS

Provide the final complete annotated source code program on USB memory sticks and CDs per Section 1.5.

PART 3 EXECUTION

3.1 APPLICATION

A. Provide programming to accomplish all control and monitoring requirements indicated or specified.

B. PROGRAM ORGANIZATION

1. Organize and format the PLC programs in each processor consistently.

2. Buffer all I/O in a common section of the program.

3. Organize the program by Process Area.

4. Organize the code sections logically within the Process Areas. Annotate each section.

5. Program using ladder logic.

3.2 PROGRAM CONTROL METHODS

A. DEFINITION OF MOTOR NORMAL OPERATION

A motor is considered running "UNDER-LOADED" when it's motor current I_m < 5 percent of its Full Load Amp (FLA) rating for more than 5 consecutive seconds. This is indicative of a motor disconnected from its load (broken coupling, broken shaft, etc.)

A motor is considered running in its "NORMAL" range when 5 percent <= I_m <= 110 percent FLA (true for motors with service factor of 1.15).

A motor is considered running "OVER-LOADED" when it's motor current I_m > 110 percent FLA for more than 5 consecutive seconds (true for motors with service factor of 1.15).

B. DEFINITION OF MOTOR STARTER PLC-DERIVED STATE CONDITIONS

The following states shall be continually derived within the PLC control logic for each starter:

1. Drive/Starter Disabled

In the "DISABLED" state, the motor cannot be queued to run by the PLC. The PLC shall set the status of a motor to the "DISABLED" state under the following conditions:

a. The motor's selector switch is NOT in "AUTO".

b. The starter is faulted for any of the following reasons:

i. Control power is not valid.

ii. Starter bus voltage is not valid (phase loss, phase imbalance, phase reversal, under voltage, or over voltage).

iii. Drive module fault.

iv. Motor overload/overcurrent.

v. Motor over temp.

2. Drive/Starter Ready

In the "READY" state, the motor can be queued to run by the PLC or is already running under PLC control. The PLC shall set the status of a motor to the "READY" state under the following conditions:

a. The motor's selector switch is in the "AUTO" position.

b. The motor and starter are not disabled.

3. Drive/Starter Running

In the "RUNNING" state, the motor is in the running queue either by a successful auto run request or a successful forced manual run. The PLC shall set the status of a motor to the "RUNNING" state under the following conditions:

a. The starter's "RUNNING" status output is true OR the motor current is in the "NORMAL" range as defined in Section 3.2.A.

C. MAJOR EQUIPMENT MOTOR MONITORING

The following shall be continually monitored and recorded by the PLC for each major equipment motor:

1. Runtime Meters

Total runtime since the equipment was put into operation.

Total runtime since the runtime meter was last reset. There will be a time date stamp recorded when the runtime meter is reset.

Total runtime for the current operating cycle.

2. Start Counts

Total starts since the equipment was put into operation.

Total starts since the start counter was last reset. There will be a time date stamp recorded when the runtime meter is reset.

3. Restart Cycling Protection

This is calculated using a start delay timer in the PLC, which records the time since the last motor call was asserted and the run is verified.

The PLC will record the number of sequential times the motor starts before the start delay timer has timed out.

The number of times in a row the re-start delay timer is allowed to be exceeded (i.e. motor allowed to start before start delay timer has timed out) before the motor will be allowed to start again. This number will be adjustable only via the PLC and will vary depending on the criticality of the equipment. This allowable number will be indicated on the motor list.

On some critical motors, the number of times the start delay timer is allowed to be exceeded will be fairly high to prevent these critical units from being shut down.

4. Fail-to-Start Alarm

The PLC shall count the number of consecutive times a motor is called, but fails to run.

The will be a type/service of equipment specific allowance for the number of consecutive times a motor is allowed to fail to start before it is locked out. If a motor is locked out due to the allowable number of fail-to-starts having occurred, the operator must acknowledge and reset the alarm via the SCADA OIs or the HMI before the lock-out is removed.

There will be an adjustable time delay for the fail to start alarm, which will dictate the time that will be allotted for a run signal to be confirmed after a call has been asserted before a fail to start will be logged.

If a motor has failed to start, even if it is able to start after a number of attempts, an alarm will be logged, but the motor will still be allowed to continue to run.

D. PUMP LEAD/LAG OPERATION

There shall be provided a pop-up window for each set of lead/lag pumps to allow the operators to set the “lead pump rotate time” (1 - 168 hours) and to select which pump is the lead pump where applicable. The lead pump shall be automatically adjusted after the lead pump rotate time period, or after the lead pump has operated and is called off by the PLC based on its control description. The “lead pump rotate time” shall initially be set for every 120 hours. The lead pump shall also be capable of being selected manually via the HMI display. In the event that a pump is manually forced into the lead position, the “lead pump rotate time” hour count shall reset so that the manually selected lead pump will remain in

the lead position for the full setpoint duration. The HMI shall also display the "lead pump rotate time remaining" for each set of pumps.

E. STANDARD ALARMS CONDITIONS

For each analog input to the PLC (hardwired or network), the PLC shall monitor the input data and produce the following alarms:

1. High Critical (typically a shutdown alarm if enabled)
2. High Warning
3. Low Warning
4. Low Critical (typically a shutdown alarm if enabled)

Each alarm point, including all digital alarm inputs to the PLC, shall be associated with a time delay setpoint. If the time delay is set to "0" then the alarm is disabled.

Initial setpoints for some alarm conditions are provided on the Plans or in the Specifications. If initial setpoints are not provided, the PLC programmer shall set initial alarm setpoints based on field input from the Owner or Engineer. In all cases, the PLC programmer shall adjust initial setpoints during startup and field commissioning as required by the Owner prior to final completion.

3.3 PROCESS CONTROL ALGORITHM

A. AREA 1 OPERATIONS BUILDING

1. Aeration System: Aeration Basin and MBR (01 MSB 01, 01 MSB 01, 01 MSB 03, & 01 AB 01)

a. PLC Control

There are three membrane scour blowers (01 MSB 01, 01 MSB 01, 01 MSB 03) and on aeration blower. The membrane scour blowers provide air to scour the submerged membrane unit surfaces and the aeration blower provides air to the aeration basin diffused air system. Blower 01 MSB 03 can serve as either a membrane scour blower or an aeration blower when the operator has set the discharge air valves to the proper positions. The membrane scour blowers will be controlled by the MBR PLC. The aeration blower shall be controlled by the WWTF PLC

based on the operator adjustable setpoints and the signals from the aerobic basin DO meter (02 DO 01).

b. Local Control/Display

The Aeration Blowers are equipped with locally mounted safety disconnect switches, HOA switch and speed potentiometer. When the HOA switch for the associated blower is in the "hand" position, the blower speed shall be controlled via the hand potentiometer.

c. Operational Description

Typically the aeration blower (02 AB 01) will provide aeration to the aeration basin. The operator shall be able select either (02 AB 01) or (02 MSB 03) as the lead aeration blower and the other blower as the automatic backup lag blower or no backup blower, depending on the operator adjustment of the discharge valves, via a pop-up window on the HMI. If the lead blower faults during operation, the PLC shall automatically start the lag blower if one has been selected via the HMI.

The PLC shall operate the aeration blower in one of two modes as selected via the HMI pop-up menu, "target DO" or "constant flow":

i. Target DO

In this mode the PLC shall modulate the blower speed based on the DO signal of its associated DO meter and the DO setpoint as entered by the Operator at the HMI, as described below.

When in "target DO" mode, a dissolved oxygen PID control loop shall be used by the PLC to derive the blower speed setpoint for the aerobic basin to maintain the DO at the DO control setpoint and the PLC shall modulate the blower speed based on the setpoints. The DO concentration setpoint and the associated deadband shall be operator adjustable via the HMI (initial value of 2.0 mg/L ± 0.3 mg/L). The WWTF PLC shall continuously monitor the dissolved oxygen concentration in the basin. The

blower speed reference for the blower should be checked and adjusted by the PLC every 2 minutes; this time interval shall be operator-adjustable in the HMI. If during a checking cycle, the DO concentration in a basin is outside of the setpoint deadband, the PLC shall increase or decrease the VFD speed reference signal to the associated blower according to a PID loop. PID tuning parameters shall be adjusted in the field by the PLC programmer to provide PID tuning to eliminate continual DO hunting. The blower shall be modulated over the range of "minimum blower speed" to 60 Hz. The blower shall not be called to operate at frequencies greater than 60 Hz, even if they are unable to maintain the dissolved oxygen setpoint. Over speeding the blowers shall not be allowed.

ii. Constant Speed

In this mode the PLC shall maintain a constant blower speed based on the signal from its associated VFD and the blower speed setpoint as entered by the Operator at the HMI.

When in "target DO" mode, a dissolved oxygen PID control loop will be used to derive the blower speed setpoint for each aerobic basin.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
01 B 01, 01 MSB 03	Run, call, VFD ready, HOA in auto, VFD speed	High temp, VFD fault alarm	Speed
02 DO 01	NA	Out of Range	DO (mg/L)

The following will be displayed via a pop-up window and or will be available for operator adjustable inputs at the HMI:

Equipment/ Component	Display	Inputs
01 B 01, 01 MSB 03	Run, call, VFD ready, HOA in auto-hand-off, VFD speed, High temp, VFD fault alarm	Min blower speed setpoint, target DO or constant flow mode, DO setpoint (mg/L), DO deadband (mg/L), DB time (sec), stabilization time (min), speed adjustment factor (%), lead/lag blower selections
02 DO 01	DO (mg/L)	NA

2. WAS Blower (01 WB 01)

a. PLC Control

The WWTF PLC shall control the WAS blower based on the operator adjustable setpoints and the signal from the radar level sensor (02 RLS 01).

b. Local Control/Display

The WAS blower is equipped with a locally mounted safety disconnect switch, HOA switch and speed potentiometer. When the HOA switch for the blower is in the "hand" position, the blower speed shall be controlled via the hand potentiometer.

c. Operational Description

The WAS blower shall only be allowed to operate in one of the two primary modes: "constant speed" mode or "variable speed" mode; with a secondary mode selection for "alternating" mode. There shall be a pop-up menu where the operator can select either mode of operation. The "constant speed" mode shall have a selection value for "speed", which will be the speed that the PLC maintains this blower at all times. The "variable speed" mode shall have set points for "min speed" and "max speed", which will also have set points for "min SWD" (side water depth) and "max SWD". When in "variable speed" mode, the blower shall run at the "min speed" set point at the "min SWD" or lower and shall run at "max speed" set point at

the "max SWD" or higher, and the blower speed shall ramp up proportionally between the two SWD's. The "alternating" mode shall also have a selection for "speed", with additional selections for "on time" and "off time". When operating in "alternating" mode, the PLC shall run the blower at the selected speed mode for the time period "on time" and then shall turn off the blower for the time period "off time", and alternate this schedule accordingly.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
01 WB 01	Run, call, VFD ready, HOA in auto, VFD speed	High temp, VFD fault alarm	Speed

The following will be displayed via a pop-up window and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
01 WB 01	Run, call, VFD ready, HOA in auto-hand-off, VFD speed, High temp, VFD fault alarm	Operational mode selection, min speed, max speed, min SWD, max SWD, on time, off time, constant speed set point

3. UV Disinfection System (01 UV 01 and 01 UV 02)

a. PLC Control: There is no WWTF PLC control of these units.

b. Local Control/Display: Each UV vessel has a dedicated control panel and is controlled by a manufacturer supplied PLC located in each panel. Each of the control panels has a door mounted operator interface.

c. Operational Description: See Specification Section 11510 for operational description.

d. PLC/HMI Summary

Reference the P&ID drawings for the minimum status and data that shall be transmitted to and from the plant control system via ethernet connection to each of the two manufacturer-supplied local control panels

There are two UV banks, each with its own associated control panel and PLC. The WWTF PLC shall provide an "On/Off" signal to the UV PLCs based on the description herein and as specified in Section 11510. Only one UV bank will receive an "On" signal at a time, since the second bank is a redundant, backup until. The WWTF shall operate the banks in lead/lag fashion and alternate the lead/lag designation of each bank each time they are both off. The WWTF PLC shall provide a "On" signal to the lead UV PLC when a "permeate pump start delay" and/or "Permeate Pump Run" signal is received from the MBR PLC and will remove this signal when all permeate pumps have been off and no permeate flow has been detected for a period of 15 minutes.

When the all permeate pumps are stopped, the PLC shall hold the last read UV Transmittance value prior to all pumps stopped and report this value. When the permeate pumps go from all pumps stopped to a pump running, the PLC shall begin reporting the actual UV Transmittance value after 1 minute of operation. No alarms for UV Transmittance should be generated when all permeate pumps are stopped.

DATA READ BY PLANT CONTROL SYSTEM VIA ETHERNET FROM EACH UV PLC AND DISPLAYED ON THE HMI

Condition	Type
Auto/Manual Mode Selection	Discrete
UV Bank Ready	Discrete
UV Bank Running	Discrete
UV Bank Fail	Discrete
Common Minor Alarm	Discrete
Common Major Alarm	Discrete
Lamp Fail	Discrete
Wiper Fail	Discrete
Cabinet Overheat	Discrete
UV Dose	Analog
UV Radiation Intensity	Analog

DATA READ FROM PLANT CONTROL SYSTEM VIA ETHERNET TO EACH UV PLC AND DISPLAYED ON THE HMI

Condition	Type
Plant Effluent Flow	Analog
UV Permissive On/Off	Discrete
Remote Wipe	Discrete
Remote Set Power	Discrete
UV Transmittance	Analog

4. Non-Potable Water System: Non-Potable Water Pumps (01 NPP 01 and 01 NPP 02), Radar Level Sensor (01 RLS 01), Float Switch (01 LS 01), Pressure Transmitter (01 PTR 01), Non-Potable Water Flow Meter (01 MFM 03)

   a. PLC Control

      The WWTF PLC will control the non-potable water pumps based on the signal from the pressure transmitter and the non-potable water flow meter.

   b. Local Control/Display

      The Non-Potable Water (NPW) Pumps are each equipped with a locally mounted safety disconnect switch, HOA switch, and speed potentiometer. When the HOA switch for the associated pump is in the "hand" position, the pump speed shall be controlled via the hand potentiometer. The pressure transmitter and magnetic flow meter each have a locally mounted display.

   c. Operational Description

      The NPW pumps shall be operated on an automatically controlled lead/lag basis and shall be controlled via the PLC when in Auto. The PLC shall generate a low level alarm and stop both pumps when the tank level is below the low level set point for the radar level sensor, otherwise the lead pump shall run continuously. The system is equipped with a pressure relief/pressure sustaining valve that is designed to limit the maximum system pressure when NPW Pump 1 and/or 2 are operating at minimum speed. The pressure relief/pressure sustaining valve setpoint shall be 10 psi above the desired system pressure. Initially, the

pressure relief/pressure sustaining valve setpoint shall be 100 psi.

Under normal conditions, the system demand is low and water will be directed through the pressure relief/pressure sustaining valve to the NPW wet well. As system demand increases, the system pressure as measured by the pressure transducer will decrease and the PLC shall increase the motor speed for the NPW pump in operation in order to maintain the system setpoint of 100 psi. As system demand decreases, the system pressure as measured by the pressure transducer will increase, and the PLC shall decrease the motor speed for the NPW pump in operation in order to maintain the system pressure setpoint of 110 psi. The minimum motor speed for each NPW pump shall initially be set at 25 percent of full load (15 Hz) as recommended by the motor manufacturer, and shall be operator adjustable. If the lead pump is operating at full speed and cannot meet the pressure setpoint, the PLC shall then call the lag pump to operate at its minimum speed and adjust the lag pump speed to meet the pressure set point.

The non-potable water pumps shall be controlled based on a combination of the non-potable water system discharge pressure (as measured by 01 PTR 01) and the non-potable water demand flow as measured by the magnetic flow meter (01 MFM 03).

If both pumps are in operation and as the overall system demand decreases, the flow as measured through 01 MFM 03 will decrease. When the flow through this meter decreases below the “pump capacity” setpoint, or the capacity of a single pump operating at full speed for a user selectable time period, the lag pump shall be called off. The lead pump motor speed shall then be adjusted as described previously to meet the system pressure setpoint.

The PLC shall also monitor for system high and low pressure. If either the high or low pressure setpoints are maintained for a user selectable time period, then an alarm will be generated and displayed at the HMI. Initially, the high pressure setpoint shall be 120 psi, and the low pressure setpoint shall be 60 psi. The PLC shall stop all

pumps and generate a low level alarm when the level in the tank is below the low level alarm set point.

The discharge pressure control set points shall initially be set as follows and shall be operator settable via the HMI:

Designation	Set Point
Lag Pump On	80 psi
High Pressure Alarm	120 psi
Low Pressure Alarm	60 psi

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
NPW Pumps (01 NPP 01 & 02)	Run, call, VFD ready, HOA in auto-hand-off, lead/lag designation	High temp, VFD fault alarm	Speed, speed command, pump capacity setpoint
NPW Flow Meter (01 MFM 03)	NA	Out of range	Flow rate (gpm), total flow, current day flow, previous day flow
NPW Pressure Transmitter (01 PTR 01)	NA	High/low pressure, out of range	Pressure, Pressure setpoint
NPW Wet Tank Radar Level Sensor (01 RLS 01)	Na	High level, Low level, Out of range	Depth (ft), Water level (ft), volume (gal)
NPW Wet Tank Float Switch (01 LS 01)	Open, Closed	High level	NA

The following will be displayed via a pop-up window and or will be available for operator adjustable inputs at the HMI:

Equipment	Display	Inputs
NPW Pumps (01 NPP 01 & 02)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed, lead/lag designation, High temp, VFD fault alarm, Speed, speed command, lead pump rotate time remaining	Pump capacity setpoint, switch lead/lag order, lead pump rotate time,
NPW Flow Meter (01 MFM 03)	Flow rate (gpm), total flow, current day flow, previous day flow	NA

Equipment	Display	Inputs
NPW Pressure Transmitter (01 PTR 01)	Pressure, pressure setpoint	Pressure Setpoint
NPW Wet Tank Radar Level Sensor (01 RLS 01)	Water level (ft), High level, Low level, Out of range	High level, low level setpoints
NPW Wet Tank Float Switch (01 LS 01)	Open, Closed, low level alarm	NA

5. Effluent Sampler (01 ES 01)

a. PLC Control

The WWTP PLC will send pulses to this unit.

b. Local Control/Display

The sampler has a locally mounted controller/display integral with the unit.

c. Operational Description

The sampler is controlled either by effluent flow volume (pulse output from the WWTP PLC) or time. The control method is selected by the operator via the influent sampler OI. The sampler will typically be set for volume control. These two control methods are described below:

i. Flow/Volume Control

The sampler is paced from effluent flow volume based on a pulse output from the WWTP PLC. The gallons per pulse value is stored in the WWTP PLC which will generate one pulse per sample. The output contact closes (for a nominal 250 msec) every time a sample should be taken.

ii. Time Control

The pulse frequency is stored in the sampler. The output contact closes (for a nominal 50 msec) according to the pulse frequency value.

6. Membrane System

a. PLC Control: There is no WWTF PLC control of the MBR System equipment. The WWTF PLC shall communicate with the MBR PLC via Ethernet connection. See the Ovivo PLC and OIU Programming Submittal for PLC control of this system.

b. Local Control/Display: The MBR System control panel is equipped with a panel mounted operator interface.

c. Operational Description: See the Ovivo PLC and OIU Programming Submittal for PLC control of this system.

d. PLC/HMI Summary

The MBR Supplier Wonderware HMI screens for the MBR system shall be incorporated in the WWTF HMI SCADA computer exactly as provided by the MBR Supplier. All changes to the MBR PLC program will be done by MBR Supplier (Kubota). This is to ensure that the SCADA computer screens and the Ovivo local HMI screens exactly match and to avoid possible control issues that could interfere with the Kubota designed MBR controls. PLC Ethernet communication bits to and from the MBR system equipment shall be coordinated with Kubota and all information transmitted from the MBR PLC to the WWTF PLC shall be logged for trending in the WWTF HMI historical screens.

In addition, the real time turbidity (01 TM 01), daily average turbidity, previous day average turbidity and the peak day turbidity values shall be calculated, displayed, and logged by the WWTF PLC. The moving peak turbidity shall be calculated within the PLC. The peak turbidity shall be determined by comparing the current value to the preceding turbidity value. If the newest value is greater than the previous value, then the newest value is stored, if not, it is deleted. This stored value is then compared to the next value read. The peak turbidity for each day shall be stored in the WWTF PLC. The WWTF PLC shall generate a “High Average Turbidity” alarm and a “High Instantaneous Turbidity” alarm as outlined below.

When the both permeate pumps are stopped, the MBR PLC shall hold the last read turbidity value prior to all pumps stopped and report this value. When the permeate pumps go from all pumps stopped to a pump running, the PLC shall begin reporting the turbidity value after 1 minute of operation. No alarms for turbidity should be generated when both permeate pumps are stopped.

The MBR PLC shall send "permeate pump start delay" signal prior to starting a pump, based on the MBR control strategy. Upon receiving the "permeate pump start delay" signal, the WWTF PLC shall send a "On" signal to the lead UV control panel (CP) to allow the UV banks to power up (approximately 3-5 minutes). Upon receipt of a "System Ready" or "System Running" signal from the UV PLC, the WWTF PLC shall then send a "Permeate Pump Enable" signal to the MBR PLC (note that the "Permeate Pump Enable" logic needs to be included in the MBR PLC & OIU Programming Submittal). If a high level alarm is present in the RAS pump station (02 SLS 02), **or if 15 minutes have passed since the UV "On" signal was generated,** the WWTF PLC shall send a "Permeate Pump Enable" signal to the MBR PLC, regardless if a "Running" signal is present from the UV PLC. (Since the MBR PLC controls these pumps based on the influent flow rate and the level in the RAS pump station, the strategy here is to only allow (enable) the permeate pumps to start only when the UV system is in operation or when there is a high level alarm in the RAS pump station {regardless of UV status}).

The following data shall be transmitted to the MBR PLC via ethernet connection:

DATA READ FROM WWTF SCADA SYSTEM

Condition
Acknowledge Alarms
RAS Pump Station High Level Alarm
RAS Pump Station Low Level Alarm
RAS Pump Station Level
Influent Flow Rate
Permeate Pump No. 1 Enable
Permeate Pump No. 2 Enable

The following will be the initial set point alarm values for the turbidity alarms:

Alarm	Value
High Average Turbidity	≥ 0.2 NTU for 10 minute duration
High Instantaneous Turbidity	≤ 0.5 for 15 second duration

The turbidity value and time period shall be operator adjustable

7. Effluent Flow Calculation: Magnetic Flow Meters (01 MFM 01, 02, & 03)

   a. PLC Control

      There is no plant PLC control of this unit.

   b. Local Control/Display

      The flow meters have locally mounted displays.

   c. Operational Description

      The WWTF shall calculate the real-time and totalized effluent flow as the sum of the readings from the two permeate flow meters (01 MFM 01 and 01 MFM 02) subtracted by the reading from the NPW flow meter (01 MFM 03).

      The real time flow from each flow meter shall be monitored by the WWTF PLC. A totalized volume signal from each magnetic flow meter shall be monitored by the PLC. Three registers shall be used for storing totalized volume information for each flow meter and for the total influent flow, which shall be the sum of the three flow meter readings. A fourth register shall store time-of-day reset value. The initial time of day reset value shall be midnight and shall be equivalent for all flow meters. The three registers for totalized flow are summarized below:

      - One non-resettable register measures totalized volume (in gallons).
      - One non-resettable register totalizes the current day's flow volume. This register is reset every day at the reset time.

- One resettable register stores the volume for the previous day (the 24 hours preceding the last reset time). The new value is stored at the time of day reset time. This should reset at midnight each day and be displayed in the HMI.
- A moving average total effluent flow rate shall also be calculated within the PLC as discussed above. The moving average flow rate (gpm) shall be determined by summing the volume (gallons) during the preceding hour every minute and dividing by 60.
- A moving average effluent peak hour volume shall also be calculated within the PLC for each flow meter and for the total influent flow. The peak hour effluent volume shall be determined by summing the volume during the preceding hour every minute. If the newest total is greater than the previous total then the newest total is stored, if not, it is deleted. The peak hour value for each day shall be stored in the WWTF PLC.

The WWTF PLC shall generate a pulse signal for a given totalized flow volume based on the effluent flow. The PLC shall transmit this pulse output to the Effluent Sampler (01 ES 01). A pulse signal shall be generated that indicates that the influent sampler should take a sample.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
01 MFM 01-03 and Total Effluent Flow	NA	Out of range	Flow (gpm), Current day and previous day total flow (gallons), moving avg flow rate (gpm), moving average peak hour flow (gpm)

The following will be displayed via a pop-up window and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
01 MFM 01-03 and Total Effluent Flow	Flow (gpm), Current day and previous day total flow (gallons), moving avg flow rate (gpm), moving average peak hour flow (gpm)	NA

8. Operations Building Supply Fan (01 SF 01) and Exhaust Fan (01 EF 01)

   a. PLC Control: There is no WWTF PLC control of these units. The PLC shall monitor the low flow alarm from both of these units associated flow switch.

B. AREA 2 PROCESS TANKS AND HEADWORKS

1. Influent Flow Meter, RAS Flow Meter, and WAS Flow Meter (02 MFM 01, 02, & 03)

   a. PLC Control

   There is no plant PLC control of this unit.

   b. Local Control/Display

   The flow meters have locally mounted displays.

   c. Operational Description

   The real time flow from each flow meter shall be monitored by the WWTP PLC. A totalized volume signal from each magnetic flow meter shall be monitored by the PLC. Three registers shall be used for storing totalized volume information for each flow meter, which shall be the sum of the three flow meter readings. A fourth register shall store time-of-day reset value. The initial time of day reset value shall be midnight and shall be equivalent for all flow meters. The three registers for totalized flow are summarized below:

   - One non-resettable register measures totalized volume (in gallons).

- One non-resettable register totalizes the current day's flow volume. This register is reset every day at the reset time.
- One resettable register stores the volume for the previous day (the 24 hours preceding the last reset time). The new value is stored at the time of day reset time. This should reset at midnight each day and be displayed in the HMI.
- A moving average of influent flow rate shall also be calculated within the PLC. The moving average flow rate (gpm) shall be determined by summing the volume (gallons) during the preceding hour every minute and dividing by 60. The moving average flow rate shall also be used by the WWTP PLC to flow pace the RAS pumps when the operator has selected them to be controlled as a multiple of influent flow.
- A moving average peak hour volume shall also be calculated within the PLC for each flow meter and for the influent flow. The peak hour volume shall be determined by summing the volume during the preceding hour every minute. If the newest total is greater than the previous total then the newest total is stored, if not, it is deleted. The peak hour value for each day shall be stored in the WWTP PLC.

The WWTF PLC shall generate a pulse signal for a given totalized flow volume based on the influent flow. The PLC shall transmit this pulse output to the Influent Sampler (02 IS 01). A pulse signal shall be generated that indicates that the influent sampler should take a sample.

d. PLC/HMI Summary

The WWTP PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
02 MFM 01-03	NA	Out of range	Flow (gpm), Current day and previous day total flow (gallons), moving avg flow rate (gpm), moving average peak hour flow (gpm)

The following will be displayed via a pop-up window and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
02 MFM 01-03	Flow (gpm), Current day and previous day total flow (gallons), moving avg flow rate (gpm), moving average peak hour flow (gpm)	NA

2. Influent Sampler (02 IS 01)

a. PLC Control

The WWTP PLC will send pulses to this unit.

b. Local Control/Display

The sampler has a locally mounted controller/display integral with the unit.

c. Operational Description

The sampler (01 IS 01) is controlled either by influent flow volume (pulse output from the WWTP PLC) or time. The control method is selected by the operator via the influent sampler OI. The sampler will typically be set for volume control. These two control methods are described below:

i. Flow/Volume Control

The sampler is paced from influent flow volume based on a pulse output from the WWTP PLC. The gallons per pulse value is stored in the WWTP PLC which will generate one pulse per sample. The output contact closes (for a nominal 250 msec) every time a sample should be taken.

ii. Time Control

The pulse frequency is stored in the sampler. The output contact closes (for a nominal 50 msec) according to the pulse frequency value.

3. Influent Motor Operated Valves (02 MOV 01 & 02)

a. PLC Control

The WWTF PLC will control the influent motor operated valves.

b. Local Control/Display

The motor operated valves are equipment with a local operator display with a “Hand/Auto (Local/Remote)” switch. These valves can also be controlled by hand and by a hand held infrared controller when local control is selected. When in remote (auto) control mode, the PLC will control the valves.

c. Operational Description

There is an electric motor operated valve on the inlet to each of the influent rotary drum screens (02 RDS 01 & 02). Motor operated valve 02 MOV 01 is associated with 02 RDS 01 and motor operated valve 02 MOV 02 is associated with 02 RDS 02.

One motor operated valve shall remain open at all times, regardless if a screen is running or not. The lead motor operated valve shall be open at all times. The PLC shall control the motor operated valves based on a lead/lag operation when in “auto”. The lead-lag order shall be stored in the PLC and shall be rotated on an operator settable schedule (operator selectable time period (1-24 hours) for run duration until rotation) and there shall be a “switch lead/lag order” button on the lead/lag schedule pop-up window. When switching lead operation, the PLC shall close the lead valve only when the lag valve is confirmed open. In the event of a high level alarm in one of the screens, the MOV associated with that screen shall automatically be changed to the lag MOV and the lead MOV shall then open (and the new lag valve shall close). If the motor operated valve does not open when called, an alarm shall be initiated and the other valve shall remain as the lead and shall remain open.

If both valves are not in Auto (are in local control mode) and both are closed, the WWTF PLC shall generate an "all influent valves closed" alarm after a 10 minute period of this condition exists.

4. PLC/HMI Summary:

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
02 MOV 01	Opened, closed, auto, control power available, call to open, call to close	Over torque, valve not opening (when called)	NA
02 MOV 02	Opened, closed, auto, control power available, call to open, call to close	Over torque, valve not opening (when called)	NA

The following will be displayed and or will be available for operator adjustable inputs at the HMI:

Equipment/ Component	Display	Inputs
02 MOV 01	Opened, closed, auto, control power available, over torque, call to open, call to close, valve not opening (when called)	Lead/lag schedule, switch lead/lag order
02 MOV 02	Opened, closed, auto, control power available, over torque, call to open, call to close, valve not opening (when called)	Lead/lag schedule, switch lead/lag order

5. Rotary Drum Screen System

a. Equipment:

Rotary Drum Screen 1	02 RDS 01
Rotary Drum Screen 2	02 RDS 02
Screenings Washer/Compactor 1	02 WC 01
Screen 1 Overflow Pressure/Level Transmitter	02 PTR 01
Screen 2 Overflow Pressure/Level Transmitter	02 PTR 01
Screen 1 Washwater Solenoid Valve	SV 211
Screen 2 Washwater Solenoid Valve	SV 212
Screen 1 Discharge Chute Washwater Solenoid Valve	SV 213A
Screen 2 Discharge Chute Washwater Solenoid Valve	SV 213B

Washer/Compacter Washwater Solenoid Valve	SV 213AC

b. Local Control/Display:

Rotary Drum Screen 1	HOA
Rotary Drum Screen 2	HOA
Screenings Washer/Compactor 1	HOA & FOR
Screen 1 Overflow Pressure/Level Transmitter	Local Display
Screen 2 Overflow Pressure/Level Transmitter	Local Display
Screen 1 Washwater Solenoid Valve	OCA
Screen 2 Washwater Solenoid Valve	OCA
Screen 1 Discharge Chute Washwater Solenoid Valve	OCA
Screen 2 Discharge Chute Washwater Solenoid Valve	OCA
Washer/Compacter Washwater Solenoid Valve	OCA

c. PLC Control

The sequence is the same for both screens:

i. When an influent pump is in operation and its associated Motor Operated Valve is opened, the screen shall start and continue to run for the time set in the SCREEN OFF DELAY TIMER after either the influent valve is off or the associated Motor Operated Valve is closed.

ii. The associated Screen Spray Wash valve shall remain open when the screen is in operation.

iii. An Overflow sensor shall be provided in each screen to provide a high level alarm signal to the WWTF PLC. Upon high level/overflow alarm in one of the screens, the WWTF PLC will generate an alarm, open the motor operated valve to the other screen and close the valve to the screen in alarm. Upon high level/overflow alarm both of the screens, the WWTF PLC will open the motor operated valves to both screens.

iv. The compactor shall run when either screen is running and continue to run after both screens stop by the time in the COMPACTOR OFF DELAY TIMER.

The Compactor Wash valve shall alternate with the Chute Wash associated with the running screen, based on the COMPACTOR WASH ALTERNATING TIMER.

v. When the compactor is running, its motor shall intermittently stop and run in reverse for a few seconds, then continue in the forward direction again. This intermittent scrub sequence periodically resets the spiral's brush bristles, helping to clear the perforations in the drain plate.

vi. If an overtorque condition exists, indicating a jam, the compactor will reverse in an attempt to clear the jam. The compactor will reverse for an adjustable period of time (set in the PLC), then run forward. If the jam has been cleared, the compactor will return to normal operation. If the jam still exists, the compactor will make additional attempts to clear the jam, up to an adjustable number of jam clear attempts (set in the PLC).

d. Alarms

The following alarms shall be generated:

- Screen High Water Level
- Screen Motor Overload
- Screen Fault
- Screen High Temp
- Compactor Fault

e. Control Set Points

The following set points shall be adjustable via the HMI:

Timer	Description	Value
T1	Screen 1 OFF Delay Timer	5 min
T2	Screen 1 Overflow debounce Timer	1 Sec
T4	Screen 2 OFF Delay Timer	5 min
T5	Screen 2 Overflow debounce Timer	1 Sec
T7	Compactor OFF Delay Timer	1 min
T11	Compactor Off Delay Timer	5 min
T12	Compactor Wash Alternating	5 min

6. Influent Pump Station (02 IP 01, 02 IP 02, 02 SLS 01, 02 LS 01, 02 LS 02)

a. PLC Control

The WWTF PLC shall control the Pumps (02 IP 01 and 02) when in Auto based on signals from the submersible level sensor (02 SLS 01) and float switches (02 LS 01 and 02).

b. Local Control/Display

The Influents Pumps are each equipped with a locally mounted safety disconnect switch, HOA switch, and speed potentiometer. When the HOA switch for the associated pump is in the "hand" position, the pump speed shall be controlled via the hand potentiometer.

c. Operational Description

The PLC shall control the pumps based on an alternating lead/lag schedule, such that each time the lead pump is de-energized, the lead pump will rotate and become the lag pump, and the lag pump will become the lead pump. The lead-lag pump order is stored in the PLC and shall be operator selected "lead on" level and the lag pump shall turn on at the operator selected "lag on" level. Both pumps shall turn off when the level in the wet well reaches the "pump off" level. The PLC shall generate a high level alarm based on the signal from the level sensors and float switches. Only one pump shall operate at a time.

When the pump hand-off-auto (HOA) switch is set to "AUTO," the PLC shall send speed reference (30 – 60 Hz) signals and "run commands" to the VFD motor starters as applicable for each pump. The PLC shall modulate the speed of the running pump via a PID loop to maintain a target wet well level setpoint. The wet well level shall be monitored by the PLC from the submersible level sensors.

The lead pump shall run when the level in the wet well is above the "pump on" level, when in "AUTO". The PLC shall start or stop pumps based on a deadband setting and a delay setpoint, making use of the "available to run" setting.

The PLC shall also monitor the signal from the WWTF PLC for the associate influent magnetic flow meter (01 MFM 01). If a pump is called to run and the signal from the flow meter is less than 1 gpm for a set point time period, an alarm should be called and the other pump should become the lead pump. The PLC shall turn on the lead pump at full speed if either level switch is closed.

d. PLC/HMI Summary

The WWTP PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
Pumps 1 and 2 (02 P 01 & 02)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed,	High temp, Leakage, VFD fault alarm	Speed, speed command
Level Sensor (02 SLT 01 & 02)	Water level	High level, Low level, Out of range, offset warning	Water level (ft)
High Level Float (02 FS 01 & 02)	Open, Closed	High level	NA

The following will be displayed and/or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
Pumps 1 and 2 (02 P 01 & 02)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed	switch lead/lag order
Level Sensor (02 SLT 01 & 02)	High level, Low level, Out of range, offset warning	High level, pumps off, lead on, lag on, low level setpoints

Equipment/Component	Display	Inputs
High Level Float (02 FS 01 & 02)	Open, Closed, High level	NA
Lead/Lag Pump	Current Lead Pump designation	"Lead pump rotate" time of day

The following will be the initial set point elevations for control based on the signal from the submersible level sensors:

Wet Well Levels	Submersible Level Sensor Elevation
High Level Alarm	TBD[1]
Lead Pump On	TBD[1]
All Pumps Off	TBD[1]
Low Level Alarm	TBD[1]
Level Sensor El.	TBD[1]
Wet Well Bottom	TBD[1]

Note: [1]Values To Be Determined will be added during the submittal phase.

The following will be the initial set point elevations and timer relay settings for control based on the signal from the float switches:

Wet Well Levels	Level Switch Elevation	Time Delay (minutes)
01 LS 02 (Lead Pump On High High Level Alarm)	TBD[1]	TBD[1]
01 LS 01 (Lead Pump On, High Level Alarm)	TBD[1]	TBD[1]

Note: [1]Values To Be Determined will be added during the submittal phase.

7. RAS Pump Station: RAS Pumps (02 RP 01, 02 RP 02), RAS Magnetic Flow Meter (02 MFM 02), Submersible Level Sensor (02 SLS 02) and Float Switches (02 LS 07 & 08)

   a. PLC Control: The WWTF PLC shall control the RAS Pumps based on signals from the submersible level sensor (02 SLS 01), float switch (02 LS 01), influent flow meter (02 MFM 01), and RAS magnetic flow meter (02 MFM 02).

b. Local Control/Display: The RAS Pumps are each equipped with a locally mounted safety disconnect switch, HOA switch, and speed potentiometer. When the HOA switch for the associated pump is in the "hand" position, the pump speed shall be controlled via the hand potentiometer. The flow meter has a locally mounted display.

c. Operational Description: The RAS Pumps lift RAS from the RAS pump station to the Anoxic Basin. Only one RAS Pump shall operate at a time.

The RAS Pumps shall be controlled in a lead/lag operation mode. The RAS Pumps (02 RAS 01 and 02 RAS 02) VFD operate at a range of X_{min}-$X_{,max}$ Hz

Each pump shall be controlled by a VFD. Each VFD is paced by the WWTF PLC via a PID loop to maintain a target setpoint RAS flow as measured by the RAS flow meter (02 MFM 02). The RAS flow rate setpoint will either be a multiple of the treatment plant influent flow or a specific flow rate, depending on the mode of operation selected. The operator shall have the capability of selecting the mode via the HMI. These modes are described below:

i. Mode 1 is a "multiple of influent flow". In this mode the total target RAS flow is based on a multiple of the average plant influent flow. In this case the average plant influent flow shall be a one hour moving average influent flow during the preceding hour. The multiple of plant influent flow setpoint value shall be operator settable via the HMI in 0.01Q increments ranging from 1.5 to $6.25_{Inf, Avg}$, where $Q_{Inf, Avg}$ is the moving average influent flow. Multiples of influent flow outside this range shall not be allowed. The RAS pumps shall not be allowed to operate at frequencies greater than 60 Hz, even if they are unable to maintain their flow setpoint.

ii. Mode 2 is the "Constant flow" mode. In this mode the WWTF PLC shall control the speed of the appropriate RAS pump to maintain the flow at a constant value. The flow setpoint shall be operator settable via the HMI.

When operating in "constant flow" mode, at no time shall the total RAS flow be allowed to drop below 1.5 times the treatment plant influent flow. If the treatment plant influent flow is zero, the "constant flow" setpoint shall be maintained.

In either mode, a determination of system operating status shall be made by logic based on whether or not a RAS pump is "Available-to-Run" and the target flow rate. One RAS Pump shall be running at all times unless the level in the RAS pump station is below elevation H_{min}.

When the level in the RAS pump station rises from the "All pumps off" elevation (H_{min}) to the "Lead pump on elevation" (H_{on}) the Lead Pump shall be started at full speed for 20 seconds and then shall ramp down to the required speed to meet the flow setpoint. If a pump is called to run and the RAS flow rate is less than 1 gpm for a set point time period, an alarm shall be generated and the lag pump shall become the lead pump. When the level in the RAS pump station lowers down to the "All pumps off" elevation, the operating pump shall ramp up to full speed for 10 seconds and then shut off.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
RAS Pump 1 (02 RAS 01)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed	High temp, Leakage, VFD fault, Cycling alarm	Speed, speed command
RAS Pump 2 (02 RAS 02)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed	High temp, Leakage, VFD fault, Cycling alarm	Speed, speed command
Submersible Level Sensor (02 SLS 02)	NA	High level, Low level, Out of range	Water level depth (ft), water surface elevation (ft)
Float Switch (02 LS 07 & 08)	Open, Closed	High level	NA

The following will be displayed and or will be available for operator adjustable inputs at the HMI (additional inputs are provided in the following tables):

Equipment/Component	Display	Inputs
RAS Pump No. 1 (02 RAS 01)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed, speed command, high temp, Leakage, VFD fault, Cycling alarm	Lead/lag schedule
RAS Pump No. 2 (02 RAS 02)	Run, call, VFD ready, HOA in auto-hand-off, VFD speed, speed command, high temp, Leakage, VFD fault, Cycling alarm	Lead/lag schedule
Submersible Level Sensor (02 SLS 02)	Water level depth (ft), water surface elevation (ft), high level, Low level, Out of range	Low level, high level,
Float Switch (02 LS 07 & 08)	Open, Closed, high level	NA

The following will be the initial set point elevations for control based on the signal from the submersible level sensors:

Wet Well Levels	Submersible Level Sensor Elevation
High Level Alarm	TBD[1]
Lead Pump On	TBD[1]
All Pumps Off	TBD[1]
Low Level Alarm	TBD[1]
Level Sensor El.	TBD[1]
Wet Well Bottom	TBD[1]

Note: [1]Values To Be Determined will be added during the submittal phase.

The following will be the initial set point elevations and timer relay settings for control based on the signal from the float switches:

Wet Well Levels	Level Switch Elevation	Time Delay (minutes)
01 LS 07 (Lead Pump On High High Level Alarm)	TBD[1]	TBD[1]
01 FS 08 (Lead Pump On, High Level Alarm)	TBD[1]	TBD[1]

8. Anoxic Basin Submersible Mixer (02 MXR 01)

a. PLC Control: There is no WWTF PLC control of this item.

b. Local Control/Display: The submersible mixer (02 MXR 01) is equipped with a locally mounted safety disconnect switch and an On-Off switch.

c. Operational Description: On-Off operation only.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
Anoxic Basin Submersible Mixer (02 MXR 01)	On-off	High temp, Leakage, Cycling alarm	NA

The following will be displayed and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
Anoxic Basin Submersible Mixer (02 MXR 01)	On-off, high temp, Leakage, Cycling alarm	NA

9. Aeration Basin Dissolved Oxygen Meters (02 DO 01)

a. PLC Control: There is no PLC control of this unit. The PLC uses data from these units to control the aeration blowers.

b. Local Control/Display: The DO meter is equipped with a locally mounted controller/transmitter with an LCD display.

c. Operational Description: The dissolved oxygen in the basin is monitored by the PLC. The PLC will control the aeration blower associated with the DO meter to maintain an operator adjustable setpoint DO (mg/L).

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
02 DO 01	NA	Low DO, High DO	DO (mg/L)

The following will be displayed and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs*
02 DO 01	DO (mg/L), Low DO, High DO	DO setpoint, Low/High DO alarm setpoint

*DO setpoint initially set at 2.0 mg/L, Low DO at 1.0 mg/l, High DO at 4.0 mg/l, allowable range for operator entry 0-20 mg/L.

10. WAS Storage Tank Waste Sludge Pump (02 WP 01), Radar Level Sensor (02 RLS 01), and Float Switch (02 LS 09)

a. PLC Control: The WWTF PLC will control the waste sludge pump (02 WP 01) based on signals from the WAS storage tank radar level sensor (02 RLS 01) and float switch (04 LS 09) and based on operator adjustable set points.

b. Local Control/Display: The waste sludge pump (02 WP 01) is equipped with a locally mounted safety disconnect switch and an HOA switch. When the HOA switch for the associated pump is in the "hand" position, the pump speed will operate at full speed. An emergency stop push button is installed at the location of the sludge loading station connection point.

c. Operational Description: The waste sludge pump will be used to transfer waste sludge from the WAS storage tank to a tanker truck. The operator will select the "time of day on" setpoint to begin pumping to the truck and the operator shall also select "pump off elevation" based on the volume the operator plans to pump to the tanker truck. The PLC will turn the waste sludge pump on at the "time of day on" setpoint and will turn the pump off when the WAS surface elevation reaches the "pump off elevation" or when the elevation reaches the low level alarm set point. The HMI

shall display the current volume in the tank based on the gallons/ft of depth.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
Waste Sludge Pump (02 WP 01)	Run, call, ready, HOA in auto-hand-off	Overload, High temp, cycling alarm, emergency stop	NA
WAS Storage Tank Level Sensor (02 RLS 01)	Na	High level, Low level, Out of range	Depth (ft), Water level (ft), volume (gal)
WAS Storage Tank High Level Float (02 LS 09)	Open, Closed	High level	NA

The following will be displayed and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
Waste Sludge Pump (02 WP 01)	Run, call, ready, HOA in auto-hand-off, Overload, High temp, cycling alarm	Time of day on, pump elevation off
WAS Storage Tank Level Sensor (02 RLS 01)	Water level (ft), volume (gal), High level, Low level, Out of range	High level, low level setpoints
WAS Storage Tank High Level Float (02 LS 09)	Open, Closed, High level	NA

The following will be the initial setpoint elevations for control based on the signal from 02 SLS 04:

Wet Well Levels	Radar Level Sensor Elevation (02 RLS 01)	Float Switch Elevation (02 LS 02)
High Level Alarm	TBD	TBD
Low Level Alarm	TBD	-
Tank Bottom	TBD	-

11. Odor Control Unit (02 OCU 01)

a. PLC Control: There is no WWTF PLC control of this item.

b. Local Control/Display: The unit is equipped with a locally mounted safety disconnect switch and an On-Off switch.

c. Operational Description: On-Off operation only.

d. PLC/HMI Summary

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
O2 OCU 01	Running	Fault	NA

The following will be displayed at the HMI:

Equipment/Component	Display	Inputs
O5 OCU 01	Running, Fault	NA

12. Valve Vault Level Switch

a. PLC Control: There is no WWTF PLC control of this item.

b. PLC/HMI Summary

The WWTF PLC will generate a vault high level alarm when this switch is activated.

13. Generator 02 GEN 01

a. PLC/HMI Summary:

The WWTF PLC will monitor the status, alarms, and values of the following equipment:

Equipment	Status	Alarm	Value
Generator	Auto, running	General alarm, fail, low battery voltage, low oil pressure, high coolant temperature, low fuel level, high fuel level, fuel tank leak	NA

The following will be displayed and or will be available for operator adjustable inputs at the HMI:

Equipment/Component	Display	Inputs
Generator	Auto, running, general alarm, fail, low battery voltage, low oil pressure, high coolant temperature, low fuel level, high fuel level, fuel tank leak	NA

C. AREA 3 BLUFF LIFT STATION

1. Bluff Lift Station

a. PLC Control

There is no PLC of the equipment at the existing Bluff Lift Station. The PLC shall monitor the signals from the relocated control panel for pump running, fault, and in auto.

D. ADDITIONAL CONTROL COMPONENTS

The following shall be monitored by the PLC and displayed on the HMI, with an operator selectable delay time (seconds):

- Control power fail.
- UPS low battery.
- DC power fail.
- UPS power fail.
- PLC minor fault alarm.
- PLC I/O fault.
- PLC low battery.
- ATS in emergency.
- Networked motor I/O listed on E sheets.
- Hardwired I/O listed on E sheets.

3.4 SOURCE QUALITY CONTROL

A. DESIGN TESTING

1. Operate the program through all possible input paths and check for correct operation including program operation, loop controls, indications, alarm responses, and on/off sequencing control.

2. Simulate or emulate I/O conditions to verify proper operation of programming.

3. Coordinate parameter addressing, aliasing, and integrated operation with the OIU and HMI programmer.

B. TEMPORARY/INTERMEDIATE PROGRAMMING

Provide additional on-site visits and PLC programming modifications, and coordinate with Evolution Controls LLC for temporary HMI programming modifications, for the required temporary programming as required to allow for automatic operation of all of the WWTP components and the temporary bypass pumping operations, as specified in Section 01530, for each the intermediate startup periods for each stage of construction, as specified in Sections 01110 and 11500.

C. FIELD TESTING, PRIOR TO COMMISSIONING

Assist in PLC commissioning. Provide a computer and software during testing to allow viewing of system parameters. Verify remote communication and transfer of data. Test and calibrate PLC scaling against actual instruments.

1. Assist in verifying all field I/O connectivity.

2. Test all analog I/O scaling and internal setpoints against actual instruments.

3. Test proper control operation of program.

4. Test PLC communication and process data and control with all networked devices (OIU, HMI, motor starters, etc.).

5. Coordinate testing with OIU and HMI programmers.

D. FIELD TESTING, DURING COMMISSIONING

Provide for programming personnel to be present on site at startup of the system(s):

1. Demonstrate PLC communication and process data and control with all networked devices (OIU, HMI, motor starters, etc.).

2. Demonstrate proper operation of the process control program, alarming functions, and setpoint input functions with the Process Engineer and the Owner.

3. Make adjustments to parameters, setpoints, and program as required to satisfy control requirements.

4. Provide Owner with a written statement that software program application has been properly started up, operates per requirements, and is ready for operation by Owner's personnel.

E. DEMONSTRATION

Demonstrate the system in accordance with Section 01800 "Testing, Commissioning, and Training."

F. ON-SITE TRAINING

1. Provide the following formal training sessions at the Owner's facility for Owner's operating and maintenance personnel by an instructor familiar with both the manufacturer's commercially available applications provided, and the specific programmed applications provided for this project, after the system has successfully completed commissioning and acceptance procedures. Each training session shall be a minimum of 2 hours.

    a. Initial 2-hour training session at the time of startup.

    b. Provide 20 hours within 18 months after startup to provide PLC program modifications.

***** END OF SECTION *****

SECTION 13452

HUMAN MACHINE INTERFACE, ALARM SOFTWARE, AND PROCESS COMPUTER

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of a furnishing, installing, and programming a process computer with Human Machine Interface (HMI) software, including installation, field testing and training.

For HMI hardware and software procurement, reference specification 16920

1.2 RELATED WORKS SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
13451	PLC Programming – Process Control Description
16050	Basic Electrical Materials and Methods
16910	PLC Hardware and Software Procurement
16920	HMI Hardware and Software Procurement

1.3 SYSTEM REQUIREMENTS

A. DESIGN REQUIREMENTS

1. Program new SCADA software algorithms, screens, pop-up windows, data storage, and alarm features for the new HMI computer.

1.4 SUBMITTALS

A. PRODUCT DATA

1. Manufacturer’s information for hardware.

2. Manufacturer’s information for software components including specific versions or release numbers for each program, module, driver, or similar software.

3. Licensing and tag counts for HMI software.

4. Manufacturer's programming manuals.

B. CONCEPTUAL SCADA PROGRAM

Submit conceptual SCADA screens to the Owner for review. Screens should show conceptual screen configuration and identify information that will be display and control functions associated with each screen.

C. OPERATION AND MAINTENANCE MANUALS

1. See Section 01300 "Submittals."

2. Provide specific information including:

a. The manufacturer's programming manual

b. Information for obtaining assistance from the manufacturer.

3. Final copies of annotated computer system configuration. Annotations include:

a. Protocols installed and associated configurations.

4. Services installed and associated configuration.

5. Include final annotated copies of SCADA system programming and tag list.

1.5 QUALITY ASSURANCE

A. QUALIFICATIONS

1. The Contractor shall have programmed two similar applications.

1.6 SEQUENCING AND SCHEDULING

A. INSTALLATION AND STARTUP

1. Sequence the installation and startup of the HMI in coordination with the scheduled startup of portions of the system and the PLC programming. This sequencing may involve startup and operation of only portions of the system under the new control system.

Provide for startup and testing operations of the new portions of the plant under the new control system, while maintaining operation of other parts of the facility under the old system until they are moved onto the new system.

2. Coordinate with the UV Disinfection System manufacturer, to obtain register address information for data to be shared between the HMI and the UV System PLC.

3. Coordinate with the MBR System Supplier, Kubota, to obtain register address information for data to be shared between the HMI and the MBR System PLC.

PART 2 PRODUCTS

2.1 APPLICATION

A. CREATE TAG NAME DATABASE AND SCRIPTS

1. Provide programming to accomplish all operator control and monitoring requirements indicated or specified in Specification Section 13451 – PLC Programming.

2. Provide programming to accomplish all operator control and monitoring requirements associated with other local networked devices that contain not resident within the PLC.

   a. UV Manufacturer's PLC

3. Provide system programming required for communication between facilities via selected telemetric technology.

B. PROGRAM ORGANIZATION

1. Organize and format additions to the tag name database logically and consistently with the existing.

   a. Assign tag names in a consistent manner which identifies the general purpose of the actual variables.

   b. Programming and annotation for any given program or script shall be formatted and organized similarly to other comparable scripts in the system.

2. Organize and format the screens logically and consistently.

   a. Assign screen names in a consistent manner which identifies the general purpose of the screen.

   b. Objects, symbols, cells, and screens denoting similar equipment, systems, or plant processes shall be formatted and displayed similarly in the system. In addition, new objects shall be displayed and formatted similarly to the existing ones.

3. Create the program to utilize system memory and resources in an efficient and logical manner.

   a. Assign or use tag names, scripts, and memory space to minimize complexity, and memory space, but not at the expense of logical order or function.

C. PROCESS DESCRIPTION

1. Review the process algorithm descriptions in Section 13451 and coordinate the program and screens with the requirements described therein. Provide displays or screens for information described there even if not described in this Section.

PART 3 EXECUTION

3.1 COMPUTER CONFIGURATION

A. Configure each computer to cleanly shut down if power fails for more than ten minutes. Each computer shall monitor its UPS to determine if power fails.

B. Install PCAnywhere or equal.

C. Install MSOffice

3.2 TAGNAME DATABASE AND SCRIPTS

A. Coordinate with the UV Disinfection System manufacturer and MBR System Supplier, to obtain register address information for data to be shared between the HMI and their associated system PLC.

B. Organize and format the tagname database in the HMI software program logically and consistently with the PLC.

1. Assign tagnames in a consistent manner which identifies the general purpose of the actual variables.

2. Programming and annotation for any given program or script shall be formatted and organized similarly to other comparable scripts in the system.

C. Organize and format the HMI software screens logically and consistently.

1. Assign screen names in a consistent manner which identifies the general purpose of the screen.

2. Objects, symbols, cells, and screens denoting similar equipment, systems, or plant processes shall be formatted and displayed similarly in the system. In addition, new objects shall be displayed and formatted similarly to the existing ones.

D. Create the program to utilize system memory and resources in an efficient and logical manner.

1. Assign or use tagnames, scripts, and memory space to minimize complexity, and memory space, but not at the expense of logical order or function.

3.3 HMI PROGRAMMING AND SCREENS

A. GENERAL

1. The SCADA software shall be programmed to provide the screen displays and functionality as described in the following sections and in the following information sources:

a. The process control algorithm descriptions, I/O lists and setpoint lists in Section 13451.

2. Error Traps

a. Include error traps to prevent miskeyed or erroneous values from being entered into the system. This includes items such as, but not limited to:

i. Non-numerical keystrokes or entries for numerical values.

ii. Values outside expected ranges.

iii. Provide warning when low setpoints are higher than high setpoints.

iv. Provide warning when high setpoints being lower than low setpoints.

b. Include confirmation steps for operator entered values such that entry of a new value is a two-step process requiring entry of the number plus a confirmatory keystroke not likely to occur by accident.

3. Alarm Groups

a. Alarm groups shall be assigned according to the process areas of the facility.

b. Tag names shall be assigned to alarm groups in accordance with the location of the equipment with which they are most closely associated.

B. GENERAL HMI SCREEN REQUIREMENTS

All PLC I/O and setpoint values shall be displayed and logged in the HMI computer. All setpoints and parameters intended to be field configurable shall be adjustable via the HMI.

The HMI shall include provisions to present all the data points listed herein.

Screen backgrounds, appearances, and equipment representations shall match closely to the recommended screens submitted by the MBR manufacturer for consistency of appearance.

Plant equipment controlled or monitored by the WWTF PLC shall have information displayed and stored in the HMI for:

- Equipment run time (stored in seconds/displayed in tenth of hours).
- Equipment number of starts.

- Equipment status (requested, available, running, fail).
- Motor over temperature (where applicable).
- Pump leakage (where applicable).

Variable Frequency Drive (VFD) and some soft-start equipment shall have additional information provided to the WWTF PLC by the starter over Ethernet/IP. This information shall be displayed on the HMI and shall include:

- VFD status (off, run, fault).
- Motor amperes/volts.
- VFD speed.

Provisions shall be made for the HMI register to contain values for time delays, setpoints, lead-lag order, etc., all values are to be adjustable via the HMI. The HMI shall include provisions to modify all the operator adjustable setpoints listed above or required by the PLC code. Critical setpoints shall have password protected pop-up windows (5 digit password = 14620). Each HMI screen shall include indication of whether any alarms are active and whether there are any unacknowledged alarms. One of the alarms displayed by the HMI will be communications stalled alarm.

Motors and equipment representations shall be colored red when off and green when on. The presence of unacknowledged alarms shall be indicated by alternate flashing of a yellow color with the red or green on-off status color. The presence of acknowledged alarms shall be indicated by a solid yellow color. Motors and equipment shall have a label with the motor or equipment tag number. The label shall be a rectangular box with black outline and text and light color fill.

A “navigation” tab shall always be visible at the top of the monitor. The tab contains buttons or pull-down menus, which access other screens. Other screens shall be made visible below the navigation screen when selected. When a screen is displayed the associated navigation button is “grayed out.” The navigation screen shall include a status light for indication of alarm conditions. The light shall flash yellow and red if an unacknowledged alarms exists with a nameplate text “Alarm”. The light shall be yellow if an acknowledged alarm exist. If no alarms exist the light shall be gray.

An “overview” screen shall provide a system overview with operational status indicators, mode selection touch zones, sequence start and stop touch zones, and access to the other system screens. This screen shall show a representation of the WWTF and associated equipment, motor

operational status, real-time data for instrumentation, alarm status, and valve positions. Individual areas or equipment items will "highlight" when the cursor is over that area and "clicking" that area will display the screen associated with that area or equipment. General status information shall be displayed by superimposing text and animated symbols or cells.

Provide a legend display for status with symbols as follows:

- Off symbol of red color
- On symbol of green color
- Unacknowledged alarm symbol flashing between yellow and red.
- Acknowledged alarm symbol of yellow color

The following are general guidelines for Schematic SCADA Screens:

1. Pump running (valve open)/not running (valve closed)/unacknowledged alarm/acknowledged alarm - This information shall be represented by the color of the pump or valve. Green = running or open. Red = stopped or closed. Flashing yellow = unacknowledged alarm. Steady yellow = acknowledged alarm

2. Pump Run Time – Pump Run Time shall be displayed in a tabular format above or below the pumps.

3. Level – The level shall be graphically displayed on the screen. There shall also be a numerical display of the level in feet. The numeric label shall be located to the left side of the graphical representation of the level and shall change with the graphical level as the level changes.

4. Start Sequence Position – The starting sequence of the pumps shall be able to be set from the schematic screen. This shall be accomplished by picking a button labeled "Start Sequence Position." The button shall be located to the left side of the first pump, adjacent to the label of the first pump. The button shall bring up a pop-up screen that will allow the user to associate a pump with a label: lead, lag1, lag2 or lag3. This pop-up screen shall have a "cancel" and "confirm" button. The "cancel" button shall take the user back to the schematic screen without making any changes to the screen. The "confirm" button shall only be accessible when each pump is associated with only one label. When the "confirm" button is picked, the pop-up screen shall

disappear and the pumps - diagrammatic screen shall be active with the new labels that were set by the user.

5. Individual areas should “highlight” when the cursor is over that area and “clicking” that area will display the screen associated with that area. General status information shall be displayed by superimposing text and animated symbols or cells.

6. Motor Representation on HMI Screen

   Each motor shall have a pop-up window or on-screen display to indicate the following:

   a. Running status (on/off)

   b. Alarm status (fault, overload, leakage, overtemp, VFD fault, etc.)

   c. Call status

   d. HOA status

   e. Number of start counts

   f. Run time

   g. VFD speed

   h. VFD current

7. Flow Meter Representation on HMI screen

   The current flow rate and moving average (where applicable) shall be shown adjacent to a representation of each air and water flow meter and each flow meter shall have a pop-up window or on-screen display to indicate the following:

   a. Totalized influent volume

   b. Current day’s totalized volume

   c. Previous day’s totalized volume

   d. Current moving average (where applicable)

8. Analog instrumentation alarms

For each analog instrumentation signal, such as flow meters, pressure transmitters, submersible level sensors, provide an HMI interface for the following operator-adjustable alarm levels:

- High Critical (typically a shutdown alarm if enabled)
- High Warning
- Low Warning
- Low Critical (typically a shutdown alarm if enabled)

Each alarm point shall be associated with a time delay setpoint. If the time delay is set to "0" then the alarm is disabled.

9. Runtime Meters and Start Counts

a. There shall be a separate Runtime and Start Count screen or pop-up showing this data for each motor.

b. Runtime is calculated in the respective plant PLC's, which record the following runtime totals.

i. Total runtime since the equipment was put into operation.

ii. Total runtime since the runtime meter was last reset. There will be a time date stamp recorded when the runtime meter is reset.

iii. Total runtime for the current operating cycle.

c. Start Counts are tallied in the respective plant PLC's, which record the following start count totals.

i. Total starts since the equipment was put into operation.

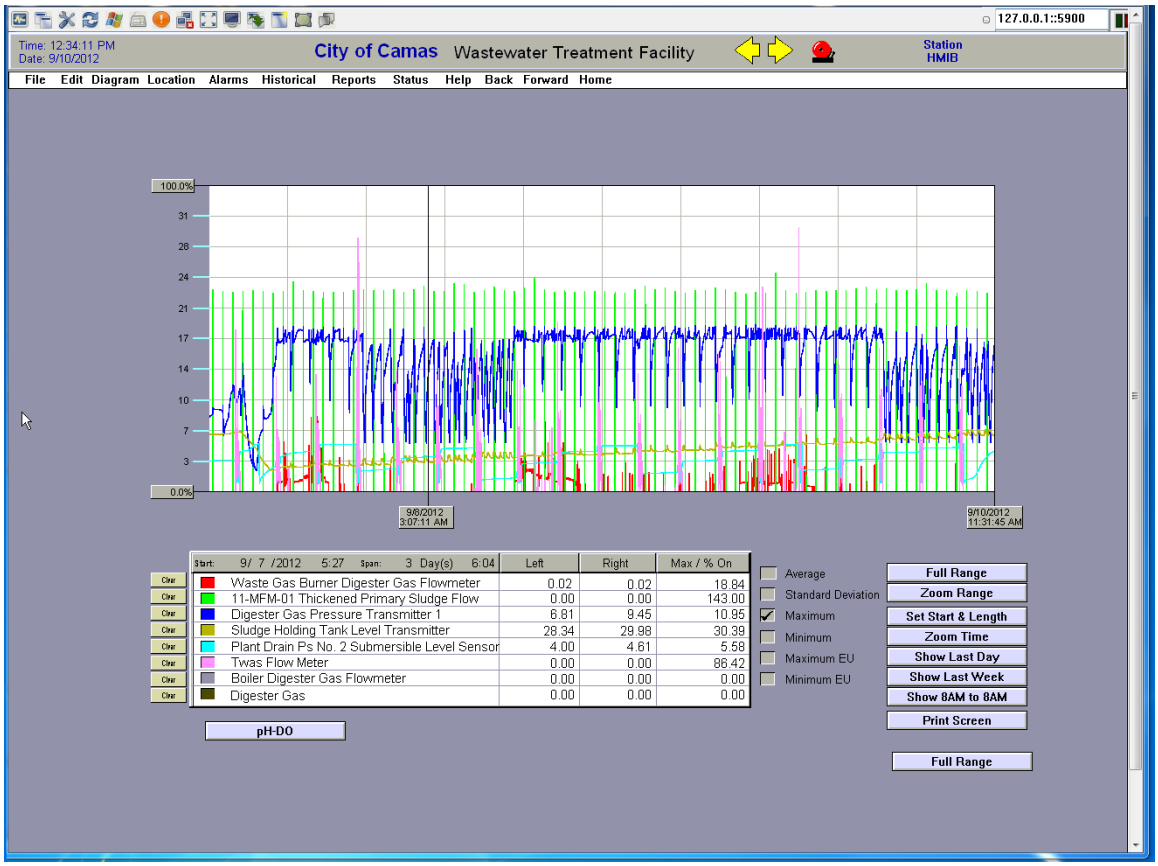
ii. Total starts since the start counter was last reset. There will be a time date stamp recorded when the runtime meter is reset.

10. An “Alarm” screen shall display all the alarms. The screen shall contain an alarm history/summary control, within a separate popup window or accessible via pull-down menu. The alarm control shall be labeled with the tagname of the currently displayed alarm group. A button shall be provided that toggles the display between alarm history and alarm summary. The history screen shall display the most recent alarms for a period of 60 days. A button shall be provided to scroll the alarm control (e.g., “Next Page,” “Previous Page”). A button shall be disabled if the alarm control indicates that no further scrolling is possible. A button shall be provided to acknowledge all alarms in the currently displayed alarm group. This button shall be the only button that acknowledges alarms. A button shall be provided to print the window containing the currently displayed alarm control.

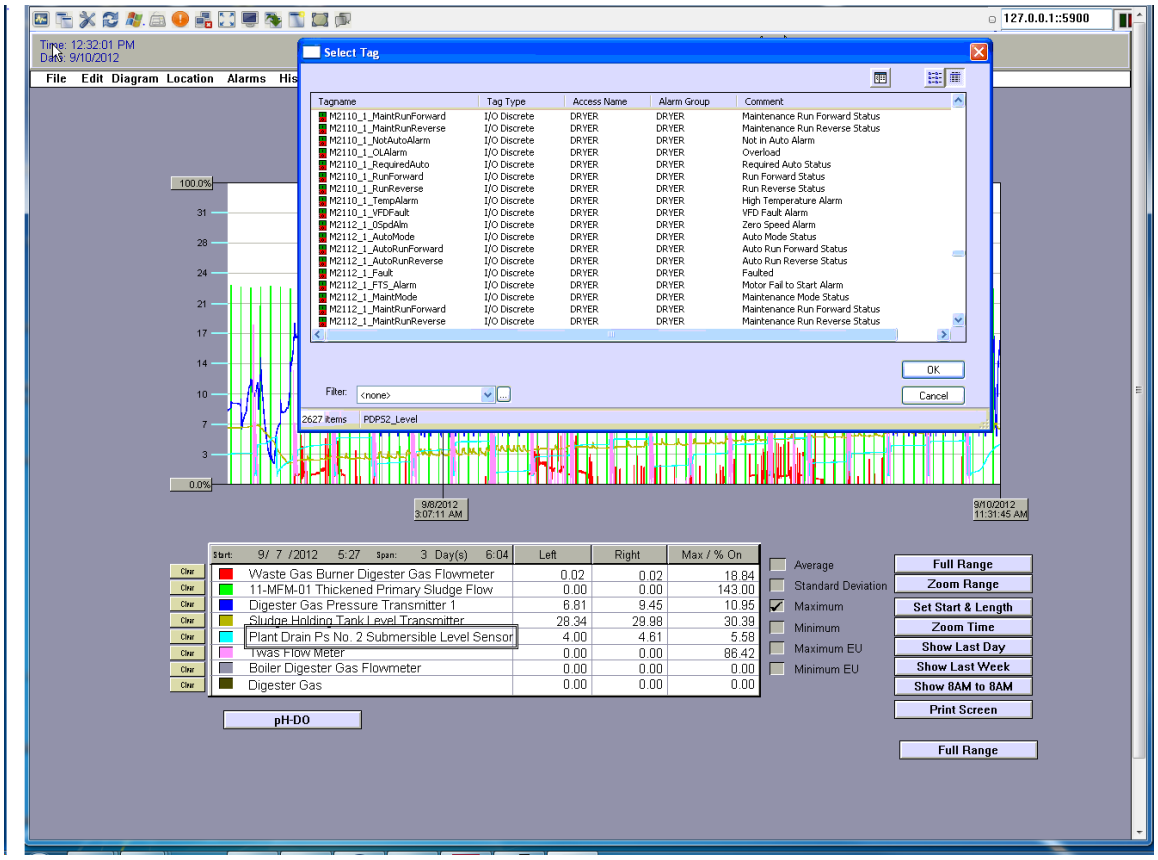
11. “Historical” screens shall be provided to show trending for all status and alarm values listed herein for a time period of 24 months. Up to eight variables shall be available to be selected in different colors as shown in the screen shot below. Nine premade trending charts shall be selectable via a pull down menu. The process variables and names for the premade charts will be provided by the engineer during submittals. The premade screens shall allow the operator to change the times shown and the range, but not the process variables.

12. An additional trending chart, “Historical New,” shall allow the operator to change the variables displayed via pop-up menu when the operator clicks on the variable in the selection table, as shown in the screen shot below. All process variables, inputs, outputs, setpoints, and alarms, shall be selectable via a list in the pop-up window. Process variables shall be identified by the equipment number or component/basin identifier followed by a descriptor (i.e., MOV01_open, MOV01_closed. The value of the variable (i.e., ft, scfm, mg/L) shall be provided in a column of the pop-up window. The function of the other pop-up menus shown below for “Full Range,” “Zoom Range,” “Set Start & Length,” “Zoom Time,” “Show Last Day,” “Show Last Week,” “Show 8am to 8am,” “Print Screen,” and “Full Range,” as well as the function buttons for “Average, Standard Deviation, Maximum, Minimum, Maximum EU, and Minimum EU” shall be as typically supplied.

"Historical" screen example:



"Historical" tag selection pop-up example:



A. HOME SCREEN

The home screen shall show a simplified schematic of the P&ID drawing with all major equipment items and piping connections on a single screen, with squares indicating separate pop-up screens that can be brought up by clicking on that location. The individual pop-up screens are described below.

B. AREA 1 OPERATIONS BUILDING

This screen will have a schematic representation of all of the components in this area with the status, alarm, value, display and input parameters and pop-up menus as specified in Section 13451-3.3A. The schematic representation shall be similar to the format shown on the Process and Instrumentation Plan Sheets (I-Sheets) for the components in this area, including the aeration systems, UV system, and NPW system.

C. AREA 2 HEADWORKS AND PROCESS TANKS

This screen will have a schematic representation of all of the components in the Headworks area with the status, alarm, value, display and input parameters and pop-up menus as specified in Section 13451-3.3b. The schematic representation shall be similar to the format shown on the Process and Instrumentation Plan Sheets (I-Sheets) for the components in this area, including the influent pump station, rotary drum screen system, anoxic basin mixer, RAS pump station, and odor control system.

D. MBR SYSTEM

This screen will have a schematic representation of all of the components in this area with the status, alarm, value, display and input parameters and pop-up menus provided by the MBR System Supplier for all equipment included on the Process and Instrumentation Plan Sheets (I-Sheets).

E. WAS STORAGE TANK

This screen will have a schematic representation of all of the components in this area with the status, alarm, value, display and input parameters and pop-up menus as specified in Section 13451-3.3A-2 and 3.3B-10, The schematic representation shall be similar to the format shown on the Process and Instrumentation Plan Sheets (I-Sheets) for the components in this area, including the WAS storage tank, WAS pump and WAS blower.

F. ADDITIONAL CONTROL COMPONENTS

This screen will have a schematic representation of all of the components as shown on P&ID sheets I-13 and I-14.

G. EVENT LOG SCREEN

An event log screen shall be provided that details events and the time they occur. The event screen shall show up to 48 hours of events on each screen. The operator shall be able to scroll forward and back in time to review events. Events shall be color coded for control events, alarm events, and alarm acknowledge events.

H. ALARM LOG SCREEN

An alarm log screen shall be provided that summarizes all alarm events. Past alarm events shall be grey. Acknowledged alarm events shall be red. Unacknowledged alarm events shall be flashing red. The operator shall be able to acknowledge all alarms or individual alarms from this screen.

I. TREND SCREENS

Trend screens shall be provided to allow the operator to review historical data trends. The operator shall be able to change the time scale or the value scale for each trend screen.

J. AUTODIALER

The software autodialer shall be programmed with the names and phone numbers of contacts specified by the Owner. Call schedules shall be set up to meet the Owner's needs for weekday working hours, weekday nights, weekends, and holidays. Alarm tags shall be set up to dial-out on alarm conditions.

K. DATA ACQUISITION AND DATABASE MANAGEMENT

The SCADA system shall be set-up to manage collected data in an efficient manner so that is can be displayed, recorded, trended and reported as needed by the operator.

L. REPORTS

Several standard reports shall be preprogrammed in the SCADA system. All reports shall be capable of being output on the printer, or the computer screen.

In various reports there may not be a reported value for every day or hour listed in the report. In these cases, special characters shall be printed ("NR" or "____", etc.) rather than zero to indicate the absence of data. Each data value shall be output in its correct position on the report sheet.

Specific Data to be included in each report will be specified by the Owner and the Engineer. The programmer shall plan on generating the following three standard reports.

1. Daily Report

   This report will summarize specific 24 hour values showing the process analog variables.

   The following shall be included for each variable: high, low, average. For flow values the total.

   This report is estimated to contain one page.

2. Monthly Report

   The report shall cover one full calendar month.

   The following shall be included for each variable: high, low and average (or total).

3. Annual Report

   This annual report shall be of the same variables as in the monthly report and show the monthly means or totals for the year. This report is estimated to contain two display pages.

M. REMOTE ACCESS

Provide, install, and provision software as necessary to provide secure remote access to the system for monitoring and alarming. Coordinate with Kubota for their access to the MBR control panel. Coordinate with the Owner's contracted plant operator (FutureClear) for full plant access.

Secure the network by blocking off unused ports and IP addresses.

Coordinate software with networking hardware. Reference Specification Section 16940.

3.4 DEMONSTRATION AND TRAINING

A. Demonstrate the system in accordance with Section 01800 “Testing, Commissioning, and Training.”

B. ON-SITE TRAINING

1. Provide the following formal training sessions at the Owner’s facility for Owner’s operating and maintenance personnel by an

instructor familiar with the both the manufacturer's commercially available applications provided, and the specific programmed applications provided for this project, after the system has successfully undergone all field testing and acceptance procedures. Each training session shall be a minimum of 4 hours. Use any time which remains after each training session to provide minor adjustments to the system per the Owner's request for easier or more convenient operator use of the system.

a. Initial 2-day training session at the time of startup.

b. Follow-up 1-day training session 3 months after startup.

c. Follow-up 1-day training session 6 months after startup.

***** END OF SECTION *****

DIVISION 14

CONVEYING SYSTEMS

SECTION 14615

PORTABLE HOISTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing one new portable hoists and three new embedded hoist sockets for the removal of pumps and equipment as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions
11313	Submersible Centrifugal Pumps
11353	Direct-Drive Submersible Mixers

1.3 PERFORMANCE REQUIREMENTS

The hoists shall have a safe load capacity 1.5 times the weight of the heaviest pump to be removed. Each hoist shall have an adjustable boom (length and angles) and shall be equal in lifting capacity, unless the lifting capacity and intended usage is labeled on each hoist.

1.4 EQUIPMENT LIST

Provide four potable hoists for the entire plant. Provide hoist sockets at locations shown on the Plans

Item	Equipment Number
Influent Pump Station	02 PH 01

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The portable hoists and sockets shall be as manufactured by Flygt or Halliday Products, or equal.

2.2 HOISTS

Each hoist shall be a portable hoist of 316 stainless steel construction with marine grade steel hand operated winch, static loop and adjustable reach. The hoists shall have a sufficient length of 316 stainless steel cable for the specific application (30 feet minimum) and a 316 stainless steel safety hook. The height of the hoist shall be as required so that the equipment items can be removed.

2.3 MOUNTING SOCKET

The mounting sockets shall be 316 stainless steel base-mounted, embedded as identified on the Plans, and manufactured specifically for use with the hoist provided. Mounting sockets shall be provided at each pair of pumps or mixer as shown on the Plans. All nuts, bolts and washers shall be 316 stainless steel. Embedded hoist sockets shall be cast into the concrete with the slab or wall. Provide a 316 stainless steel cover plate and a drain hole with each socket to keep moisture from accumulating inside the socket.

PART 3 EXECUTION

Mounting sockets shall be properly attached as shown on the Plans and in accordance with the manufacturer's recommendations using 316 stainless steel threaded rods in epoxy anchors (3/4-inch minimum diameter) so as to hold the hoist in a true vertical position.

The Contractor shall demonstrate to the Engineer that the hoist can be easily inserted into each of the sockets, can lift the pumps and mixer, can be easily rotated in the mounting socket while loaded and then can be easily removed. The Contractor shall correct all deficiencies to the satisfaction of the Engineer. The Contractor shall coordinate with the portable hoist manufacturer and the submersible centrifugal pump manufacturer to ensure that all portable hoist sockets are located so that the hoist lifting hook is positioned directly above the pump lifting point.

***** END OF SECTION *****

DIVISION 15

MECHANICAL

SECTION 15050

PIPING SYSTEMS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes process and utility piping, fittings, supports, and accessories shown on the Plans, described in these Specifications and as required to completely interconnect all equipment with piping for complete and operable systems.

The Contractor shall direct the attention of all subcontractors and suppliers of piping systems and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
02300	Earthwork
02700	Gravel Materials
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Piping systems and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection,

operation, maintenance and repair. In order to meet these requirements minor deviation from the Plans may be made as approved by the Engineer.

1.4 PIPE MATERIALS

The materials to be utilized for the various pipe sizes and applications on the project shall be as follows, unless otherwise noted on the Plans or herein:

Process		Inside or Above Grade	Buried
Air Low Pressure	ALP	Stainless Steel	Stainless Steel
Chemical Cleaning Solution	CCS	Solvent Welded PVC	Solvent Welded PVC
Drain (<3")	D	Solvent Welded PVC, Galvanized Steel (to 1 ft. above and below grade)	Solvent Welded PVC. Buried drain pipe under slabs shall be cast iron soil pipe as indicated in drainage piping notes on Sheet P-1.
Drain (≥3")	D	Ductile Iron, FL	Ductile Iron(1). All buried drains serving floor drains and fixture drains shall be cast iron soil pipe.
Equalization	EQ	------	Ductile Iron(1)
Final Effluent	FE	Solvent Welded PVC	Solvent Welded PVC
Force Main	FM	------	Solvent Welded PVC
Irrigation	I	Solvent Welded PVC	Solvent Welded PVC
Mixed Liquor	ML	Ductile Iron, FL	Ductile Iron, MJ
Non-Pot Water (<3")	NPW	Solvent Welded PVC, Galvanized Steel (Outdoor Exposed)	Solvent Welded PVC or PEX
Non-Pot Water (≥3")	NPW	Ductile Iron, FL	Ductile Iron(1)
Odor Control Duct	OCD	Solvent Welded PVC	Solvent Welded PVC
Outfall	OTF	HDPE SDR 11 IPS and Ductile Iron, MJ as shown on the Plans	HDPE SDR 11 IPS and Ductile Iron, MJ as shown on the Plans
Overflow	OF	Solvent Welded PVC	Solvent Welded PVC
Permeate	PER	Solvent Welded PVC	Stainless Steel
Potable Water (<3")	W	Copper	Copper, HDPE or PEX
Potable Water (>3")	W	------	Ductile Iron, MJ
Raw Sewage	RS	Ductile Iron, FL	Ductile Iron(1)
Return Activated Sludge	RAS	Ductile Iron, FL	Ductile Iron(1)
Sample	SAM	Vinyl Tubing	Vinyl Tubing
Sanitary Sewer	SS	------	PVC
Storm Drain	SD	------	Corrugated PE
Sump Pump Discharge	SPD	Solvent Welded PVC	Solvent Welded PVC
Vent	V	Solvent Welded PVC	Solvent Welded PVC
Waste Activated Sludge	WAS	Solvent Welded PVC (above grade), Ductile Iron, FL (in valve vault)	Ductile Iron, MJ
Waste Sludge	WS	Ductile Iron, FL	Ductile Iron(1)

(1) Buried Ductile Iron pipe shall have mechanical or push on joints while all fittings and valves shall be mechanical joints. All buried ductile iron pipe shall be restrained unless otherwise shown on the Plans.

1.5 SUBMITTALS

Submittal data shall be supplied in accordance with Section 01300. Detailed installation drawings of all piping and connected equipment shall be submitted. The drawings shall include all piping, valves, fittings, pipe support locations and types, seismic bracing, and appurtenances.

Submit data to show that the following items conform to the Specification requirements:

A. Pipe, fittings, and accessories.

B. Valves.

C. Couplings and couplers.

D. Pipe supports and seismic braces as required herein.

Submit certified test reports as required herein and by the referenced standards.

Submit HDPE fusion plan and operator certifications for HDPE pipe installations.

PART 2 PRODUCTS

2.1 GENERAL

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Part 3 Execution of this Section.

All piping in contact with potable water shall be certified under NSF 61 and NSF 372 for potable water use.

All buried, submerged, or intermittently submerged piping that is bolted together or uses bolts to hold materials together shall use 316 stainless steel nuts, bolts, and washers. This requirement applies to a distance of 12 inches above the highest

water level in any tank, channel, or structure. Otherwise, bolts, nuts, and washers may be hot-dip galvanized steel.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. GENERAL

Ductile iron pipe shall be centrifugal cast pipe conforming to AWWA C151, Class 52, unless otherwise noted, cement mortar lined in accordance with, AWWA C104. Where flanged spools are utilized, all spools shall be Class 53.

All above ground piping shall be flanged piping unless otherwise specified or indicated.

Below ground piping shall be push on joint or mechanical joints unless otherwise specified or indicated. Mechanical joints shall comply with AWWA C111.

All mechanical joints shall be restrained joints with a retainer. The restrainer shall utilize the full circumference of the pipe for restraining and utilize standard MJ gasket and bolts. The restrainer shall be Grip Ring as manufactured by Romac Industries, Mega-Lug, or equal.

All push on joints shall be restrained with field lock gaskets or TR Flex pipe from US Pipe or equal.

Flanges shall comply with ANSI Bl6.1, Class 125. Flange gaskets shall be full face. Approved adaptor flanges shall be used instead of flanges where shown on the Plans.

Fittings shall be ductile iron and shall comply with AWWA C110 or AWWA C153, cement mortar lined, 250-psi minimum pressure. Fittings shall be mechanical joint or flanged fittings. Fittings shall not be “Tyton” or other push-on type joint.

The exterior of buried ductile iron pipe and fittings and pipe and fittings in contact with concrete shall be coated with bituminous coating. The exterior surface of ductile iron pipe and fittings inside of buildings, structures, and vaults shall be painted in accordance with Section 09900 of the Specifications.

All bolts not in contact with potable water shall be coated with Armite Anti-Seize Compound No. 609, or equal, prior to installation. All bolts in

contact with potable water shall be coated with an NSF-61 approved anti-seize compound, SAF-T-EZE, or equal, prior to installation.

2.3 PVC PIPE AND FITTINGS

A. GRAVITY AND VENT PIPING

Gravity PVC sewer and vent pipe shall be solid wall PVC pipe or approved equal. PVC pipe and fittings shall conform to ASTM D3034 (15-inch and smaller) or ASTM F679 (18-inch and larger), for standard dimension ratio (SDR) 35 pipe. PVC pipe and fittings shall be furnished with integral, gasketed, bell-and-spigot, push-on type joints conforming to ASTM D3212. Elastomeric gaskets shall have a solid cross-section, be factory-installed and securely locked in place in the bell, and conform to ASTM F477. Sizes and dimensions shall be as shown on the Plans. Nominal laying lengths shall be 13 or 20 feet.

B. PRESSURE PIPE

All PVC pipe 3 inch and smaller shall be Schedule 80. Pipe shall be constructed of material that meets or exceeds ASTM D2241 and D1784 and Commercial Standard CS 256. Joints shall be solvent weld with press fit. Fittings shall conform to ASTM D2466 and D2467 for socket type and ASTM D2464 for threaded pipe.

All PVC pipe 4 inch and larger shall be PVC, Cast Iron pipe equivalent O.D., Class 235, conforming to the requirements of AWWA C900. Pipe joints shall be gasketed. Solvent-cement joints will not be acceptable. Fittings for PVC pipe 4 inch and larger shall be ductile iron, as specified in Part 2.2 of this Section.

Provisions for pipe expansion shall be as recommended by the pipe manufacturer.

Bolts for PVC pipe, where required, shall be 316 stainless steel, ASTM A193, Grade B8M, hex head with ASTM A194, Grade 8M hex nuts. Washers of the same material shall be supplied.

C. CHEMICAL CLEANING SYSTEM (CCS) PIPE

All pipe for chemical feed service shall be Schedule 80 PVC pipe as described in Part B. Glue for the chemical feed piping shall meet ASTM F493 and shall be specifically formulated for chemical resistance to hypochlorite solutions. Acceptable glue products include IPS WELD-ON 724 with P-70 primer, or approved equal.

Where chemical feed pipe joins with equipment that has threaded connections, threaded pipe joints may be used. Threaded pipe joints shall be made in accordance with the pipe manufacturer's recommendations. Pipe tape for threaded joints shall be Military Specification T-27730A tape. Pipe compound shall be used with pipe tape to make all threaded joints.

All plumbers and pipe fitters shall be trained in the ASTM B-31.3 pipe joining procedure by a representative of the PVC pipe company prior to beginning construction of the chemical feed pipe.

2.4 STAINLESS STEEL PIPE AND FITTINGS

Stainless Steel pipe shall be general service made of 316 Stainless Steel. Pipe shall be Schedule 40 with threaded and coupled fittings.

2.5 STAINLESS STEEL PIPE AND FITTINGS FOR AIR SERVICE

All stainless steel air pipe larger than 2 inches in diameter shall be Schedule 10S and conform to ASTM A778.

All stainless steel air pipe 2-inches and smaller in diameter shall be fabricated from Type 304L stainless steel pipe conforming to ASTM A312 and AISI 304L, and shall be Schedule 40. Non-welded parts and pieces such as nuts, bolts, washers, supports, follower flanges, and anchor bolts shall be made from Type 316 stainless steel.

All stainless steel threaded fittings shall be Type 304 and conform to ANSI B16.3, Class 150. All gaskets shall be 45 to 55 durometer (Shore A) neoprene.

All Type 304L stainless steel material shall conform to the chemical requirements of ASTM 240-72A and ANSI 304L except that the maximum carbon content shall be limited to 0.30 percent. Dimensions shall be as shown on the drawings with dimensional tolerances uniform to ASTM 554-72 and ASTM A530.

After fabrication, all stainless steel piping shall be passivated by immersion in a pickling solution of nitric and hydrofluoric acid. Parts shall be free of iron particles or other foreign materials. A final neutralizing rinse will complete the cleaning.

Stainless steel pipe shall be butt-welded in accordance with the applicable standards. In addition to the locations shown on the Plans, expansion couplings shall be installed at a maximum spacing of 40 feet on all stainless steel pipe.

The locations of the expansion couplings shall be determined by the Contractor prior to pipe fabrication and shall be subject to review and approval by the Engineer.

2.6 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

All HDPE shall be butt welded PE 3608 HDPE pipe conforming to ASTM D3350, having a cell classification of PE 345634C or better. Pipe dimensions and workmanship shall conform to ASTM F714. Pipe shall be Iron Pipe Size (IPS). HDPE pipe shall have an SDR of 11.

Manufacturer shall provide certification that stress regression testing has been performed on the product. Pipe shall be free of cracks, holes, inclusions, voids or other inclusions. Pipe manufacturer shall meet the minimum quality control requirements of D3035 or ASTM F714.

Fittings shall be standard HDPE fittings, meet the above HDPE pipe specifications, and be manufactured by injection molding or extrusion and machining. All fittings shall have the same working pressure as the pipe. Where butt fusion PE plastic fittings are allowed or called for on the plans, they shall comply with ASTM D3261.

Pipe sections shall be joined by butt fusion complying with ASTM F2620 and the joints shall be equal or greater in strength than the pipe. Socket fusion joints shall not be used. Class 150, ANSI B16.5 flanges shall be use for connections for flanged connections of another material. Flange backing rings used shall be 316 stainless steel with 316 stainless steel nuts, bolts and washers.

2.7 COPPER PIPE

Copper pipe and fittings shall be Type K (buried) or Type L or M (above ground), when used as water service lines, and Type L tube, when used as waste, vent or drainage lines.

2.8 CORRUGATED POLYETHYLENE PIPE

Corrugated polyethylene pipe (CPEP) and fittings shall conform to the requirements of AASHTO M-252 and AASHTO M-294, Type S. Fittings shall be as shown on the Plans and as required to provide a complete piping system and meet the same requirements as the CPEP. The CPEP shall be installed to the lines and grades shown on the Plans.

2.9 CROSS LINKED POLYETHYLENE (PEX) PIPE

Cross-linked polyethylene pipe (PEX) shall conform to the minimum requirements listed in ASTM F876 and F877, as applicable. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180 degrees F temperature and 80 psi gauge pressure at 200 degrees F temperature. Pipe shall be marked every three feet with the manufacturer's name, nominal size, material designation, standard dimension ratio, applicable ASTM or other testing agency testing requirements, and pressure rating.

Fittings shall conform to the minimum requirements listed in ASTM F2080, F1807, F2159, and ASSE 1061, as applicable. Where fittings are encased in concrete or buried underground, fittings shall be wrapped as per manufacturer's recommendation to protect the material.

2.10 STAINLESS STEEL TUBING

Stainless steel tubing shall be seamless welded austenic Type 304 stainless steel tubing. All tubing materials and connections shall conform to ASTM A269.

Variations in the tubing outside diameter and wall thickness shall not exceed the amounts prescribed in ASTM A 269 Table 3. All Type 304 stainless steel tubing material shall conform to the chemical composition requirements of ASTM A 264 Table 1.

2.11 GROOVED PIPING CONNECTIONS

As stated herein, grooved piping connections may be utilized in lieu of flanged, push-on, mechanical joint, or other above-grade piping connections noted above. For piping types *not* listed below, grooved couplings are not acceptable.

All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

A. DUCTILE IRON PIPE

Grooved couplings shall comply with AWWA C606 and shall be Victaulic Style 31 or equal.

Adapter flanges, where required for pipe connection or where shown on the Plans shall be Victaulic Style 341.

For direct connection between IPS/steel pipe and AWWA / ductile iron pipe, couplings shall Victaulic Style 307.

Where grooved couplings are utilized, spools as shown on the Plans shall be Class 53 materials.

B. STAINLESS STEEL PIPE (AIR SERVICE)

Where grooved joints are used, they shall be rigid Victaulic Style 489 with stainless steel housings**.**

Flexible type shall be Victaulic Style 77S for pipes 8" through 18" diameter and 77DX for pipes 6" diameter or less.

For pipes ≤ 2-inch, the Vic-Press piping system for Schedule 10S pipe may be used in lieu of threaded joints. System shall be rated for service to 500-psig. Schedule 10S pipe shall be roll grooved using a Victaulic grooving tool equipped with RX roll sets, specifically designed for stainless steel pipe.

Split-sleeve couplings shall consist of an arched housing, rolled stainless steel meeting ASTM A240. ASTM D2000 O-ring type elastomer gaskets meeting ASTM D2000 and suited for the intended service, along with stainless steel bolts and nuts meeting ASTM F593/F594 shall be provided.

1. Where required, couplings provided with restraint rings to be welded to the pipe OD. Rings shall be stainless steel meeting ASTM A276.

2. Couplings shall be:

    a. Victaulic Style 230S: Non-restrained flexible.

    b. Victaulic Style 231S: Non-restrained expansion.

    c. Victaulic Style 232S: Flexible with joint restraint.

    d. Victaulic Style 233S: Flexible with joint restraint and limit ring.

C. GROOVED PIPE COUPLERS

Grooved pipe couplers for steel pipe shall consist of two ductile iron housing segments conforming to ASTM A536, pressure responsive elastomer gasket, and ASTM A449 zinc electroplated steel bolts and nuts. Couplings shall comply with ASTM F1476 "Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications."

1. Rigid Type

Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

a. 2-inch through 12-inch

Installation-Ready, for direct stab installation without field disassembly, with grade EHP center leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, rated to +250 degrees F. Couplings shall be Victaulic Style 107N, or approved equal.

2. Flexible Type

For use in locations where vibration attenuation and stress relief are required. The couplings shall be placed in close proximity to the source of the vibration. Couplings shall be Victaulic installation ready Style 77, or equal.

The gaskets shall be suitable for use with the carrying media.

2.12 HOSE ASSEMBLY

The Contractor shall furnish and install hoses, nozzles and fittings for each yard hydrant and hose bib where shown on the Plans and as described below.

A. HOSE ASSEMBLY

Washdown hoses shall be EDPM, Hosecraft USA RM2 or equal. The hose shall be red in color. The inner diameter shall be equal to the diameter of the thread connection for each yard hydrant and hose bib, as shown on the Plans. The hose and all fittings shall have a pressure rating of at least 150 psi. The inner tube shall be smooth and the outer cover shall be reinforced with braded synthetic cords. Each section of the hose

assembly shall be 50-feet long and have male and female brass couplings sized to fit its yard hydrant or hose bib. Threaded female fittings shall swivel until tightened. Each hose assembly shall have a nozzle.

The Contractor shall furnish and install any and all transition or specialized fittings required to connect the hose to the yard hydrant and or hose bib at no additional cost to the Owner.

B. NOZZLES, 1-INCH THROUGH 1-1/2-INCH SIZE

Nozzles to fit 1-inch through 1-1/2-inch hoses shall be industrial fog nozzles with brass body, rubber protective rim, adjustable from fog-stream to straight stream by a twisting action with the ability to shut off flow completely at the nozzle, maximum working pressure of at least 150 psi, and NPSH threads, Dixon model WHFN150 or equal.

C. NOZZLES, 3/4-INCH SIZE

Nozzles to fit 3/4-inch hoses shall be industrial fog nozzles with brass body, rubber protective rim, adjustable from fog-stream to straight stream by a twisting action, maximum working pressure of at least 100 psi, and GH threads, Dixon model WDN75 or equal.

2.13 HDPE SERVICE PIPE/TUBING

HDPE tubing for water service shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 250 psi rating. Tubing shall be SIDR 7 size, such that the internal diameter is greater than or equal to the nominal pipe size. Fittings shall be brass, either compression or stab type. Stab types fittings shall utilize an internal grip ring and O-ring seal. Stainless steel liners shall be used when utilizing compression fittings on HDPE tubing.

2.14 VINYL TUBING

Vinyl tubing for sample line shall be Norton PRS Industrial Grade PVC, formulation C-486-A, 1/2-inch O.D., 3/8-inch I.D.

2.15 MISCELLANEOUS FITTINGS

A. FLEXIBLE COUPLINGS

Flexible couplings shall be Romac 501 or approved equal. Middle ring and follower shall have fusion bonded epoxy coating. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

For grooved piping connections, bolted split-sleeve couplings shall be Victaulic Style 230S and/or Style 231S.

B. FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be Rockwell (Smith-Blair) Type 912, Dresser Style 127, or equal.

C. ADAPTER FLANGES

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-lb. pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

D. CALDER-TYPE FLEXIBLE COUPLINGS

Flexible couplings shall be Calder-type where specifically indicated on the Plans. Calder-type flexible couplings shall consist of all elastomeric PVC sleeve secured to the pipes with stainless steel clamping bands. Adapter couplings shall be furnished for transitions between piping of different outside diameters as necessary.

Calder-type flexible couplings shall be as manufactured by Calder Co., Fernco, or equal.

E. FLEXIBLE CONNECTORS AND EXPANSION JOINTS

Flexible connectors and expansion joints shall be provided where shown on the Plans. The flexible connectors and expansion joints shall be provided with Class 125 ANSI flanges and be single arch-type multiple ply rubber or synthetic elastomers, complete with steel retaining rings, as manufactured by the Red Valve Company, Inc., the Metraflex Company, or equal.

Grooved fittings shall be Victaulic Style 240S stainless steel bellows, or equal.

F. DIELECTRIC INSULATED UNIONS

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to

which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

For grooved connections, fittings shall be copper-silicon casting conforming to UNS C87850 and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall be Victaulic Style 647, or equal.

G. WALL SLEEVES AND SEALS

Wall and/or floor pipe penetrations shall be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast waterstop of 1/2-inch minimum thickness and 2-1/2-inch minimum height. Wall sleeves shall be omni*sleeve or equal.

Seals for pipe sleeves shall be bolt-up type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. When bolts are tightened the rubber sealing elements shall expand to result in a watertight seal. Bolts and pressure plate nuts shall be Type 316 stainless steel in below grade or "wet" locations, and of carbon steel at other installations. Rubber links shall be suitable for use in water, moist environments, normal atmospheric conditions, and -40 degrees F to 250 degrees F temperatures for standard service.

H. STAINLESS STEEL PIPE EXPANSION COUPLINGS

Stainless steel pipe expansion couplings shall be restrained and still allow for expansion. Expansion couplings shall be Type 304 stainless steel body with Type 316 stainless steel sealing plate and end rings. Sealing pad and O-rings shall be silicone and all bolts shall be Type 316 stainless steel. Stainless steel pipe expansion couplings shall be Victaulic VBSP Style 232S Type 1 restrained flexible expansion coupling or approved equal.

I. NPW ASSEMBLY FILTER

The filter shall be Netafim 1-1/2-inch Super Manual Disc Filter, Model 25A17-040, with 040 mesh, and stainless steel clamp. The Contractor shall also provide one spare 040 mesh filter element including filter spine and ring set.

2.16 PIPING INSULATION

All new above ground exterior pipe carrying liquids, shall be insulated with 1-inch-thick fiberglass insulation and 0.016-inch anodized aluminum jacket; insulated by Owens-Corning, Certainteed, Johns-Manville or equal, unless otherwise noted. Buried piping less than 4 inches in diameter carrying liquids with less than 24 inches of cover shall be insulated with Rubitex closed cell foam insulation or equal.

2.17 HEAT TAPE

A. SELF-REGULATING HEATING CABLE

The self-regulating heating cable shall be constructed of a semi-conductive heater matrix that is extruded between parallel 16 AWG or greater buss wires with tinned copper braid. The cable shall have a Fluropolymer corrosion resistant jacket over the copper braid for hostile/corrosive environments. The self-regulating heating cable shall adjust its output to independently respond to temperatures all along its length, allowing the heating cable to be crossed over itself without overheating. As the temperature increases, the heating cable's resistance shall increase which lowers the total output wattage. Conversely, as the temperature decreases, the resistance shall decrease and the cable shall produce more heat. The cable shall have a maximum maintenance temperature rating of 150 degrees F. All heating cable core shall be permanently marked with the manufacturer's identification number for traceability.

The heat cable shall have a thermal output rating listed in the following table and shall be rated for installation in Class 1, Division 1 hazardous locations. The heat cable shall also be supplied with junction boxes that are rated for installation in Class 1, Division 1 hazardous locations.

Heat tape shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on this Project.

Pipe Size	Output	Model	# of Runs
3" or less	5 W/ft	Chromalox SRF 5-1C or equal	1
4"	8 W/ft	Chromalox SRF 8-1C or equal	1
6"	10 W/ft	Chromalox SRF 5-1C or equal	2

Use Model SRL for classified spaces. SRF is not classified.

B. INTEGRATED TEMPERATURE CONTROLS

The integrated temperature controls for the heat tracing shall consist of an ambient-sensing thermostat switch, a stainless steel sheath temperature sensor, a set point adjustment knob, and a set point indicator. The temperature controls shall be watertight. The temperature controls shall be provided with a secure mounting appropriate for the heat tracing application. The temperature set point shall range from 0 to 225 degrees F. The switch shall have a scale division of at least 10 degrees F. The sensor shall have at least a 250 degrees F max. temperature exposure with at least a -40 degrees F to 160 degrees F operating range. The temperature control unit shall be rated for installation in Class 1, Division 2 hazardous locations.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. GENERAL HANDLING AND PLACING

All piping constructed on this project shall be performed in accordance with the Uniform Plumbing Code. These Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as a part of this Section and all costs included in the lump sum bid.

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not to injure pipe coating. No other pipe or material of any kind shall be placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

The types and sizes of pipes to be used shall be as specified herein and as shown on the Plans. Where sizes of small pipe are omitted from the plans and not mentioned in the Specifications, the sizes to be used shall correspond to plumbing code requirements. In any event, undesignated pipe sizes shall be proper for the function to be performed and as accepted by the Engineer.

All pipe shall be carefully placed and supported at the proper lines and grades and where possible shall be sloped to permit complete drainage. Piping runs shown on the Plans shall be followed as closely as possible,

except for minor adjustments to avoid architectural and structural features. If major relocations are required, they shall be approved by the Engineer.

Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. Unions shall be ground joint, malleable iron type. Where unions connect dissimilar materials, the union shall be protected from reaction with dissimilar metals by installation of insulating materials and dielectric unions at contact points.

The interior of all piping shall be cleaned after assembly and before connecting to equipment.

All piping for which no location dimensions are shown shall be installed in a neat and workmanlike manner in accordance with best trade practice. Wherever possible runs and rises shall be grouped and kept parallel. Properly lay out all miscellaneous piping to clear obstructions such as passageways, equipment, larger sized pipes, ventilation ducts, lights, etc.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All piping to be buried below structures, foundations, or slabs shall be installed with extreme care. When all joints have been made, Contractor shall demonstrate to Engineer's satisfaction that all of piping is watertight and that all lines are clear before proceeding with any work above this piping. It shall be Contractor's responsibility to see that these lines are kept clear until final acceptance of the project, providing suitable tight wooden bulkheads or plugs for open end pipes. Any blockage of these systems due to earth, debris, cement slurry or anything else shall be rectified at Contractor's expense before project is accepted.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, jointing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. At all times during pipe laying operations keep trench free of water either by pumping, bailing, or drainage. Seal end of line with a tight-fitting plug when pipe is not being laid.

Valves shall have interiors cleaned of all foreign matter and inspected, both in open and closed positions prior to installation.

All pipes running through concrete walls below water surface or where subject to groundwater pressure shall be assembled as shown on the plans. Pipes running through concrete not subject to water pressure may be installed through standard steel sleeves, one or two pipe sizes larger than pipe in question. The pipe shall be free of all dirt and grease and thoroughly cleaned to insure a tight bond with the concrete.

All above ground outside pipe carrying liquids shall be insulated.

B. GENERAL EXPOSED PIPING INSTALLATION

Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

Piping shall be installed without springing or forcing.

All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

Flexible couplings shall be provided for all piping connections to motor-driven equipment and where otherwise shown in the Plans. The Contractor may install additional flexible couplings at approved location to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

Unions or flexible couplings shall be installed where shown on the Plans, and at all non-motor-driven equipment to facilitate removal of the equipment.

Where equipment drain connections are provided, they shall be valved, with the discharge pipe carried to the nearest floor drain, drain trench, or sump. Where no receptacle for drain exists, drain valves shall be piped to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

All exposed or submerged piping shall be painted and color-coded in accordance with Section 09900, unless otherwise specified.

3.2 PVC PIPING

A. GENERAL

PVC piping socket weld connections shall be made up in accordance with the pipe manufacturer's recommendations and as follows:

Where pipe is cut, remove all burrs and ream inside to provide smooth flow line. Bevel the plain end pipe 1/16 inch to 1/32 inch. Joints shall be first cleaned with cleaner before making up. Apply primer to the female joint. Apply primer to the male joint. Reapply primer to the female joint. Apply glue to the male joint. Apply glue to the female joint. Reapply glue to the male joint. Join pipe quickly with a 1/4 turn. If joint cannot be made up to full depth of socket, cut out and discard. Wipe off excessive cement. Hold for 30 seconds and do not move for 15 minutes after making up joint. Pipe joining below 40 degrees F will not be permitted. Cleaner and cement types shall be as recommended by the manufacturer for the size of pipe being used.

B. FUSIBLE PVC

Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.

3.3 FLANGED PIPING

Flanged joints shall be made in accordance with best trade practice. Screwed flanges for piping shall be run until pipe projects beyond face and no more than one thread is exposed on backside. All flange faces shall then be machined so as to be perfectly parallel. All flanged pipe shall be accurately dimensioned; no "drawing-up" will be allowed. Gaskets shall be full face, rubber.

3.4 GROOVED JOINT PIPING

Grooved joints shall be installed in accordance with the manufacturer's latest published 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 of an elastomer grade suitable for the intended service, and 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 and installation of grooved joint products. The representative shall periodically visit the jobsite and review Contractor is following best recommended practices in grooved product

installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s)).

3.5 THREADED PIPING

Threads for threaded joint piping shall be neatly cut with sharp tools and jointing procedure shall conform to best practice. Before jointing, all scale shall be removed from pipe by some suitable means such as pounding. After cutting, all pipe shall be reamed. All pipe shall be screwed together with an application of approved pipe compound applied to all male threads. Once a joint has been tightened, it shall not be backed off unless threads are recleaned and new compound applied. This application neatly made; all compound, dirt thoroughly wiped off outside of every joint.

Unions shall be installed in all threaded joint piping to facilitate removal of sections for maintenance, repair in accordance with best trade practice. All such unions shall be included in bid price whether shown on Plans or not.

3.6 MECHANICAL JOINT PIPING

Mechanical joint piping shall be installed in best trade practice with torque wrenches used to avoid overstressing bolts. Piping shall be installed using recommended procedures outlined in "Handbook of Cast Iron Pipe" as published by Cast Iron Research Association which in part requires that all contact surfaces of rubber seal with pipe be wire brushed, spigot be centrally located in bell. When tightening bolts, it is essential that the gland be brought up toward pipe flange evenly, maintaining approximately same distance between gland and face of flange at all points around socket.

3.7 HDPE PIPING

A. GENERAL HANDLING AND PLACING

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not to injure pipe coating. No other pipe or material of any kind shall be placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

Piping alignment shown on the plans on the bluff exterior shall be followed as closely as possible, except where existing terrain requires adjustment and receives Owner approval.

Anchors shall be installed on exterior surface run piping to adequately secure the pipe in place against horizontal and vertical forces. Exact anchor locations may be adjusted in the field based on actual surface conditions.

The interior of all HDPE piping shall be deburred and cleaned after assembly and before connecting to the outfall diffuser valve.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All piping to be installed below existing utilities shall be installed with extreme care. It shall be Contractor's responsibility to ensure that all existing utilities are protected until final acceptance of the project.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, fusing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. Seal end of line with a tight-fitting plug when pipe is not being laid.

B. PIPE FABRICATION

HDPE pipe and stainless steel closure couplings shall be installed in accordance with the manufacturer instructions as shown on the drawings and as specified herein.

In some cases along the pipeline the manufacturer's recommended bending radius is exceeded and fabricated fittings are required. All fabricated fittings shall be fully pressure rated and configured to conform to the total deflection angle noted on the Drawings.

C. PIPE FUSION

Sections of polyethylene pipeline shall be joined into continuous lengths by the butt fusion method in accordance with ASTM D2657 prior to lowering into Puget Sound. The joining method shall be performed by approved personnel trained to assemble the pipe in strict accordance with the pipe manufacturer's recommendations.

Thermal butt fusion joining of the polyethylene pipe shall be performed with field-proven equipment that has a centerline guidance system to hold

the pipe and fittings in close alignment while the opposing butt ends are faced, cleaned, melted, and fused together, and then cooled, all in strict accordance with the pipe manufacturer's recommendations. The interior weld bead of the fused joints shall be removed by cutting the bead away without scoring the inside wall of the pipe in accordance with the submitted and approved interior debeading procedures. Butt fusion joining shall be 100 percent efficient, offering a joint weld strength equal to or greater than the tensile strength of the pipe.

D. PIPE FUSION TESTING

On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of the Engineer. The following shall apply:

1. Heating plates shall be inspected for cuts and scrapes. The plate temperature shall be measured at various locations to ensure proper heating/melting per manufacturer's recommendations and approval by the Engineer.

2. The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e., joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16 inch to a maximum 3/16 inch.

3. The Contractor shall submit documentation of the pipe fusion test with the record information for the outfall installation.

E. INSTALLATION

1. HDPE pipe shall be installed in accordance with the manufacturer's instructions as shown on the Plans and as specified herein. Pipe trenching shall be done in accordance with ASTM D2321. Pipe bedding materials shall be Class I or II as specified by ASTM D2321 Section 6. Bedding and compaction rates for pipe installation shall be performed in accordance with ASTM D2321 Section 8.

2. Flanges or other pipeline appurtenances including anchors shall not be utilized for moving the pipeline into position. The pipe shall be towed and positioned using slings on the pipe.

F. MISCELLANEOUS NUTS AND BOLTS

All miscellaneous nuts, bolts and other hardware shall be Type 316 stainless steel, unless otherwise shown. All Type 316 stainless steel fittings, nuts, bolts, and washers shall be marked "316" by either raised or stamped numbers.

3.8 WELDED PIPING

All welding shall be by the inert gas, MIG, or TIG method. Procedures are in accordance with ASME B31.1. Filler wire shall be added to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint mechanically bevel pipe ends.

Interior weld beads shall be smooth, evenly distributed with an interior projection not exceeding 1/16-inch beyond the ID of the air header or fittings.

The outside welds shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel.

3.9 COPPER PIPE

All copper water service lines shall be tested, cleaned, and chlorinated, as described below. All waste, vent or drainage lines shall be flushed clean, and shall be tested by plugging the lowest point and filling the waste, vent or drainage piping with water to the level of the top of the vent pipe, but no joint in the system shall be submitted to a test of less than 10 feet of head. Under this condition, all joints shall remain watertight for a period of not less than 1 hour.

Piping shall be pressure-tested with water to a pressure of 125 psi.

3.10 CROSS LINKED POLYETHYLENE (PEX) PIPE

PEX pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

Install in accordance with manufacturer's instructions and recommendations and route piping in an orderly manner. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Piping that passes through expansion joints or walls shall be covered in protective polyethylene convoluted sleeves extending 15 inches on each side of the joint unless otherwise indicated on the Plans. Sleeves shall be secured on pipe to prevent movement during installation. Where piping enters or exits a wall a protective conduit shall be placed around the pipe, with the conduit extending a

minimum of 6 inches into the wall and exiting by a minimum of 6 inches unless noted otherwise on the Plans.

At connections and fittings, use a plastic pipe cutter to ensure square (90-degree) and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants.

Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

3.11 PIPE SUPPORTS

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans, or as specified in Section 15066.

3.12 FLEXIBLE COUPLINGS

Flexible couplings shall be installed in accordance with recommendations of manufacturer and used where indicated on the Plans. Finished joint shall be airtight or watertight under test pressure of pipeline. Buried flexible couplings shall be coated with asphalt base paint after assembly.

3.13 PIPE BEDDING

All pipe shall be bedded as specified in Section 02300.

3.14 TESTING

A. GENERAL

All piping shall be tested and inspected in accordance with the provisions of Division 7 APWA/WSDOT, except as modified herein. Where new piping systems are being connected to existing piping systems the existing piping systems shall be tested prior to connecting to the new pipe to the existing piping. Once the new piping system has been connected to the existing piping system the entire system shall be tested again.

All piping systems will be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein, the costs to be included in the lump sum bid price.

Each particular piping system shall be tested as hereinafter specified. All leaks shall be repaired or defective material replaced and the test repeated

as directed by the Engineer. After compliance with test requirements and approval of the Engineer, the field painting, where required, may be started. All pressure testing shall be done prior to any finish painting or pipe insulating.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

All thrust blocks shall be in place for at least 7 days to allow concrete to cure before testing. Install adequate blocking or other means of resisting test pressure.

B. AIR PIPING

Low pressure air piping shall be pressurized with air to 25 psig and remain leaktight for 1 hour.

C. PRESSURIZED LIQUID PIPING

All PVC, ductile iron and steel piping for pressurized liquid, including sludge, shall be pressurized with water to 100 psig and remain leaktight for a period of 4 hours.

Plant potable and non-potable water piping shall be pressurized with water to 125 psig and remain leaktight for a period of 1 hour.

All cross connection protection equipment shall be tested by a certified inspector prior to putting the piping into service. Submit test report to Owner.

D. DISINFECTION

Before being placed into service, all new and modified potable water pipe and appurtenances shall be sterilized and a satisfactory bacteriological report obtained in accordance with Section 7-09.3(24) of the WSDOT Standard Specifications.

As each pipe is laid, sufficient high-test dry calcium Hypochlorite (65 to 70 percent chlorine) shall be placed in the pipe to yield a dosage of not less than 50 mg/l available chlorine, calculated on the volume of water which the pipe and appurtenances will contain. Minimum free chlorine residual after 24 hours shall be 25 mg/l.

During the process of sterilizing, all valves, hydrants, and/or other appurtenances shall be operated to insure complete contact.

All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5 to 6 percent chlorine).

Following chlorination, all pipe shall be flushed to remove any solids until a test shows no more than 0.2 parts per million available chlorine. If no hydrant is installed at the end of the main, then a tap shall be provided large enough to develop a velocity of at least 2.5 FPS in the main.

Before placing the lines into service, a satisfactory report shall be received from the local or state health department on samples collected from representative points in the new pipe after the 24-hour sterilization period has elapsed. Samples for bacteriological tests in the presence of the Owner and transported by the Owner.

Should the initial treatment result in an unsatisfactory bacteriological test or should corrective work be required because of testing, then the chlorination procedure shall be repeated by the Contractor at their own expense until satisfactory results are obtained. These repeat procedures shall follow Section 7-09.3(24) of the WSDOT Standard Specifications, as appropriate and as necessary for the addition of chlorine. The cost of disposal of water used for disinfection shall be borne by the Contractor.

***** END OF SECTION *****

SECTION 15066

PIPE AND CONDUIT SUPPORT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work specified in this Section includes pipe and conduit hangers, brackets, and supports. Pipe and conduit support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
15050	Piping Systems
15400	Plumbing
15700	Heating, Ventilation, and Air Conditioning
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 REFERENCES

All pipe and conduit support materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this Section shall prevail.

ANSI A13.1	Piping and Piping System
ANSI B31.1	Power Piping
ASME	Boiler and Pressure Vessel Code
ANSI/MSS SP-58	Pipe Hangers and Supports C Materials, Design and Manufacture
ANSI/MSS SP-69	Pipe Hangers and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
IPC	International Plumbing Code

1.4 SUBMITTALS

In accordance with the requirements of Section 01300, submit the following project data prepared by a licensed Professional Engineer:

A. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.

B. Location of pipe and conduit support, including type of structural and pipe attachments, shown on detail drawings and/or specified under paragraph 1.5 of Section 15050.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall design, provide, and install pipe and conduit support systems, which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers, supports and structural attachments as specified herein. The support system shall be designed in conjunction with the pipe and conduit to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in paragraph 1.3.

In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Plans, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the Contractor's responsibility to provide a complete system of pipe and conduit supports. Pipe support schedule under paragraph 2.7 of this Section sets forth minimum requirements for pipe supports.

2.2 PIPE RACKS AND TRAPEZE HANGERS

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, clamps, brackets, fittings, and accessories for supporting pipes in equipment and pump rooms. All components for pipe and conduit rack and trapeze shall be Unistrut or equal.

2.3 PIPE CLAMPS AND HANGERS

In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hangers and stanchion saddle support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied.

Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.

All pipe clamps and hangers, including all accessories, shall be galvanized steel for indoor use and Type 316 stainless steel for outdoor use.

Pipe and conduit clamps and hangers shall be as manufactured by Anvil or equal and shall be as follows:

Type	Pipe Size (In.)	Pipe Material	Anvil Figure
Swivel Ring, Split Type	3/4 to 8	All type	104
Split Clamp	1/2 to 3	All type	138R
Adjustable Ring	1/2 to 6	All type	97
Adjustable Ring	1/2 to 4	Copper	CT-269
Adjustable Clevis	3 to 24	All type	590
Pipe Clamp	3 to 42	All type	216
Socket Clamp	4 to 24	Cast Iron	595
Pipe Stanchion	4 to 24	All Type	63
Stanchion Saddle	4 to 36	All type	259
Adjustable Saddle Support	3 to 36	All type	264
Riser Clamp	2 to 24	All type	40
Adjustable Pipe Roll	6 to 12	Stainless Steel	177, 181, or 274

2.4 STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface-mounted channel or individual inserts for existing concrete or where applicable, steel, roof plate supported attachments in the control building, complete with all accessories required. All structural attachments including all accessories shall be galvanized steel for indoor use and stainless steel for outdoor use, and shall be provided by a single manufacturer. Structural attachments shall be as measured by Unistrut Corporation or approved equal.

2.5 PIPE SUPPORT ATTACHMENTS TO CONCRETE

All pipe support attachment to concrete shall be in adhesive anchors unless noted otherwise.

Products which may be incorporated in the work include, but are not limited to, the following:

A. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

B. HIT HY 150 Injection adhesive Anchor, Hilti, Inc.

C. Power-Fast, Powers Fasteners, Inc.

2.6 PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the Plans. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be Anvil Figure 160 through Figure 166 or approved equal.

2.7 SPACING

Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1" & Smaller	Iron or Steel Copper Plastic Tubing	6 4-1/2 continuous continuous
1-1/4 to 2"	Iron or Steel Copper or Plastic	8 5
2-1/2 to 4"	Iron or Steel Copper or Plastic	10 6
6 to 8"	Iron or Steel Plastic	12 8

PART 3 EXECUTION

3.1 DESIGN

Pipe and conduit support systems shall be designed in accordance with applicable reference standards specified in paragraph 1.3. Pipe and conduit supports shall be designed and selected to withstand seismic loads as listed in Specification Section 11000 for IBC 2021 Seismic Design Category D with S_{DS}=0.959g and S_{D1}=0.617g and shall adhere to the following conditions:

A. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps, and other support items shall not exceed the manufacturer's recommended loads.

B. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping,

and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.

C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.

D. All pipe supports shall provide a means or vertical adjustment after erection.

E. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

3.2 INSTALLATION

Pipe support system shall be installed strictly in accordance with standards and codes referenced in paragraph 1.3 of this Section and piping support system manufacturer and piping manufacturer's recommendations.

In addition, all piping shall be rigidly support and anchored so that there is no movement or visible sagging between supports.

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. Those portions of pipe supports, which contact other dissimilar metals, shall be rubber or vinyl coated.

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 contract 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 and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Plans or specified in other sections.

*****END OF SECTION *****

SECTION 15100

VALVES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of valves and accessories as shown on the Plans, described in these Specifications, and as required to completely interconnect all equipment with piping for complete operable systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Payment
01300	Submittals
01800	Testing, Commissioning and Training
09900	Painting
Division 11	Equipment
Division 15	Mechanical

1.3 SUBMITTALS

Submit Catalog cuts and shop drawings in accordance with Section 01300 to demonstrate that the valves and appurtenances conform to the Specifications requirements.

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all valves.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall be by the manufacturer specified.

All materials in contact with potable water shall be NSF 61 and NSF 372 certified for potable water use.

See Section 15400 for Plumbing specifications and requirements.

PART 2 PRODUCTS

2.1 GATE VALVES

Gate valves 3 inches and smaller shall be bronze, non-rising stem, wedge disc, 125 pound service, Crane No. 438, Kennedy Figure 427, Victaulic, or equal.

Gate valves larger than 3 inches shall be iron body, bronze mounted, resilient seat, wedge disc, left opening, high-strength bronze stem, O-ring with a 2-inch-square operating nut and complying with AWWA C509 or C515. Gate valves shall be non-rising stem unless noted otherwise.

Above ground gate valves shall be provided with handwheels.

2.2 PLUG VALVES

Plug valves shall be non-lubricated eccentric plug type with port area exceeding 80 percent of full pipe area. The valve body shall be of ASTM A126, Class B cast iron. The plug shall be one piece construction of ASTM A536, 65-45-12 ductile iron or ASTM A126, Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with grease and/or petroleum-resistant neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240. All plug valves shall be furnished with a 1/8-inch overlay seat of not less than 90 percent pure nickel of minimum 200 Brinell hardness. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

Shaft bearings shall be sleeve-type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 stainless steel ASTM A743 Grade CF8M, or sintered oil impregnated bronze in 1/2- to 36-inch sizes. Non-metallic bearings shall not be acceptable. Shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. Valve pressure ratings shall be 175 psi through 12 inches and 150 psi for 14 inches and larger. Each valve shall be given a hydrostatic and seat test with test results being certified.

Valves shall be furnished with end connections as shown on the Drawings. Flanged valve shall be faced and drilled to the ANSI 125 standard. Mechanical joint end shall be to the AWWA C111, grooved end per AWWA C606. Screwed ends shall be to the NPT standard. Valves shall be DeZurick PEC Eccentric or equivalent equipment manufactured by Pratt, Victaulic, or Milliken, or equal.

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, handwheels, etc., as indicated on the Drawings. All valves and larger than 4 inches shall be equipped with gear-handwheel actuators. All gearing shall be enclosed in a cast iron housing.

Buried valves and valves with extension stems that are to be lever-actuated shall be DeZurick Fig. 118, F, 10, RS26, ANG, or equal with low-friction nitrile butadiene packing on 4 inch and smaller sizes. Buried valves, larger than 4 inches shall have enclosed gear operators.

The Contractor shall furnish chain actuated operators for all valves with geared operators or lever operators that are located 6 feet or higher from finished floor. Chainwheels shall be equipped with operating chain and chain guide to permit rapid handling of operating chain without "gagging" the wheel and reasonable side pull of the chain. Chains shall be furnished with permanently attached double-acting lever. Operating chains shall be of heavily cadmium plated pintle chain looped to extend to within 3 feet of finished floor.

2.3 BUTTERFLY VALVES

A. FLANGED OR MECHANICAL CONNECTION

Butterfly valves for air service shall be iron body and disc, Viton resilient seat, stainless steel shaft, bronze bearings, wafer body style, suitable for service in air to 350 degrees F. Air service butterfly valves shall be DeZurick, Pratt, or equal.

Butterfly valves for liquid service shall have iron body and disc, Buna N seats attached to the valve body, stainless steel shaft, corrosion resistant bearings, and flanged style body and shall comply with AWWA C504 and/or AWWA C606. Extension bonnets shall be sealed from liquid intrusion and shall encase the valve torque tube from the valve trunnion to the top-mounted geared handwheel actuator. The entire assembly shall be factory assembled and tested. Liquid service butterfly valves shall be DeZurik, Pratt 2FII, or equal.

Where butterfly valves are installed adjacent to check valves or other fittings, which interfere with the valve's full range operation, flange fillers, or other spacers, shall be installed between the valve and the obstructing fitting as necessary to ensure unrestricted operation of the butterfly valve from full open to closed.

2.4 CHECK VALVES

A. LIQUID SERVICE

Check valves for liquid service for piping less than 2 inches shall be swing check, bronze body, composition disc, 125 pound service, as manufactured by Watts, or equal.

Check valves for liquid service 2 inches and larger shall be swing check, outside lever with weight or spring, cast iron body and cover, stainless steel seats and shaft, and Buna-N gaskets/coverings. Valves shall be provided with fusion bonded epoxy coating and shall provide up to the full pipe flow opening. Valves shall be AWWA C508 compliant, suitable for 125 pound service, and shall be as manufactured by Millikin, Mueller, Victaulic, DeZurik, Val-Matic, or equal.

Where possible, check valves provided for the project shall be provided by the same manufacturer for uniformity.

B. AIR SERVICE

Check valves for air service, unless otherwise noted, shall be double disc style.

Double disc check valves shall be of the spring-loaded, wafer body style. The check valves shall have a cast iron body with stainless steel discs, springs, and pins. Seat shall be resilient and from Viton materials suitable for air service. The valves shall have a maximum cold working pressure rating of 150 psig. The disc of the check valves shall be easily removable and replaceable without the need of any special tools. Valves shall have a fusion bonded epoxy coating and suitable for Class 125 pound service. Valves shall be as manufactured by DeZurk, Milliken, Pratt, Mueller, Victaulic, Val-Matic, or equal.

2.5 COMBINATION AIR AND VACUUM VALVES

The combination air and vacuum release valve shall allow unrestricted venting or re-entry of air, through it, during filling or draining of the pipeline, to prevent water column separation or pipeline collapse during vacuum. The air-vacuum release valve shall incorporate one upper and one lower stainless steel float connected by a common stainless steel float guide, thereby maintaining an air gap between the bottom float and top shut-off float. The internal baffle shall be fitted with a guide bushing and act to protect the shut-off float from direct air flow. The baffle shall retain the 45 Durometer Buna-N seat in place, without distortion, for drip tight shut-off. All internals shall be easily removed through the top cover

without removing the main valve from the lines. Both floats shall withstand 1,000 psi or more. Valve shall be fitted with blow off valves, quick disconnect couplings and a minimum of 6 feet of hose, to permit back flushing after installation without dismantling the valve. The combination air-vacuum release valves shall be APCO Model Series 400 (Sewage), or equal, with a shut-off and outlet valve, unless otherwise noted on the Plans.

Air release valves on potable and non-potable water pipes shall be APCO Models 50 or 55, or equal. Each air valve shall be provided with an isolation valve for isolation on the inlet side. A vent pipe shall be routed from the valve to within 12 inches of the floor, unless otherwise noted on the Plans. Orifice shall be sized for maximum system pressure. Valve body shall have a minimum pressure rating of 150 psi. Pins, levers, retaining rings, float ball and internal screws shall be stainless steel.

2.6 PVC BALL VALVES

Ball valves shall be PVC Class 1245 4-B, conforming to ASTM D1784, true union type, threaded per ANSI B1.20.1, full port design, rated 150 psi, Nibco Chemtrol Tru-Block, Asahi/America, or equal.

2.7 PVC DIAPHRAGM VALVES

Diaphragm valves shall have PVC bodies, Teflon diaphragms and PVDGF gas barriers. Sizes 2 inch and smaller shall be provided with union ends with Teflon encapsulated Viton connector seals. Valves shall come standard with a position indicator and adjustable travel stop to prevent over-tightening. Diaphragm valves shall be ASAH 1/America Type 14 diaphragm valves, or approved equal.

2.8 BACKFLOW PREVENTERS

Backflow preventers shall be of the reduced pressure type, Febco, Watts, Beeco, or equal as approved by the State Health Department. Sizes to be as indicated on the Plans.

2.9 SOLENOID VALVES

Solenoid valves shall be two-way 1-1/2-inch size with 1-1/4-inch orifice. They shall be suitable for operating at pressures up to 125-psi differential pressure, and be rated up to 300 psi safe working pressure. All valves shall be normally closed, 120 VAC coil, rated continuous duty Class H, Molded Class A, UL approved. Valve shall be ASCO Model 8210, or equal.

2.10 YARD HYDRANT VALVES

Yard hydrant valves shall be non-freeze type, Zurn Z-1385 and Zurn Z-1390 post hydrants, or equal. Bury depths shall be as shown on the Plans. Hydrants shall be provided with 3/4-inch or 1-1/2-inch male hose thread connections and shall have bronze interior parts and seats. Hydrant to include a tapped 1/4-inch drain port in valve housing.

2.11 HYDROSTATIC PRESSURE RELIEF VALVES (PRV)

Unless otherwise noted, provide 4 inch minimum diameter groundwater pressure relief valves in concrete structure walls or slabs where indicated on the Plans. Products, which may be incorporated into the work, include, but are not limited to, Waterman, Troy, or Clow cast iron pressure relief valves with internal grate. Provide bronze and/or neoprene seats with PRV body and cover.

2.12 VALVE IDENTIFICATION TAGS

Each shut-off or control valve, shall be provided with a 1-1/2-inch minimum diameter heavy brass tag. Tags shall bear the identifying number of the valve and one or more identifying letter symbols of the service line.

Numbers and letters shall be block type with 1/2-inch-high numbers and 1/4-inch-high letters stamped on the tags and filled with black enamel.

Attach tags to the valves by split-key rings soldered so that the ring and tag cannot be removed.

Furnish a drawing and a neatly typed valve directory listing each valve number, type of valve and its location. Submit the directory and drawing to the Owner for approval.

2.13 VALVE BOXES

There shall be furnished and installed with all valves installed underground, two piece adjustable cast iron valve boxes with a minimum inside diameter of 5 inches. The valve boxes shall be set concentric with the axis of the stem and adjusted to the finish grade. Valve box lids shall be identified with a letter/number code and opening direction designation as shown on the Plans.

2.14 PRESSURE REGULATORS

Pressure regulators shall be sized and located as shown on the Plans and shall be diaphragm type with strainer with all working parts readily accessible without removing the regulator from the pipe line, Mueller H-9300, APCO, Clayton or equal.

2.15 VALVE INSULATION

All new above ground valves carrying liquids shall be insulated with 1-inch-thick fiberglass insulation and 0.16 of an inch anodized aluminum jacket; insulation by Owens-Corning, Certainteed, Johns-Manville or equal, unless otherwise noted.

PART 3 EXECUTION

3.1 GENERAL

All valves and accessories shall be installed in a manner and location as shown on the Plans or as required for the application and in accordance with manufacturer's instructions. Valve size is fully equal to line piping in which the valve is installed unless otherwise noted on the Plans. Support all valves where necessary. In case on conflict between these Specifications and a governing code, the more stringent standard shall prevail.

All valves of the same style or type shall be furnished by a single manufacturer.

Provide all accessories necessary for proper valve operation as specified or required for the application. Buried valves shall be installed with square operating nuts and adjustable cast iron valve boxes with covers. Valve boxes shall be set such that the slots in the boxes are in line with the run of pipe the valves are in. Provide two sets of T wrenches for buried valve operation.

Buried valves shall be provided with 1-inch solid steel extension stems with rock guards if the operating nut will be 18 inches or more below the ground surface.

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to insure that space is available for operation of lever or handwheel operated valves without interference to walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner suitable to the Engineer at the expense of the Contractor. Operations for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer.

For submerged valves, provide stem guides as recommended by the valve manufacturer on a spacing of 6'-0". As an alternate, provide valves with extended bonnets where practical. Provide supports for extended bonnets as required. Stem guides and supports shall be 316 stainless steel. All installation fasteners for submerged valves, guides, and supports (nuts, bolts and washers) shall be 316 stainless steel.

***** END OF SECTION *****

SECTION 15110

VALVE OPERATORS AND OPERATOR APPURTENANCES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of furnishing and installing valve operators and related valve operator appurtenances as shown on the Plans, described in these Specifications, and as required for complete operable systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning and Training
09900	Painting
Division 11	Equipment
Division 15	Mechanical
Division 16	Electrical

1.3 SUBMITTALS

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all operators.

1.4 QUALITY ASSURANCE

All valve operators on this project shall be furnished and installed in accordance with the applicable AWWA Standards except as otherwise noted herein.

1.5 PAYMENT

No separate or additional payment will be made for the work and materials specified herein. All costs for the valve operators and operator appurtenances, as specified herein, shall be included in the appropriate unit and lump sum bid items.

1.6 SUBMITTALS

Submittals shall be in accordance with Sections 01300 and 11000. In addition, the Design submittals shall include the following:

A. Manufacturer certification of Build America, Buy America Act (BABAA) compliance.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Manual valve operators shall be manufactured by the valve supplier.

2.2 MOTOR OPERATED VALVE ACTUATORS

A. EQUIPMENT LIST

Item	Equipment Number	Duty Type
Rotary Drum Screen Motor Operated Valve 1	01 MOV 01	Open/Close
Rotary Drum Screen Motor Operated Valve 2	01 MOV 02	Open/Close

B. ACCEPTABLE MANUFACTURERS

The motor operated valve actuators shall be model IQ or IQT as manufactured by Rotork Controls, or equivalent by AUMA or Limitorque.

C. GENERAL REQUIREMENTS

The electric motor operated valve actuators shall include a 120 Vac, 1-phase motor, reduction gearing, reversing contactor starter with local controls, turns and torque limitation with electronic logic and monitoring facilities all housed in a double-sealed water tight enclosure meeting the requirements of IEC IP68, suitable for submersion in water to a depth of 7 meters for 72 hours (NEMA 4 and 6). The electric operators shall include provisions to allow remote control via a dual channel Modbus/RTU 2 wire RS-485 fieldbus. The operators shall be supplied with one hand held remote setting tool for infrared operation to open and close the actuator.

The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator. In

order to maintain the integrity of the enclosure, setting of the torque level, position limits and configuration of the indication contacts, etc., shall be carried out without the removal of any actuator covers over an infrared interface. Sufficient commissioning tools shall be provided with the actuators and they must be weatherproof and intrinsically safe as standard. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage/authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.

The actuators shall include remote control capabilities for acceptance of open and close commands (dry contact inputs for each signal) and outputs (limit switches suitable for 2A, 120 Vac circuits) for indication of valve fully closed and fully open position as required for the duty type listed herein.

Actuators shall be recognized or listed and labeled by a recognized electrical testing laboratory or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

D. MOTOR

The motors shall be squirrel cage electric induction motors of special high torque, low inertia design, meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, B 30,000 anti-friction bearings, cast iron frame and end bells. The motors shall be 120 volts AC, 1-phase, 60 Hz power, continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor. The motors shall be protected against burnout by embedded thermostats, with facilities for bypassing under emergency shutdown control.

Protection shall be provided for the motor as follows: The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve. A thermostat to protect against overheating shall sense motor temperature.

E. TORQUE AND POSITION CONTROL

Torque and turns shall be adjustable a follows: Position setting range shall be 2.5 to 100,000 turns, with resolution of 15 degrees actuator output and torque setting shall be 40 to 100 percent rated torque.

Electronic latching shall be provided for the torque sensing system to inhibit torque off during unseating or during staring in mid-travel against high inertia loads. A "jammed valve" protection circuit shall de-energize the motor if no movement occurs after a few seconds from receipt of a signal to open or close.

When power to the actuator is isolated, all settings shall be retained in an EEPROM. In the event of manual operation of the valve during isolation or loss of the power supply a battery shall provide power to the internal position-monitoring transmitter to update the valve position data in the EEPROM. The battery shall also drive the LCD display, without back lighting, and the four latching contacts of the remote input/relay PCB while the power to the actuator is not available. Minimum battery life shall be seven years.

F. INTEGRAL CONTROL GEAR

The power module incorporates a mechanically and electrically interlocked reversing contactor starter, a control supply transformer fed from two phases of the incoming power supply and the Syncrophase circuit with single phasing protection. Local controls shall include two selectors, one for Local/Stop/Remote selection padlockable in each position and the other for Open/Close Control. The selectors shall give non-intrusive operation of internal reed switches.

Opto-isolator interfaces shall be provided for remote "positive switching" Open, Close, Stop, and ESD control signals, and Thermostat Bypass and Interlock functions. These shall be internally fed from the actuator 24V DC supply. Four latching contacts shall be provided, each independently configurable to signal one of the following:

Valve opening, closing, moving (continuous or pulsing signal), fully open, fully closed or intermediate positions, motor tripped on torque in mid travel, motor tripped on torque going open, or motor tripped on torque going closed, preset torque exceeded, motor stalled, battery low, actuator being operated by handwheel.

Each contact is selectable to either "normally open" or "normally closed" and rated 5A, 120 AC, 30V DC. The Emergency Shut Down (ESD) facility provides for a remote, active high signal to open or close the valve, which will override any local Open or Close signals and the motor thermostat if suitably selected.

The main PCB shall incorporate the gate array control for the actuator together with infrared receiver for external non-intrusive settings.

G. LOCAL POSITION INDICATION

A backlit liquid crystal display shall give digital indication from fully Open to full Closed in one percent increments. Three LED's colored red, green, and yellow for indication of open, close, and intermediate positions respectively shall also be provided.

H. MONITOR RELAY

A relay with a volt-free changeover contact for monitoring actuator electrical availability shall be provided. Contact rating shall be 5 A 120V AC, 30V DC.

I. WIRING

Wiring shall be jib built harnesses of individually numbered stranded conductors, tropical grade PVC insulated, connecting internal components to the sealed terminal block. The remainder of the internal wiring shall be color-coded ribbon cable.

J. TERMINALS

Terminals shall be separately sealed compartment containing segregated metric thread M5 power and M4 control terminals. Terminal screws and washers shall be supplied with the actuator. All internal control connections to the printed circuit boards shall be via plugs and sockets. The terminal box cover shall carry a terminal identification code card. An instruction handbook and wiring diagram shall be enclosed with each actuator.

K. MANUAL OPERATION

A hand wheel shall be provided for emergency operation and engaged when the motor is declutched by a lever or similar means; the drive being restored to power automatically by starting the motor. The hand/auto selection lever should be padlockable in both "Hand" and "Auto" positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in "Hand" without damage to the drive train.

The hand wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time. Clockwise operation of the hand wheel shall give closing movement of the valve unless otherwise specified.

L. STARTUP KIT

Each actuator shall be supplied with a startup kit comprising installation instruction, electrical wiring diagram, and sufficient spare cover screws and seals to make good any site losses during the commissioning period.

2.3 DATA PLATES

Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity, head rating, and other pertinent data in accordance with Section 11000 (2.9). Data plates shall not be painted.

2.4 PAINTING

Motor operators shall be painted in accordance with Section 09900 (2.2.C) of these Specifications.

2.5 VALVE BOXES

There shall be furnished and installed with all valves installed underground, 2-piece adjustable cast iron valve boxes with a minimum inside diameter of 5 inches. The valve boxes shall be set concentric with the axis of the stem and adjusted to the finish grade. Valve box lids shall be identified with a letter/number code and opening direction designation as shown on the Drawings.

PART 3 EXECUTION

All valve operators and accessories shall be installed in a manner and location as shown on the Drawings or as required for the application and in accordance with manufacturer's instructions.

***** END OF SECTION *****

SECTION 15120

GATES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the stop gates and flap gates as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
01800	Testing, Commissioning and Training
11000	General Equipment Requirements

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Aeration Basin Inlet Stop Gate	02 STG 01
Aeration Basin Bypass 1 Stop Gate	02 STG 02
Aeration Basin Bypass 2 Stop Gate	02 STG 03
Membrane Basin 1 Inlet Stop Gate	02 STG 04
Membrane Basin 2 Inlet Stop Gate	02 STG 05
Membrane Basin 1 Exit Stop Gate	02 STG 06
Membrane Basin 2 Exist Stop Gate	02 STG 07
Influent Lift Station Inlet Flap Gate	02 FG 01
Drain Flap Gate	01 FG 02

1.4 SUBMITTALS

The Contractor shall submit certified shop and erection drawings, produce information and calculations in accordance with Section 01300 verifying that the product provided meets the requirements set forth in the Specifications. Submittals shall include a manufacturer certification of Build America, Buy America Act (BABAA) compliance for pumps and all ancillary components.

1.5 QUALITY ASSURANCE

The gates, operators, operating stems, and appurtenances specified under this section shall be furnished by a single manufacturer who has been building said equipment for a minimum of 10 years.

The gate assemblies, including stems, stem guides, and manual operators shall be a standard product of the gate supplier and shall be manufactured and assembled at the gate suppliers manufacturing facility.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. STOP GATES

The stop gates shall be manufactured by Plasti-Fab, or equal.

B. FLAP GATE

The flap gates shall be manufactured by Rodney Hunt, Hydro Gate, Waterman, Golden Harvest or equal.

2.2 STOP GATES

Stop gates shall be as shown on the Plans and shall be individually molded from green fiberglass reinforced polyester to the dimensions shown on the Plans. Both sides of the stop gates shall be faced with a 10-mil layer of C-Veil and finished smooth with a layer of ultraviolet inhibited resin. Deflection shall not exceed more than 1/360 of the plate width at maximum operating hydraulic head. The gates shall be laminated with a sandwiched center core having a high density polyurethane closed cell foam, as shown on the Plans. The stop gates shall be manufactured in accordance with the applicable portions of NBS 15-69 and ASTM C582 and inspected in accordance with ASTM D2563. The stop gates shall be equipped with hand lifts, fabricated from cast aluminum Alloy 356-T6.

The stop gates shall be installed in fiberglass guide channels, as described on the Plans.

2.3 FLAP GATES

A. GENERAL

Flap gates shall open automatically with a small differential pressure on the back of the gate. Differential pressure on the front of the gate (seating head) shall close the valve. The flap gate shall be designed for no less than the seating head conditions shown on the Plans.

B. SEATS

Bronze seats, ASTM B21-CA464, machined to 63 micro-inch finish, or better.

C. COVER AND FRAME

Cast Iron, ASTM A126, Class B. Provide lifting eye in cover suitable for manually opening the valve.

D. HINGE ARMS

The gate shall have two hinge arms, each with two pivot points. Lower pivot point shall be adjustable. Provide factory installed, permanently lubricated, bronze bushings. Stainless steel hinge pins.

PART 3 EXECUTION

The manufacturer shall provide instructions. The installation and adjustment of gates, operators, and all accessories shall be in full accordance with these instructions.

***** END OF SECTION *****

SECTION 15400

PLUMBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of plumbing to include interior water systems, drain and waste systems, and fixtures and trim as shown on the Plans and specified herein.

All permits shall be obtained in accordance with Section 01160 of these Specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
15050	Piping Systems

1.3 REFERENCES

ASTM B62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	Specification for Seamless Copper Water Tube
ASTM B371	Specification for Copper-Zinc Silicon Alloy Rod

1.4 MANUFACTURERS

Use products of a single manufacturer where two or more units of the same class of equipment are required.

1.5 QUALITY ASSURANCE

All plumbing shall be performed in accordance with the current edition of the Uniform Plumbing Code. The Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as part of this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

Material shall be delivered to the project site in its original unopened containers with labels informing manufacturer and product name. Material shall be stored and handled in compliance with manufacturer's recommendation to prevent damage.

1.7 NAMEPLATES

Provide major components of equipment with manufacturer's name, address, catalog number, capacity, and equipment designation securely affixed in a conspicuous place.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS - WATER SYSTEM

A. BURIED PIPE

1. Pipe

   a. Type "K" copper, ASTM B88, silver solder.

   b. Type "B" crosslinked polyethylene (PEX) tubing, ASTM F876.

2. Fittings

   a. Wrought copper; ANSI B16.22, silver solder.

   b. Forged Brass, ASTM F1807, crimp connection method.

B. ABOVE GROUND PIPING

1. Pipe

   a. Type "K" copper, ASTM B88, silver solder.

2. Fittings

   a. Wrought copper; ANSI B16.22, silver solder.

2.2 PIPE AND FITTINGS - DRAIN AND WASTE SYSTEM

A. BELOW GROUND PIPING

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM A888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

B. ABOVE GROUND PIPING

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM A888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

C. FITTINGS

All fittings and pipe joints shall be hubless, conforming to the requirements of the latest issue of CISPI Standard #301.

D. COUPLINGS

Hubless coupling gaskets shall be the heavy-duty type with dual stainless steel pipe clamps on each side, and shall conform to ASTM C1540, as manufactured by Anaco, Tyler or equal.

2.3 VALVES

A. GATE VALVES

Gate valves 3 inches and smaller shall be bronze, non-rising stem, wedge disc, 125 pound service, Crane No. 438or equal.

Gate valves larger than 3 inches shall be iron body, bronze mounted, resilient seat, wedge disc, left opening, high-strength bronze stem, O-ring complying with AWWA Standard C509. Gate valves shall be non-rising stem unless noted otherwise.

Above ground gate valves shall be provided with hand wheels. Buried valves shall have 2-inch square operating nuts.

Solder end valves may be used where copper tubing is used.

B. RELIEF VALVES (ASME - UFPVC)

Bronze ASTM B62 with bottom inlet, side outlet spring-loaded top guided type with 10-percent overpressure and reset. Setting at lesser of 10-percent or 25 psig over operating pressure or as required by code for specific application. Threaded inlet. B&G, Farris, Consolidated, Lonergan, Watts.

C. BALL VALVES

Ball valves 2 inches and smaller shall be bronze, full port, two-piece, lever handle, 200-pound service, meeting standard MSS SP-110, Apollo Series 77-100, or equal.

2.4 FLOOR DRAINS

A. GENERAL

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Floor Drain – FD – 2320, galvanized with a nickel bronze top.

2. Funnel Floor Drain – FFD – 3610, galvanized with a nickel bronze top and 6-inch-diameter funnel.

2.5 CLEANOUTS

A. GENERAL

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Grade Cleanout - GCO - 4283 - brass tapered thread plug.

2. Floor Cleanout - FCO - 4023 - brass tapered thread plug.

2.6 FLASHING AND COUNTER FLASHING

A. REQUIREMENTS

3-lb. lead soldered joints and seams, 24" x 24" base pad and counterflashed into pipe.

2.7 PIPING SPECIALTIES

A. STRAINERS

0.045 of an inch perforated 304 stainless steel screen, Armstrong A1SC or equal by Yarway, Sarco.

B. UNIONS

2 inches and smaller; ground joint, malleable iron type. Crane, Walworth, Syspac.

C. INSULATING UNION

Epco, Capitol.

D. ACCESS PANELS

Milcor, Type "DW" with screwdriver operated lock. Stainless steel access panels in tile walls.

E. ESCUTCHEON

Grinnell Fig. 2 or 13, nickel plated.

F. PIPE MARKING

See Section 15050.

2.8 FIXTURES AND TRIM

A. SHOWER COMPARTMENT AND FIXTURES

Furnish and install shower stalls as shown on the Plans. Shower stalls shall be one-piece wheelchair accessible, designed for handicapped use. Shower stalls shall be Florestone Products Co. Model 42-3W, or equal. Unit to be manufactured of gel coated fiberglass, with galvanized steel stiffeners laminated into each wall. Unit to be supplied with heavy-duty hand held shower head, chrome-plated hose, valve, slide wall bar, stainless steel grab, slip-restraint floor, curtain rod, and left hand folding white naugahyde wheelchair transfer seat. Removable type stainless steel strainer plate shall be supplied. Contractor to provide shower curtain.

B. WATER CLOSET AND FIXTURES

Furnish and install toilet as shown on the Plans. The toilet shall be Vitreous China with an 18-inch rim height and shall be complete with water service fixtures, toilet seat, etc. The toilet shall be American Standard Products Elongated Water-Saver Cadet Toilet, Model No. 2467.016, or equal.

C. LAVATORY AND FIXTURES

A lavatory with fixtures shall be provided for installation as shown on the Plans. The lavatory shall meet the American Disabilities Act guidelines and ANSI 117.1 requirements for people with disabilities.

The lavatory unit shall be Vitreous China, with front overflow and nominal dimensions of 21" W x 18" L. The lavatory shall be American Standard, Aqualyn Countertop Sink, Model No. 0475.028, or equal.

The lavatory fixtures shall include aquaseal valves with renewable seats, 4-inch centers and 4-inch brass wrist handles; an aerator with 2-1/2-gpm flow restrictor; and a pop-up drain with a 1-1/4-inch tailpiece. The fixtures shall be American Standard, Heritage Centerset Faucet, Model No. 7075.205, or equal.

D. ONE BASIN SINKS

At epoxy resin sinks, furnish and install hot and cold water, deck-mounted chrome plated faucet with swing gooseneck spout and atmospheric vacuum breaker. Outlet shall have removable, serrated, full-flow laboratory nozzle and handles shall be 4-inch wristblade handles. Faucet shall be Chicago Faucets No. LWM10-A13-E, or equal. Sinks shall be complete with drain fitting, p-trap, and waste arm.

E. STORAGE WATER HEATERS

Storage water heaters shall be electric tank style water heater. Storage water heaters construction shall be steel with baked enamel finished exterior. All internal surfaces of the heater exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing. Electric heating elements shall be low watt density. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused. Electrical junction box with heavy duty terminal block shall be provided. Tanks shall include drain valve shall be located in the front for ease of servicing. Heater tanks shall include a three year limited warranty.

Storage water heaters shall have a water capacity and electrical requirements per the Water Heater Schedule. Storage water heaters shall be A.O. Smith DRE series, or equal.

Storage water heaters shall be provided with all code-required accessories such as insulating base-pads, expansion tanks equal to Amtrol ST-25V, and pressure/temperature relief valves.

F. FREEZE PROTECTED EMERGENCY SHOWER AND EYE/FACE WASH

The freeze protected emergency shower and eye/face wash station shall be vertically mounted and shall be located as shown on the Plans.

The unit shall be capable of maintaining a flow rate of 20 gpm at 30 psi at the showerhead, 3.7 gpm at the eye/face wash, and comply with ANSI Z358.1.

Freeze protected combination shower and eye/face wash shall be constructed with galvanized pipe and fittings, brass valves, ABS plastic showerhead with stay-open ball valve, eye/face wash assembly with integral flow controls and dust cover, and an automatic thermal actuator freeze protection bleed valve. Unit shall include thermostatically controlled electric heat traced cable protected by 3/4" insulation and an ABS plastic jacket that prevents freezing down to ambient temperatures of -30 °F. Unit shall also include cast-iron floor flange, universal sign, and 1-1/4" NPT supply. Combination shower and eye/face wash shall be Haws Model 8317CTFP, or equal.

2.9 TRAP PRIMER SYSTEM

Trap primers shall be an electronic system employing a solenoid valve, an atmospheric vacuum breaker, an electronic controller, and a water distribution manifold. The controller shall include an adjustable timer and override/test switch. Distribution manifold shall be able to supply up to 30 traps and be calibrated to evenly distribute water to each trap primer line. The system shall operate on 120 VAC, single phase, 60 Hz power supply. Trap primer systems shall be Precision Plumbing Products PTS series, or equal.

PART 3 EXECUTION

3.1 PIPE AND PIPE FITTINGS – WATER SYSTEM

A. BURIED WATER PIPE

Install with not less than 1 foot of cover, measured from top of pipe to approved finish floor. Install pipe in accordance with the manufacturer's recommendations. Construct water lines under other utilities where necessary to meet the minimum cover requirements.

B. PIPES

Remove burrs by reaming. Use Teflon tape on male threads only.

C. OPENINGS IN PIPES

Keep closed during progress of work.

D. COORDINATION

Install so as not to interfere with light fixtures or other trade components.

E. CLOSE NIPPLES

Not permitted on any part of work. Use standard short nipples for short pipe connections. Use of bushings not permitted.

F. PIPING OF COPPER TUBING

Continuous. Copper tubing inserts in runs of steel pipe not permitted. Solder joints in copper piping. Do not lay copper tubing on rocks or gravel.

G. CONNECTIONS BETWEEN PIPES OF DISSIMILAR METALS

Make with insulating union (Dielectric). Include cast iron valve connections to adapters for copper pipe.

H. CUTTING OF COPPER PIPE

Use a cutter. Smooth sharp edges with emery cloth.

I. SADDLES ON PIPE IN LIEU OF TEES AND BENDING PIPE

Not permitted.

J. EQUIPMENT ISOLATION

Provide isolation valves (gate or ball valve) and unions at piping connections to all equipment.

K. CONCEALED PIPING

Conceal all piping in finished areas unless otherwise noted.

3.2 PIPE AND PIPE FITTINGS - DRAIN AND WASTE SYSTEM

A. BURIED DRAIN PIPE

Install with not less than 1 foot of cover, measured from top of pipe to approved finish floor. Install pipe in accordance with the manufacturer's recommendations. Construct drain lines under other utilities where necessary to meet the minimum cover requirements.

B. HORIZONTAL SOIL AND WASTE PIPE GRADING

Provide a grade of 1/4 inch per foot where possible, but in no case less than 1/8 of an inch per foot. Install main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

C. PIPES

Remove burrs by reaming. Use Teflon tape on male threads only.

D. OPENINGS IN PIPES

Keep closed during progress of work.

E. COORDINATION

Install so as not to interfere with light fixtures or other trade components.

F. CONCEALED PIPING

Conceal all piping in finished areas unless otherwise noted.

3.3 VALVES

A. RELIEF VALVES

Install at all points required by code and where required for protection of equipment and piping. Set pressure shall be as indicated or directed. Pipe discharge to nearest floor drain where pressure cannot exceed 30 psig or to safe acceptable terminus.

B. PRESSURE REDUCING VALVE ASSEMBLY

Install with a strainer on inlet side and relief valve on low pressure side. Make connections to pressure reducing valve through a gate valve and a union on each side and a full-size globe valve bypass around reducing valve. Install valves so that they are easily accessible for maintenance and removal. Provide pressure gauges on both high and low pressure sides.

C. AIR GAPS

Distance between inlet pipe and flood level rim twice the diameter of supply pipe.

D. VACUUM BREAKERS

Use atmospheric type where vacuum breaker is not upstream of shut-off. Install 12 inches above highest downstream pipe elevation. Use pressure type otherwise. Provide for lawn sprinkling, hose bibs, and faucets with hose end connections.

E. BALL AND BUTTERFLY VALVES

May be used in lieu of gate valves on all services except steam systems.

3.4 CLEANOUTS

Provide every 50 feet and install at all locations required by code and to permit cleaning of all sewer piping. Provide cleanouts full size of pipe, but not larger than 4 inches. Close cleanout openings with brass screw plugs. Where cleanouts occur in floor, install a brass ferrule complete with a screwed brass cover, flush with floor. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and make them easily accessible.

3.5 VENTS

A. FLASH AND COUNTERFLASH

Install vents passing through roof with roof flashing and counterflashing assemblies.

3.6 AIR CHAMBERS

Provide at each water connection to a plumbing fixture, same size as connection. Minimum length 16 inches, except 24-inches length at flush valves.

3.7 PIPING SPECIALTIES

A. GAUGES

Mount so gauges can be easily read from the floor. Provide ball valves to isolate pressure gauges. Cocks or petcocks are not acceptable.

B. THERMOMETERS

Mount to be easily read from the floor. Provide swivel at neck.

C. UNIONS

Install at final connections to all equipment items and on control side of all valves in mains, branches and risers.

D. ESCUTCHEONS

Install at all places where exposed piping passes through walls, floors or ceilings.

E. ACCESS PANELS

When not specifically shown on the Plans, provide in walls, ceilings, etc., to provide adequate access for service and maintenance of concealed valves, dampers, motors, air vents or any other concealed equipment or accessories. Minimum size 12" x 12".

F. TRAP PRIMERS

Install automatic trap primers at all locations as shown on the Plans.

G. EQUIPMENT, VALVES, AND PIPING

Tag for identification, indicating equipment, zone and area served. Provide nameplates for access doors and removable ceiling panels to areas containing mechanical equipment, valves, etc. Submit to Engineer for approval proposed list of nameplates. Run all drips and drains for pumps, pans, reliefs, etc., to the drain. Discharge onto floor not permitted.

H. GALVANIZED IRON SLEEVES

Not less than 20 gauge, cast in concrete, and installed wherever piping passes through floors, footings or walls of concrete or masonry construction. Sleeves for insulated pipe shall be of sufficient size to allow the covering to pass through sleeve. Use steel pipe extended 1 inch above finished floor for sleeves in floors of rooms exposed to water. Watch and protect all sleeves and inserts while concrete is poured. For penetration of floors and walls from buried pipe, caulk annular space between pipe and sleeve with first quality oakum and fill with pitch.

I. EXPOSED PIPING, VALVES, HANGERS, ETC., AT FIXTURE

Chromium-plated finish.

J. SINK SIZE

Coordinate and verify each sink size with cabinet manufacturer prior to ordering.

K. ROUGH-IN AND CONNECTION FOR FIXTURES AND EQUIPMENT

Connect fixtures and equipment furnished and installed by General Contractor, Owner, or others. It is the Contractor's responsibility to obtain from supplier sufficient information to rough-in properly and connect all fixtures in accordance with manufacturer's recommendation. Furnish all traps, valves tailpieces and other trim not furnished with equipment.

L. SHUT-OFF VALVES

Provide shut-off valves on all water lines to fixture groups.

M. LOCATION OF FIXTURES

Locate in accordance with details and dimensions on Plans.

N. INSTALLATION OF FIXTURES AND EQUIPMENT

Support and fasten wall hung fixtures with concealed floor support type carriers. Align fixtures and equipment installed in batteries in accord with architectural drawings. Fit fixtures on finished walls without noticeable warpage on either the wall or fixture and grout with G.E. silicone or similar approved material.

O. VACUUM BREAKERS

Locate and install on water supply to all fixtures which have water connection located below rim. Install on all hose bibs.

P. WATER CONNECTION STOPS

Install individual loose key stops on all fixtures. If water connections are concealed, install valves in lieu of stops.

3.8 MECHANICAL SUPPORTING DEVICES

A. GENERAL

Mechanical equipment and materials are not to be suspended or supported from pipe, electrical conduit, ceiling systems or any non-structural member.

B. CONCRETE ANCHORING

Use cast inserts in new construction; stamped metal inserts not acceptable. Expansion shells may be used in existing construction; powder actuated inserts are not acceptable.

C. PIPE HANGERS AND SUPPORTS

Item selections, hanger spacings, rod diameters, and protection shields in accord with MSS SP-69 and MSS SP-58, unless otherwise indicated. Pipes shall not be hung or supported from each other. Isolate copper water pipes from dissimilar metals, hangers, steel or aluminum studs, etc.

D. STRUCTURAL ATTACHMENTS

Beam clamps where possible.

E. VERTICAL ADJUSTING DEVICES

Provide on all rigid hangers.

F. PROTECTION SHIELD/PROTECTION SADDLE

Use on insulated pipe.

3.9 EXISTING UTILITIES

Locate well enough in advance of the excavation to prevent damage during construction. The Contractor is responsible for any damage whatsoever resulting from his operations on the project.

3.10 CONTAMINATION

Prevent contamination of the pipeline during construction from any operation or source.

3.11 HOT WATER

Generate at 120 degrees F unless indicated otherwise on the Plans.

3.12 SYSTEM DRAINING

Grade domestic water piping so that it can be drained from low points. Provide a valved drain run to nearest floor drain or approved terminus.

3.13 HEAD PROTECTION

Where duct angles, pipe hangers, equipment support angles, etc., are exposed in walkways or in access ways to equipment for maintenance purposes, cover all such potentially injurious protrusions less than 6'-8" above the floor with padding. Secure padding permanently and finish comparable to adjacent surfaces.

3.14 WELDING

A. QUALITY CONTROL

Procedures in accordance with ANSI B31.1.

B. PROCEDURES

Use butt weld joints. Mechanically bevel pipe ends.

C. ELECTRODES

Store in dry heated area. Do not use moist or damp electrodes.

3.15 TESTING AND STERILIZATION

A. WATER SYSTEM (POTABLE AND NON-POTABLE)

Clean piping prior to testing by thoroughly flushing with water until all dirt and foreign materials have been removed. Maintain flushing operations for not less than 1 hour and until piping is clean. Not less than 80-psi flushing pressure.

Conduct for a period of not less than 8 hours at 150-percent operating pressure, 125 psig minimum.

Potable water piping shall be sterilized with calcium hypochlorite at 50 mg/L chlorine for 24 hours prior to line acceptance. Contractor shall furnish hypochlorite. The cost of disposal of water used for sterilization shall be borne by the Contractor.

B. DRAIN AND WASTE SYSTEM

Subject all work to hydrostatic test of 10-feet head of water or as directed by local plumbing inspection authority. Obtain approval for all work or portions of work as tested, in writing, prior to covering or concealment in any manner. Notify Engineer at least two normal working days prior to testing any portion of work and do not conceal any work until so directed by the Engineer.

3.16 INSPECTION

It shall be the Contractor's responsibility to contact the Owner and arrange for final inspection.

***** END OF SECTION *****

SECTION 15440

SUBMERSIBLE SUMP PUMPS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing submersible sump pumps as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01200	Measurement and Payment
01300	Submittals
09900	Painting
11000	General Requirements for Equipment
11010	Vibration and Critical Speed Limitations
Division 15	Mechanical
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item	Equipment Number
Valve Vault Sump Pump 1	02 SP 01
Valve Vault Sump Pump 2	02 SP 02

1.4 PERFORMANCE REQUIREMENTS

Submersible sump pumps shall be capable of meeting the following performance requirements without overloading the rated nameplate horsepower of the motor.

Parameter	Value
Design capacity (gpm)	25
Design head (feet)	48
Maximum, shut-off head (feet)	55
Maximum motor size (hp)	0.5

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The submersible sump pumps shall be Zoeller Model X4161, equivalent model by Barnes, or approved equal.

2.2 PUMPS

The pump shall have heavy duty cast iron multi-vane, non-clog, vortex impellers. The shaft shall be 416 stainless steel and sealed from the pumped liquid with a carbon and ceramic mechanical seal. Pump shall be equipped with upper and lower ball bearings.

The pumps shall be an automatic model featuring integral control and starter. Level control shall be integral to the pump using an integral external float mechanism. A control panel shall not be required for starting, thermal overload or level control functions on automatic single-phase models.

Pump housing shall be Class 30 cast iron, with stainless steel bolts, and stainless steel or brass hardware.

2.3 MOTORS

The motor shall be a standard horizontal, TENV electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. The motors shall be coordinated with the thermal, electrical, and mechanical characteristics supplied in accordance with Division 16, Electrical. The motors shall be listed as suitable for Class I, Division 2, Group D applications.

The motor windings shall be provided with three (total) thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120 volt AC and 24 volt AC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) table 14-4B, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

The units shall be supplied with motors capable of meeting the design conditions specified herein at a maximum operating frequency of 60 Hz.

Motors shall be manufactured by U.S. Motors, Baldor, Reliance, or Toshiba/Houston. No other motor manufacturers shall be accepted.

2.4 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This list shall also include any additional information needed to setup, program or adjust the variable frequency drive which serves motor driven equipment such as minimum speed, acceleration, etc. The list shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the motor information for the submitted equipment

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.5 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.6 PAINTING

Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

3.2 INSTALLATION

The pump(s) shall be installed as shown on the Plans and in accordance with manufacturer recommendations.

***** END OF SECTION *****

SECTION 15700

HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of the heating, ventilation, and air conditioning equipment and other associated items as shown on the Plans, and as further specified herein.

All permits shall be obtained in accordance with Section 01160.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	Item
01300	Submittals
Division 16	Electrical

1.3 QUALITY ASSURANCE

Submittals shall be in accordance with Section 01300.

All equipment supplied in this Section shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on shop drawing submittal for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work to ensure connecting and disconnecting accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor whenever possible. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as approved by the Owner.

The manufacturer's recommendations and instructions of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.4 PROJECT MEETINGS

Attend a minimum of two site meetings, each up to 2 hours in duration. The first site meeting will be held after 95 percent of the HVAC equipment and controls have been installed. Any required training should be scheduled and performed at this first site meeting. A follow up site meeting shall be scheduled 6 months after the complete installation of the HVAC and controls to ensure proper operation. Any additional training required should be scheduled and performed at the follow up site meeting.

1.5 EQUIPMENT LIST

Refer to Heating, Ventilation and Air Conditioning Schedules shown on the Plans.

1.6 SUBMITTALS

Submit manufacturer product data on HVAC equipment, as listed in this Section, under the provisions of Section 01300.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Equipment manufacturers and model numbers shall be as shown on the Plans except where indicated herein.

2.2 LOUVERS

Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. Certified performance data shall include airflow pressure loss and water penetration.

A. DRAINABLE BLADE

Louvers shall be stationary type with drainable blades in a 6-inch louver frame. Each stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill. The louver construction shall consist of a frame and blades from aluminum extrusions of minimum 0.081-inch nominal wall thickness. The blades shall be positioned at 37 degree angles. Each louver shall be equipped with a framed, removable, 0.051 x 3/4 flattened aluminum rear-mounted bird screen or 16 x 18 mesh aluminum insect screen. Louvers shall be supplied

with a Kynar finish which meets AAMA 2605. Each factory-assembled louver section shall be designed to withstand wind loadings of 25 psf. Drainable blade louvers shall be Greenheck ESD series, or equal.

B. BRICK VENTS

Provide and install brick vents as shown on the Plans. Brick vents shall be of heavy gauge aluminum construction, and be 4 inches in depth. The vents shall have water stops and deep overlapping blades, each with integral storm drip, and shall be complete with 18 x 14 mesh aluminum insect screen set behind louvers in extruded stop on frame. Brick vents shall be Greenheck BVE series, or equal.

C. COLOR SELECTION

Louver color to be selected by Owner from the manufacturer's standard palette of at least 24 colors.

D. GRAVITY BACKDRAFT DAMPERS

Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

Gravity backdraft dampers shall be suitable for pressures up to 1-inch w.g., velocities to 2,500 ft/min and temperatures to 180 degrees F. Gravity-operated back draft dampers shall rotate to the fully open position in the direction of the airflow when subjected to a differential pressure of 0.2 of an inch w.g. or less. Gravity damper construction shall consist of minimum 18-gauge galvanized steel frame with 2.5-inch to 3.5-inch depth; aluminum blades; 304 stainless steel axles turning in synthetic bearings. The damper shall be equipped with extruded vinyl blade seals, and internal aluminum tie bar with spring assist. Finish shall be mill galvanized unless otherwise shown on equipment schedule. Gravity backdraft dampers shall be Greenheck WD series, or equal.

2.3 FANS

Fans shall be bear the AMCA Certified Ratings Seal for both sound and air performance and be UL tested and approved.

A. RESTROOM CEILING EXHAUST FANS/LIGHTS

Ceiling Fans/Lights shall be ceiling mount with multi-speed control (0, 30-100 CFM) that shall be built-in with a high/low adjustable delay timer and

activated by a wall switch. Select from 50/80/110 CFM. The motor shall be enclosed with brushless ECM motor engineered to run continuously. ECM motor speed shall automatically increase when the fan senses static pressure to maintain selected CFM. A High/Low delay timer shall return the fan to the preset CFM after a definable period of time. Power rating shall be 120v/60Hz. Duct diameter shall 4" or 6". Fan shall be UL and cUL listed. Lamps shall be of the LED panel type utilizing no less than one 10 watt LED lamp. Ceiling exhaust fans shall be Panasonic FV series, or equal.

B. INLINE DIRECT DRIVE FANS

Inline direct drive fans shall be of the centrifugal, direct drive inline type. The fan, fan housing, and accessories described below and in the Plans shall be one unit supplied by the same manufacturer. The housing shall be of square design constructed of heavy-gauge aluminum and include square duct mounting collars. Fan construction shall include two removable access panels. The fan wheel shall be centrifugal backward inclined, constructed of aluminum. The wheel shall be statically and dynamically balanced. Motor shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20 percent of full speed (80 percent turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Fan motor shall be of the high-efficiency type running at a minimum of 85 percent efficient at all speeds. Motors shall be heavy-duty ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure as indicated on the Fan Schedules. Motor and drives shall be readily accessible for maintenance. The accessories, controls, and finish shall be as indicated on the Fan Schedule. Inline direct drive fans shall be Greenheck SQ series, or equal.

2.4 ELECTRIC HEATERS

Heaters shall be UL Listed, CSA Certified and meet requirements of the National Electrical Code.

A. UNIT HEATERS

Heaters shall be horizontal or vertical mount type. Heater housing shall be constructed of heavy gauge steel. Heaters shall be fan-forced air unit with aluminum finned, copper clad heating elements. The fan shall be completely enclosed and dynamically balanced. The unit shall be

complete with pivotal wall or ceiling mounting kit as specified on Plans, control transformer, automatic reset thermal overheat protector, adjustable louvered outlet grille and enamel finished steel housing; all shall be one unit supplied by the same manufacturer. Unit heaters shall be Qmark MUH series, or equal.

B. WALL MOUNTED HEATERS

Provide and install fan forced electric wall mounted electric heaters. Heater shall be designed for wall recessed or surface mounting. Construction shall be galvanized steel housing with steel grille. The heating elements shall be resistance wire enclosed in a steel sheath with steel plate fins. Heater shall include thermal cutout switch and built-in thermostat. Wall mounted heaters shall be QMark AWH series, or equal.

2.5 DUCTLESS SPLIT SYSTEMS

Ductless split systems shall AHRI certified. Unit shall be constructed in accordance with UL standards and be UL listed. Unit efficiency shall meet or exceed those listed in the latest edition of the Washington State Energy Code.

A. VRF OUTDOOR UNITS

1. General

The system shall be a split system, heat pump with variable-speed inverter compressor technology. The system shall consist of a horizontal discharge, single-phase outdoor unit, a matched capacity indoor unit that shall be equipped with a wired wall-mounted controller. The system shall use R454B refrigerant. The outdoor unit shall be compatible with the indoor unit. The connected indoor unit shall be of the same capacity as the outdoor unit. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0 degrees F ambient temperature without additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units. System shall operate at up to a maximum refrigerant tubing length of 100 feet between indoor and outdoor units without the need for line size changes, traps, or additional oil. The unit shall be precharged for a maximum of 100 feet of refrigerant tubing. The outdoor unit shall be completely factory assembled, piped, and wired. The

outdoor unit sound level shall not exceed 52 dBA in cooling and 53 dBA in heating.

2. Cabinet

The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford a reliable equipment mount and stability. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

3. Fan

The unit shall be furnished with DC fan motors. The fan blades shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

4. Coil

The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be regulated by means of an electronically controlled, precision, linear expansion valve. All refrigerant connections between outdoor and indoor units shall be flare type.

5. Compressor

The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual-rotary type. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load. The compressor will be equipped with internal thermal overload protection. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. The outdoor unit shall have an accumulator and high-pressure

safety switch. The compressor shall be mounted to avoid the transmission of vibration.

6. Electrical

The electrical power of the unit shall be 208/230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. Power for the indoor unit shall be supplied from the outdoor unit. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

B. WALL-MOUNTED INDOOR UNITS

The system shall consist of a wall-mounted indoor section with wired, wall-mounted controller and a horizontal discharge, single-phase outdoor unit. The indoor unit shall factory assembled, wired, and tested. Contained within the unit shall be all factory wiring and internal piping, drain left mechanism, control circuit board, fan, and fan motor. The unit, in conjunction with the wired, wall-mounted controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.

1. Unit Cabinet

The indoor unit cabinet shall be wall mounted by means of a factory-supplied mounting plate. The cabinet shall be formed from high-strength molded plastic with front panel access for filter.

2. Fan

The evaporator fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall a minimum of five speed settings, low, medium 1, medium 2, high, and auto. The auto fan setting shall adjust the fan speed based on the difference between controller set point and space temperature.

3. Vane

A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). An integral, motorized, multi-position, horizontal air sweep vane shall be provided for uniform air distribution, up and down. Vane shall have 5 selectable positions plus auto, to control position based upon mode where the microprocessor shall automatically determine the vane angle to provide the optimum room temperature distribution, and swing to continuously move up and down. In off mode the horizontal vane shall return to the closed position.

4. Filter

Return air shall be filtered by means of an easily removable, long-life, washable filter.

5. Coil

The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner groves for high efficiency heat exchange. The coils shall be pressure tested at the factory, and all tube joints shall be brazed with silver alloy. A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan. The lift mechanism shall be equipped with a positive-acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reaches maximum level. Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.

6. Electrical

The indoor unit shall be provided with a system allowing the indoor unit to be powered and controlled directly from the outdoor unit providing primary power and integrated by directional, digital control signal without additional connections. The indoor unit shall not have any supplemental electrical heating elements.

7. System Control

The control system shall consist of a minimum of two microprocessors, one on each indoor and outdoor unit, interconnected by a single nonpolar two-wire cable. Field wiring shall run directly from the indoor unit to the wall-mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

The indoor unit shall be connected to a wall-mounted wired controller to perform input functions necessary to operate the system. 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 wired controller, providing emergency operation, and controlling the outdoor unit.

8. Unit Cabinet

The cabinet shall be space saving, low profile, horizontal, ducted type. The cabinet shall be configured for horizontal supply and return air connections. Bottom return air connection shall be achievable with a manufacturer supplied accessory. Formed cabinet shall be constructed of galvanized steel with applied insulation to prevent condensation on outer surfaces. The cabinet shall be provided with four mounting brackets to accommodate suspension from threaded rod or structural support located on the side panels in all four corners. Brackets shall be suitable for supporting the weight of the indoor unit. The indoor unit cabinet shall be equipped with a ducted air outlet and ducted rear return air connection.

9. Fan

The indoor unit fan unit shall be sirocco fans direct driven by a single motor. Fan shall develop airflow to deliver up to 0.20-inch w.g. of external static pressure. The indoor fans shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fans shall operate on any of four speeds, low, medium, high, and auto. The auto setting shall adjust the fan speed based on the difference between controller set point and space temperature.

10. Filter

A filter box with MERV 8 filters shall be attached to indoor unit. The filter box construction shall be minimum 20-gauge galvanized steel. The box shall have an access door to allow for easy filter replacement. A foam gasket shall provide airtight connection to the indoor unit and access door. Return connection in back shall be easily field converted to bottom of box.

11. Coil

The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange, and all tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 21 inches above the condensate pan. The lift mechanism shall be equipped with a positive-acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reaches maximum level. Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.

12. Electrical

The indoor unit shall be provided with a system allowing the indoor unit to be powered and controlled directly from the outdoor unit providing primary power and integrated by directional, digital control signal without additional connections. The indoor unit shall not have any supplemental electrical heating elements.

13. System Control

The control system shall consist of a minimum of two microprocessors, one on each indoor and outdoor unit, interconnected by a single nonpolar two-wire cable. Field wiring shall run directly from the indoor unit to the wall-mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

The indoor unit shall be connected to a wall-mounted wired controller to perform input functions necessary to operate the system. 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 wired controller, providing emergency operation, and controlling the outdoor unit.

2.6 VRF OUTDOOR UNIT WALL BRACKET

Wall bracket shall be rated to support equipment up to 500 Lbs, constructed of 11-gauge powder coated steel, adjustable for 6”-34” in width, and minimum 25 inches deep. Provide corrosion resistant hardware and stand-offs. Wall bracket shall be Mitsubishi QSWB series, or equal.

2.7 THERMOSTATS

Provide thermostats, as required to control heating and ventilating equipment. Thermostats shall be located on an interior wall that does not receive direct solar exposure unless otherwise indicated. Adjustment screws and temperature-setting indicator shall be accessible without opening the enclosure.

A. PROGRAMMABLE THERMOSTATS (FOR EQUIPMENT SPACES)

Programmable thermostats shall be wired remote controller for ductless split system heat pumps. Thermostat shall include weekly timer with up to 8 pattern settings per day. The controls shall include an LCD display, On/Off button, Increase/Decrease Set Temperature buttons, mode selector, Timer Menu and Timer On/Off buttons, and fan speed selector. Thermostat shall display room temperature in either Fahrenheit or Celsius and shall be in increments of 1 °F or 0.5 °C. Programmable thermostat shall be Mitsubishi PAR series, or equal.

B. SEVEN-DAY PROGRAMMABLE THERMOSTATS (FOR OFFICE SPACES)

Seven day programmable thermostats for Heat Pump and/or air conditioning control shall meet the following requirements:

1. System Requirements

   a. Control variable speed split system heat pump for heating, cooling and humidity, and three heating stages for standby electric heat.

   b. 7-day programming.

   c. Provide four periods per day for occupied and unoccupied conditions.

   d. Offer automatic heat/cool changeover with 2 degrees F minimum deadband.

   e. Provide override capability for a 1, 3, 8 or 12-hour period.

   f. Include a comfort adjust feature to modify set points for the override duration.

   g. Provide Proportional plus Integral (P+I) temperature control.

   h. Display room temperature in degrees F.

   i. Display time in 12-hour clock format.

j. Disable system and fan selections so both are in AUTO continuously.

k. Use in conjunction with an economizer.

l. Low voltage.

m. The system shall comply with applicable provisions of ASHRAE 90-75. All wiring shall meet National Electric Codes and local electric codes.

n. During power loss internal memory stores programmed settings for an unlimited time and the clock shall continue for 72 hours.

2. Sequence of Operations

The heating and cooling set points shall be individually adjustable for both the occupied and unoccupied periods. Space temperature deviation above the cooling set point or below the heating set point shall generate a demand signal to control the system as follows:

a. Heating

i. The thermostat shall control the heating output based on space temperature deviation (proportional gain), the duration of that temperature deviation (integral gain), and the rate of change of the deviation (derivative gain).

ii. The thermostat shall energize heating equipment when space temperature falls below heating set point.

iii. In heat pump applications, auxiliary heat shall be controlled at 2 degrees F below heating set point.

b. Cooling

i. The thermostat shall control the cooling output based on space temperature deviation (proportional gain), the duration of that temperature deviation (integral gain), and the rate of change of the deviation (derivative gain).

ii. The thermostat shall energize cooling equipment when space temperature exceeds cooling set point.

c. Humidity Control

i. Set relative humidity to 60 percent.

ii. Control compressor and blower for dehumidification.

d. Economizer Interface

When configured enables economizer via digital output (relay contact) whenever the thermostat is in occupied status (Occupied or Standby Mode).

e. Heating Setback and Cooling Setup

Initiation of heating setback or cooling setup for each of 7 days shall be provided by a programmed time schedule manually entered into the thermostat. When all or a portion of a manually programmed schedule is unavailable, the thermostat shall control to the default program as follows:

Table of Default Program		
	Occupied	**Unoccupied**
Heating Set Points	70°F (21°C)	55°F (13°C)
Cooling Set Points	78°F (26°C)	90°F (32°C)
Start Times	8:00 am	10:00 pm

f. Set point Recovery from Unoccupied to Occupied

g. The thermostat shall incorporate a programmable ramping feature for both heating and cooling that gradually changes the space setpoints with settings for both min. and max. setpoint recovery in degrees per hour. During recovery operation, the setpoint changes at a rate in degrees per hour. Fan Operation

Fan operation shall be selectable as follows:

i. Heat Pump Applications

1) Auto: fan is energized with calls for heating and cooling in the occupied and unoccupied periods.

2) Continuous Occupied: fan is energized continuously in the occupied periods and energized with calls for heating and calls for cooling in the unoccupied periods.

h. Heating and Cooling Operation Minimum On and Off Times

The thermostat shall incorporate a program to maintain minimum-stage operation in both the heating and cooling.

i. Five-Minute Compressor Timeguard

This timer prevents compressor from starting unless it has been off for at least 5 minutes.

ii. Fifteen-Minute Cycle Timer

This timer prevents the start of a heating or cooling cycle until at least 15 minutes after the last start of the same cycle. Its function is to assure that equipment is not cycled more than 4 times per hour.

iii. Fifteen-Minute Staging Timer

In multistage heating or cooling, this timer prevents any higher stage from turning on until preceding stage has been on for 15 minutes.

iv. Three-Minute Minimum On Time

In normal operation, when a stage turns on, it will not turn off for a minimum of 3 minutes.

v. Heat/Cool Set Points (Desired Temperature)

A minimum difference of 2° is enforced between heating and cooling desire temperatures.

i. Power Interruption

The system shall cycle off and provide timed restaging of heating or cooling equipment upon restoration of power. The restaging operation shall occur according to minimum stage operation times incorporated in the thermostat.

i. During a power interruption less than 8 hours, the thermostat retains all programmed occupied and unoccupied start times and temperatures as well as the present time and day.

ii. During a power interruption greater than 8 hours, the thermostat retains all programmed occupied and unoccupied start times and temperatures. Only the present time and day will need to be reprogrammed.

j. Calibration

i. No calibration and no adjustment shall be required for mixed air temperature, throttling range, reset ratio, band width, or discharge air temperature.

ii. Temperature setting displayed on thermostat shall be adjustable within ±3 degrees F of measured room temperature.

k. Security

Two levels of security shall exist:

i. A key pad lockout switch located on the back of the thermostat shall allow for three types of keypad lockout.

1) Lock out all keys on the thermostat.

2) Lock out all keys on the thermostat except the System and Fan settings, temporary set

point adjustments, and clock and day adjustments.

3) Lock out thermostat installer setup mode only.

ii. Thermostat shall allow for door to be locked by use of two Allen head screws to lock the cover and not allow access to the keypad.

l. Overrides

Temperature set points can be overridden in three ways:

i. Thermostat shall allow for a 1, 3, 8, or 12-hour timed override from unoccupied set point to occupied set point from the thermostat keypad. In addition, the thermostat shall allow for the adjustment of the occupied set point during the timed override from the keypad.

ii. Thermostat shall allow for a continuous override to the unoccupied set point from the thermostat keypad.

7-day programmable thermostats shall be Honeywell TC500A, or equal.

C. MODULATING THERMOSTATS

Modulating thermostats shall be control designed to regulate fan speed based on level of temperature space. Control shall include a Proportional Integral Derivative (PID) feedback loop and shall have labeled terminal strips for easy wiring. Control shall output a 0-10 VDC signal to operate an electronic commutation (EC) motor. Temperature setpoint range shall be 50-90 °F. Modulating thermostats shall be Greenheck Temperature/Humidity Control, or equal.

2.8 TAPE

Non-combustible, three inches in size, foil backing, pressure-sensitive lap of facing material. NASHUA 322, NASHUA FSK (High Pressure) or equal.

2.9 DUCT SEALANT

Duct sealant shall be Foster 32-19 Duct-Fas, or equal.

2.10 ADHESIVE

Adhesive shall be Foster 85-60 Quick-Tack, or equal.

2.11 LINESET

Lineset copper tubes shall meet ASTM B280 and be tested in accordance with ASTM E243, annealed, refrigerant grade, ACR type, and individually insulated with closed cell, CFC-free, elastomeric insulation. The insulation shall be UV resistant and suitable for extended outdoor applications, have a thermal conductivity of 0.30 BTU-inch/hour per Sq Ft / °F, water vapor transmission of 0.08 Perm-inch, and flame-spread index of less than 25* and a smoke-development index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

Linesets shall be Diamondback ML series, or equal.

2.12 LINE HIDE SET

Line hide set shall be plastic duct to aesthetically contain HVAC piping and wiring. Sets shall be weather resistant, UV stabilized, paintable PVC duct and fittings, and come in standard ivory color. Sets shall be suitable for use in ambient temperatures ranging from -4 °F to 140 °F. Mounting shall be done using stainless steel fasteners. Line hide sets shall be Mitsubishi Line-Hide, or equal.

2.13 SEISMIC SUPPORTS

All HVAC supports, tie rods, bracing, brackets or other types of supports shall be designed in accordance with the current edition of the International Building Code (IBC) and ASCE 7-10. Evaluate the seismic loads in accordance with IBC and Chapter 13 of ASCE 7-10 for the seismic design parameters shown on the Plans.

2.14 FIRE SEALANT

UL listed field installed self-curing fire barrier material (1 hour minimum rating), suitable for insertion in the annual space between a pipe or duct and its wall penetration or sleeve; Dow Corning “Fire Stop” sealant, 3M “Fire Barrier” caulk or putty or Nelson “Flameseal” putty.

Three-hour rated fire seals shall be manufactured modular mechanical type, Thunderline "Link-Seal" Model FS Pyro-Pac with accessory wall sleeve, or equal.

2.15 FILTERS

Air filters shall be 80 percent efficiency, disposable type, and not less than MERV 8 rated. Filter shall UL Class 2 listed unless specifically noted otherwise on the Plans.

PART 3 EXECUTION

3.1 INSTALLATION

All materials shall be installed as shown on the Plans and according to manufacturer's recommendations. Adjust all dampers and louvers to provide tight seal when closed and unobstructed flow when open. Provide all necessary controls, and coordinate all control wiring with Division 16. All installed equipment shall function in manner intended.

The heating/cooling system shall be installed as shown on the Plans and shall be connected to any ductwork with flexible connections. The Contractor shall be responsible for the installation of any condensate drain piping and conduit/wire runs for controllers/thermostats.

3.2 TESTING, ADJUSTING AND BALANCING

A. QUALIFICATIONS

All work shall be performed under the direct supervision of an AABC Certified Test and Balance Engineer. Resumes including education, experience, and certification of each person on the project shall be submitted for review and approval by the Owner. Notify the Owner 10 days prior to testing. The Owner shall witness the testing and balancing.

B. INSTRUMENTATION

All instruments used will be currently calibrated and listed in the TAB report showing instrument description, serial number, and date of calibration.

C. AIR BALANCE

When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the AABC Standard. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

1. Filters

   Check air filters and filter media and balance only systems with essentially clean filters and filter media.

2. Fan Speed

   Measure and record RPM at each fan speed.

3. Voltage and Amperage Readings

   Measure and record the final operating amperages and voltage for each motor.

4. Static Pressure Profile

   Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device. Static pressure profiles shall also be provided for systems, which do not perform as designed.

5. Equipment Air Flow

   Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan and coil.

6. Coil Temperatures

   Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil, and HVAC terminal unit. At the time of reading, record water flow, entering

and leaving water temperatures (In variable flow systems adjust the air and water flow to design for all the above readings).

7. Zone Air Flow

   Adjust each zone of multizone units, each HVAC terminal unit, and air-handling unit for design CFM.

8. Outlet Air Flow

   Adjust each exhaust inlet and supply diffuser, register and grille to within the tolerances shown in the AABC Standard. Include all terminal points of air supply and all points of exhaust.

9. Pitot Tube Traverses

   For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts, outside air, and return ducts shall have air velocity and volume measured and recorded by the Pitot tube traverse method shown in the AABC Standard. Locations of these traverse test stations shall be described on the sheet containing the data.

10. Heat Pump Startup

    Perform startup test run of heat pump systems per manufacturer recommendations, and complete pre-install and commissioning documentation. Startup shall include, at a minimum, leakage testing, electrical connections test, and system diagnostics check.

D. REPORTS

The report will contain all required information as described within this specification, including the information formatted and shown in the AABC Standard. Include with the data the date tested, personnel present, records of test instruments used, and a list of all measurements taken. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports shall be certified by the Agency's Test and Balance Engineer. Six copies of the final report shall be submitted to the Owner indicating a summary of actual operating data and any abnormal operating conditions.

E. EXECUTION

1. Provide additional dampers, and clean filters as specified herein and shown on the Plans.

2. Put all systems and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions, and cleaning of systems have been completed.

3. Do not begin testing and balancing until systems are completed and in good working order.

4. Check motors for proper rotation, coupling and drive alignment, belt tension, and freedom from vibration, etc.

5. Make all changes to drives and dampers as necessary to accomplish specified airflows.

*****END OF SECTION*****