

CITY OF SNOHOMISH
SNOHOMISH, WASHINGTON

CONTRACT DOCUMENTS

for the

PERACETIC ACID DISINFECTION SYSTEM

PRELIMINARY PERMIT REVIEW SET

Prepared for:

City of Snohomish



Prepared by:



950 Pacific Avenue, Suite 710
Tacoma, WA 98402
Phone: 253.344.5084




May 2019

CERTIFICATE PAGE

CITY OF SNOHOMISH

PERACETIC ACID DISINFECTION SYSTEM

The engineering material and data contained in these Specifications were prepared under the supervision and direction of the undersigned, whose seal as a registered professional engineer is affixed below.

	<p>Specifications: Divisions 1, 2, 9, 11, and 15</p> <p>Kenneth William Gray II, P.E. BHC Consultants, LLC</p>
	<p>Specifications: Divisions 1, 2, 9, 11, and 15</p> <p>Tom P. Giese, P.E. BHC Consultants, LLC</p>
	<p>Specifications: Divisions 3, 5, 6 and 13</p> <p>Gustavo Franco, S.E. BHC Consultants, LLC</p>



Specifications:
Divisions 16 and 17

Jeffrey S. Gibson, P.E.
BHC Consultants, LLC

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SECTION 1

BID PROPOSAL

CITY OF SNOHOMISH
PERACETIC ACID DISINFECTION SYSTEM
NOTICE OF CALL FOR BIDS

NOTICE IS HEREBY GIVEN, that sealed bids shall be received and recorded by the City Clerk at City Hall, 116 Union Avenue, Snohomish, WA 98290, until **##:00 XM**, Pacific Coast Time, **Xxxxxday, XXXXXX X, 20##**, and then publicly opened and read aloud.

The work to be performed under this contract provides for construction of a Peracetic Acid (PAA) Disinfection System including: temporary erosion and sediment control; removal of the existing wooden structure housing the chlorine residual analyzers; demolition of the existing chlorination and dechlorination equipment in the chlorine contact tank (CCT) and Chlorine Mixing Manhole; demolition of existing concrete slabs and asphalt paving; extending potable water service to the new PAA Building; constructing a slab on grade for the new PAA Building foundation; installing a precast vault with protective coatings for containment of PAA totes, complete with level switch and grating; installing a pre-engineered metal canopy over the PAA tote storage area with lighting, outlets and an outdoor emergency shower/eyewash; installing the pre-engineered PAA Building complete with the metering pump skid, a relocated residual analyzer, and required building appurtenances; asphalt paving for the new PAA tote storage area; installing PAA, carrier water, drain and sample pipelines including associated valves, connectors, heat tracing, insulation, and appurtenances; remote input/output (I/O) panel in the PAA Building connected to existing Main Control Panel-2A (MCP-2A); Power to the PAA Building and carrier water pump from existing EMCC2; modifying existing PLC programming in MCP-2A and existing SCADA programming to integrate the new equipment; startup and testing of the PAA system; repair of cracks in the existing CCT; and all associated work for a complete and operable system at the City-owned wastewater treatment plant, as shown on the project plans and specified herein for the City of Snohomish, Snohomish County, Washington.

Project Title: **City of Snohomish Peracetic Acid Disinfection System**

Engineer's Estimate: \$900,000

Plans, specifications, addenda, and a plan holders list for this project are available on-line through Builders Exchange of Washington, Inc. at <http://www.bxwa.com>; 2607 Wetmore Avenue, Everett, WA 98201-2929, (425) 258-1303, Fax (425) 259-3832. To access the project, click on: "Posted Projects", "Public Works", "City of Snohomish", and "Projects Bidding". Note: Bidders are encouraged to "Register as a Bidder", in order to receive automatic email notifications of future addenda and to be placed on the "Bidders List". Contact Builders Exchange of Washington at (425) 258-1303 should you require further assistance. Informational copies of any available maps, plans and specifications are on file for inspection at the Snohomish Public Works Engineering Department, (360) 282-3196 and posted on the City of Snohomish's website: <http://ci.snohomish.wa.us>.

An optional Pre-Bid meeting will be held at **##:00 XM**, Pacific Coast Time, on **Xxxxxday, XXXXXX ##, 20##** at the Wastewater Treatment Plant located at 2115 Second Street, Snohomish, WA 98290. RSVP is not necessary, but questions can be directed to Duane Leach, Lead WWTP Operator, at (360) 282-3186 or by email at leach@snohomishwa.gov. A project site review will occur immediately following the meeting.

BID PROCEDURES AND CONDITIONS

All bid proposals shall be accompanied by a bid proposal deposit in postal money order, cashier's check or surety bond in an amount equal to five percent (5%) of the grand total amount of such bid proposal. NO BID SHALL BE CONSIDERED UNLESS ACCOMPANIED BY SUCH BID PROPOSAL DEPOSIT. If the successful bidder does not enter into a contract and file a performance and payment bond and the required insurance certificates, with the City of Snohomish within ten (10) working days after Notice of Award of Bid, the amount of the bid deposit shall be forfeited to the City of Snohomish. Unsuccessful bidders' deposits will be returned upon City's execution of contract documents or rejection of all bids.

A one hundred percent (100%) Contractor's Performance and Payment Bond is required. The bond must be delivered to the Snohomish City Clerk within ten (10) working days after notification of the award to the successful bidder. The Bond must be approved by City officials before the contract award is final.

A Contract is required and must be executed and returned to the City of Snohomish within ten (10) working days after notification of award. Approval of the contract by City officials is required before the contract award is final.

A certificate of liability insurance reflecting the required public works contract insurance limits for this project must be furnished to the City of Snohomish within ten (10) working days after Notice of Award of Bid. This insurance certificate shall also specifically name the City of Snohomish as an additional insured. The successful bidder may not commence work under this contract until all required insurance coverage has been approved by the City.

The City of Snohomish reserves the right to reject any or all Bids, and to waive irregularities or informalities in the Bid or in the opening. A Bid shall be rejected if the Bidder is judged to be non-qualified and therefore not a responsible Bidder, as described in the Information for Bidders. A Bidder shall also be deemed not responsible and the Bid rejected per any one or more of the conditions listed in 2018 WSDOT Standard Specification 1-02.14. The City reserves the right to delete portions of the work.

No bidder may withdraw his bid after the hour set for the opening thereof, or before award of contract, unless said award is delayed for a period exceeding sixty (60) calendar days.

The bidder further agrees to begin work within ten (10) working days after Notice To Proceed has been issued by the City of Snohomish. The Contractor has 160 working days to complete the project. Payment of liquidated damages by the Contractor to the City in the amount specified in the Contract if the construction work is not physically completed within the allotted working days, in accordance with Section 1-08.9 of the Standard Specifications.

Dated this ##th day of Xxxxxx 20##.

City of Snohomish, Washington

Pat Adams, City Clerk

Publish:
Daily Journal of Commerce, Everett Herald

INFORMATION FOR BIDDERS

BIDS will be received by the CITY OF SNOHOMISH (herein called the "OWNER") at the time and location set forth in the Call for Bids herein before and then at said office publicly opened and read aloud.

Each BID must be submitted in a sealed envelope addressed to the CITY OF SNOHOMISH, 116 Union Ave., Snohomish, WA, 98290. Each sealed envelope containing a BID must be plainly marked on the outside as BID for City of Snohomish Peracetic Acid Disinfection System. The envelope should bear on the outside the name of the BIDDER, his address, his license number if applicable, and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the OWNER at the above address.

All BIDS must be made on the required PROPOSAL FORM. All blank spaces for BID prices must be filled in, in ink or typewritten, and the PROPOSAL FORM must be fully completed and executed when submitted. Only one copy of the PROPOSAL FORM is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within sixty (60) days after the actual date of the opening thereof.

The OWNER may make such investigations as it deems necessary to determine the ability of the BIDDER to perform the work or if the BIDDER is qualified to do the work, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request including mandatory submittal of "Statement of Bidder's Qualifications", included herein as part of the Part 1 Bid Procedures and Conditions. In evaluating whether projects were "successfully completed", the City of Snohomish may check references for the previous projects and may evaluate the bidder's performance, including, but not limited to, the areas of: (a) quality control, (b) safety record, (c) timeliness of performance, (d) use of skilled personnel, (e) management of subcontractors, (f) availability of and use of appropriate equipment, (g) compliance with contract documents, and (h) management of submittals process, change orders, and close-out, and (i) successful completion of projects of similar size and scope, see Section 1-02.1 Qualifications of Bidder.

A Bidder shall be deemed not responsible and the Bid rejected if the Bidder is judged by the City to be not qualified to do the work after checking references as described in the preceding paragraph, and therefore judged to be not a responsible Bidder, or does not meet the responsibilities criteria in RCW 39.04.350. **A Bidder shall also be deemed not responsible and the Bid rejected per any one or more of the criteria listed in 2018 WSDOT Standard Specification 1-02.14.**

The City of Snohomish reserves the right to reject any Bid if evidence submitted by, or investigation of, such Bidder fails to satisfy the City of Snohomish that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work contemplated therein. If a bid is rejected, the rejected Bidder shall have two working days after receipt of the rejection notice to appeal such a decision.

BID PROCEDURES AND CONDITIONS

Before submitting its proposal, the BIDDER shall examine the site of the work and review the drawings and specifications including ADDENDA and ascertain for themselves the work required and all of the physical conditions in relation thereto. Failure to take this precaution will not release the successful BIDDER from entering into contracts nor excuse the BIDDER from performing the work in strict accordance with the terms of the contract. No verbal statement made by any officer, agent, or employee of the OWNER, in relation to the physical conditions pertaining to the site of the work, will be binding on the OWNER during the gathering of information for proposal preparation by each BIDDER. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

An optional Pre-Bid meeting will be held at ##:00 XM, Pacific Coast Time, on Xxxxxxday, Xxxxxx ##, 20## at the Wastewater Treatment Plant located at 2115 Second Street, Snohomish, WA 98290. RSVP is not necessary, but questions can be directed to Duane Leach, Lead WWTP Operator, at (360) 282-3186 or by email at leach@SnohomishWA.gov. A project site review will occur immediately following the meeting.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID deposit payable to the OWNER for five percent of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the deposits of all except the three lowest responsible BIDDERS. When the Agreement is executed, the deposits of the remaining unsuccessful BIDDERS will be returned.

The party to whom the contract is awarded will be required to execute the Agreement and obtain the performance and payment bond within ten calendar days after the date on the NOTICE OF AWARD. The performance and payment bond in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract. The NOTICE OF AWARD shall be accompanied by the necessary Agreement and bond forms. In case of failure of the BIDDER to execute the Agreement, the OWNER may at his option consider the BIDDER in default; in which case the BID deposit accompanying the bid shall become the property of the OWNER.

The OWNER, within 10 days of receipt of acceptable bond and Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement within such period.

CONTRACTOR shall not commence work until a NOTICE TO PROCEED has been issued by the OWNER.

The OWNER may make such investigations as he deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request.

The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER, in the OWNER'S discretion, that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

BID PROCEDURES AND CONDITIONS

A conditional or qualified BID will not be accepted.

Award will be made as a whole to one BIDDER.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID.

The lowest responsible bidder must supply the names and addresses of major material suppliers and subcontractors when requested to do so by the OWNER.

The City of Snohomish reserves the right to delete portions of this work.

Bid Package and technical related questions can be directed to Tim Jackson, Utilities Manager, at (360) 282-3170 or Kenneth Gray, P.E., BHC Consultants, LLC at (206) 357-9963.

BIDDER'S CHECKLIST

NOTE: The purpose of this checklist is to serve as a reminder of the major items to be addressed in submitting a bid and by the Successful Bidder after Notification of Award. It is not intended to be all-inclusive. It does not alleviate the Bidder from the responsibility of becoming familiar with all aspects of the Project Manual and proper completion and submittal of the Bid.

1. Contract Documents thoroughly read and understood. _____
2. All blank spaces in proposal filled in, preferably in black ink. _____
3. Receipt of addenda acknowledged. _____
4. Bid Form and other documents making up the proposal signed by authorized officer. _____
5. Prices computed and presented correctly. _____
6. Subcontractors are named as indicated in the Contract Documents. _____
7. The following documents, to be submitted with the bid, completed, signed, and dated as applicable.
 - a. Bid Proposal _____
 - b. Deposit or Bid Bond Form _____
 - c. Anti-Discrimination Certificate _____
 - d. Indemnification Addendum _____
 - e. Statement of Bidder's Qualifications _____
 - f. List of Subcontractors _____
 - g. Non-Collusion Affidavit – Section 00314 _____
 - h. Certification of Non-segregated Facilities – Section 00319 _____
8. Bid documents submitted in sealed envelope and labeled **"Bid for City of Snohomish Peracetic Acid Disinfection System"** _____
9. The following documents shall be executed and complied with after the contract is awarded:
 - a. Contract _____
 - b. Contract Bond _____
 - c. Insurance Coverage Questionnaire _____
 - d. Contractor's Declaration of Option for Management of Statutory Retained Percentage _____
 - e. Retained Percentage Escrow Agreement _____
 - f. Retainage Release Requirements _____

END OF BIDDER'S CHECKLIST

CITY OF SNOHOMISH - BID PROPOSAL

TO: City of Snohomish
Attn: City Clerk
116 Union Avenue
Snohomish, WA 98290

The bidder declares that he or she has carefully examined the contract documents for the project; that he or she has personally visited the sites; that he or she has satisfied himself or herself as to the quantities of work involved, including materials and the equipment and conditions of work involved, and including the fact that the description of the quantities of work and materials as included herein, is brief and intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the contract documents and that this proposal is made according to the contract documents, which are hereby made a part of this proposal.

The bidder declares that he or she has exercised his or her own judgment regarding the interpretations of the specifications contained within the construction documents and has utilized all data that he or she believes pertinent in arriving at his or her conclusions.

The bidder agrees to hold his or her bid proposal open for sixty (60) days after the receipt of bids by the City.

The bidder agrees that if this proposal is accepted, he or she will, within ten (10) working days after notification of acceptance, execute a contract in the form included in the construction documents with the City of Snohomish, and will, prior to the time of execution of the contract, deliver to the City of Snohomish a performance and payment bond and a Certificate of Insurance and as required therein, and will, furnish all machinery, tools, apparatus, and other means of construction, and do the work in the manner, in the time, and according to the methods specified in the contract documents.

The bidder further agrees, if awarded the contract, to begin work within ten (10) working days after the date of notice to proceed and to complete the construction within 160 working days after the notice to proceed.

In the event the bidder is awarded the contract and shall fail to complete the work within the time limit or extended time limit agreed upon as more particularly set forth in the contract documents, liquidated damages shall be paid to the owner per the specifications contained in the contract documents.

The bidder proposes to accept as full payment for the work proposed herein the amount computed under the provisions of the contract documents. This amount shall be based on actual quantities of material placed and work performed. Bidder agrees that the unit prices represent a true measure of the labor and material required to perform the work, including all allowances for overhead and profit for each type of work called for in these contract documents.

The City of Snohomish reserves the right to delete portions of the work that best serve the interest of the City.

BID PROPOSAL**CITY OF SNOHOMISH, WASHINGTON****Peracetic Acid Disinfection System**

Note: Unit prices for all items, all extensions, and the total amount bid must be shown. Where conflict occurs between the unit price and the total amount named for any item the unit price shall prevail, and totals shall be corrected to conform thereto. All entries must be typed or entered in ink.

BID SCHEDULE

Item No.	Spec. Section	Description	Unit	Quantity	Unit Price	Total Amount for Item
1	01025	Mobilization/Demobilization, Bonds and Insurance	1	LS		
2	01025	General Site Work	1	LS		
3	01025	PAA Building	1	LS		
4	01025	PAA Storage and Containment	1	LS		
5	01025	Controls and System Integration	1	LS		
6	01025	CCT Crack Repair	50	LF		
7	01025	Additional CCT Crack Repair	200	LF		
8	01025	Force Account	1	FA	\$20,000	\$20,000
			SUBTOTAL			
			Sales Tax @ 9.2%			
			TOTAL AMOUNT OF BID			

RECEIPT OF ADDENDA

Receipt of the following Addenda to the Contract Documents is hereby acknowledged

Addendum #	Date of Receipt	Signed Acknowledgement

Note: Failure to acknowledge receipt of Addenda may be considered an irregularity in the bid proposal.

BID PROPOSAL SIGNATURE SHEET

The undersigned bids for completion of the following project: **Peracetic Acid Disinfection System** as described in the contract documents. The bidder proposes to accept as full payment for the work proposed herein; the amount computed under the provisions of the contract documents.

NOTE: The City reserves the right to accept or reject any and all bids as determined by the City.

TOTAL BID:

Total Bid Including Applicable Tax	\$
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Contractor (Firm Name)

Signature

Address

Name & Title (printed)

Phone _____ Fax _____
Phone & Fax Number

Date of Signing

Washington State Contractor's
Registration Number

Indicate whether contractor is partnership,
corporation, or sole proprietorship

All bid proposals shall be accompanied by a bid proposal deposit in postal money order, cashier's check or surety bond in an amount equal to five percent (5%) of the amount of such bid proposal. **NO BID SHALL BE CONSIDERED UNLESS ACCOMPANIED BY SUCH BID PROPOSAL DEPOSIT.**

Bid proposal to be submitted in a sealed envelope marked "**BID ENCLOSED**" FOR **PERACETIC ACID DISINFECTION SYSTEM**

WASHINGTON STATE SALES TAX.

The work on this contract is to be performed upon lands whose ownership obligates the Contractor to pay sales tax. The provisions of Section 1-07.2(2) apply.

COMPLETION TIME AND LIQUIDATED DAMAGES

It is understood and agreed that all work required to complete this Project and achieve the implied intent of the Plans and Specifications shall be physically completed within 60 working days. Refer to Section 1-08.5 of the General Requirements.

It is further understood and agreed that the Owner may deduct liquidated damages from payments due or to become due the Contractor in the amount set forth in Section 1-08.9, Liquidated Damages, for each working day in beyond the time allowed in the contract, as stipulated in the paragraph above, unless specified otherwise. Such deductions may be made for any delays, which cannot reasonably be shown to be beyond the Contractor's control.

The liquidated damages do not include and are in addition to damages from costs for engineering, administrative, and other costs incurred beyond contract completion date. The cost of additional office and field engineering, construction surveillance, and other costs beyond contract completion date shall be billed the contractor at standard billing rates for said services then in effect.

NONCOLLUSION DECLARATION

The undersigned, being duly sworn, deposes and says that the Bid submitted herewith is a genuine and not a collusive or sham bid or made in the interest or on behalf of any person herein named and that the person, firm, association, joint venture, co-partnership, or corporation herein named, has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in the preparation and submission of a bid for consideration in the award of a contract for the improvement described on the first page of this Proposal Form.

PREVAILING WAGES

The prevailing rate of wages shall be paid to all workers, laborer, or mechanics per Chapter 39:12 RCW. (See 2018 WSDOT/APWA Standard Specifications).

BID PROPOSAL FORM (continued)

BID DEPOSIT

A Bid Deposit in an amount of five percent (5%) of the Total Bid Amount(s) based upon the Lump Sum or Bid Schedule approximate quantities at the unit prices including applicable taxes and in the form indicated on the following pages.

Cashier's Check _____ IN THE AMOUNT OF \$ _____

Postal Money Order _____ \$ _____ Payable to the Owner

Surety Bond _____ IN THE AMOUNT OF 5% OF THE AMOUNT BID

SURETY

If the Bidder is awarded a construction contract on this Bid, the Surety who provides the Contract Bond will be _____.

Whose address is _____
Street

City State Zip Code

BIDDER INFORMATION AND SIGNATURE

The party by whom this bid is submitted and by whom the contract will be entered into, in case the award is made to him, is

Firm Name Corporation/Partnership/Individual
(Circle One)

Doing business at _____
Address City/State

Which is the address to which all communications concerned with this bid and contract should be sent.

BID PROPOSAL FORM (continued)

The name of the president, treasurer, and manager of the bidding corporation, or the names of all persons and parties interested in this bid as partners or principals are as follows:

<u>Name/Title</u>	<u>Address</u>

BID PROPOSAL FORM (continued)

IN WITNESS hereto, the undersigned agrees to the conditions of the BID, certifies that this BID has not been restricted, modified or conditioned, acknowledges receipt of addenda ____ to ____, attests to the absence of collusion in the Non-Collusion Affidavit below, and agrees to be bound by its provisions, certifies and agrees concerning non-segregated facilities in the Non-Segregated facilities statement below, covenants, stipulates and agrees in accordance with the Anti-Discrimination Certification below, declares, accepts and understands in accordance with the Bidder's Declaration and Understanding below, agrees as to prevailing wages as below, agrees as to Washington State Sales tax as above, understands and agrees as to the completion of time and liquidated damages as below, and with the full authority of the firm or other business entity submitting this BID has set his hand this _____ day of _____ 2018.

If Sole Proprietor or Partnership

Signature of Bidder

Title

If Corporation

Attest:

Name of Corporation

Secretary

By _____

Title _____

Sworn to before me this _____ day of _____, _____.

Notary Public in and for the State
Of Washington residing at

NOTE:

1. If the Bidder is a co-partnership, so state, giving the Name under which business is transacted.
2. If the Bidder is a corporation, this Proposal must be Executed by the duly authorized officials and notarized.

DEPOSIT OR BID BOND FORM

DEPOSIT STATEMENT

Herewith find deposit in the form of certified check, cashier's check or cash in the amount of \$ _____, which amount is not less than five percent of the total bid.

SIGN HERE _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, _____, as Principal, and _____, as Surety, are held firmly bound unto the _____, Washington, as Obligee, in the penal sum of _____ Dollars, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for

_____ ,

Washington, according to the terms of the bid made by the Principal therefore, the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee, or if the Principal shall, in case of failure to so do, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect, and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED, AND DATED THIS _____ DAY OF _____, _____.

Principal

Surety

_____, _____

Received return of deposit in the sum of \$ _____

ANTI-DISCRIMINATION CERTIFICATE

CITY OF SNOHOMISH

STATE OF WASHINGTON

COUNTY OF SNOHOMISH

The bidder hereby covenants, stipulates and agrees that no person shall be discriminated against in the bidding of the service and/or materials hereunder and that the bidder shall not refuse to hire any person therefore because of such person's race, creed, color or national origin, unless based on a bona fide occupational qualification. Also, the bidder will in no matter discriminate against any person because of such person's race, creed, color or national origin. Any such discrimination shall be deemed a violation of this bid and shall render this bid subject to forfeiture.

Contractor's Signature

Subscribed and sworn to before me this _____ day of _____, _____.

Notary Public in and for
The State of Washington,
Residing at

My commission expires _____

INDEMNIFICATION ADDENDUM

_____ (hereinafter called Contractor) agrees to defend, indemnify and hold the City of Snohomish (hereinafter called Owner) harmless from any and all claims, demands, losses and liabilities to or by third parties arising from, resulting from or connected with services performed or to be performed under this subcontract by Contractor or contractor's agents or employees to the fullest extent permitted by law and subject to the limitations provided below.

Contractor's duty to indemnify Owner shall not apply to liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of Owner or Owner's agents or employees.

Contractor's duty to indemnify Owner for liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the concurrent negligence of (a) Owner's agents or employees, and (b) Contractor or contractor's agents or employees, shall apply only to the extent of negligence of Contractor or Contractor's agents or employees.

Contractor specifically and expressly waives any immunity that may be granted it under the Washington State Industrial Insurance Act, Title 51 RCW. Further, the indemnification obligation under this subcontract shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable to or for any third party under workers compensation acts, disability benefits acts, or other employee benefits acts; provided Contractor's waiver of immunity by the provisions of this paragraph extends only to claims against Contractor by Owner and does not include, or extend to, any claims by Contractor's employees directly against Contractor.

Contractor's duty to defend, indemnify and hold Owner harmless shall include as to all claims, demands, losses and liability to which is applies, Owner's personnel-related costs, reasonable attorney's fees, court costs and all other claim-related expenses.

THE UNDERSIGNED HEREBY CERTIFY THAT THIS ADDENDUM WAS MUTUALLY NEGOTIATED.

Dated: _____

Dated: _____

Owner: CITY OF SNOHOMISH

Contractor:

By: _____

By: _____

Title: _____

Title: _____

STATEMENT OF BIDDER'S QUALIFICATIONS

Name of Firm: _____

Address: _____

Telephone No.: _____ Fax No.: _____

Contact Person for this Project: _____

E-mail: _____

Number of years the Contractor has been engaged in the construction business under present firm name, as indicated above: _____

Gross dollar amount of work currently under contract:

Gross dollar amount of contracts currently not completed:

General character of work performed by firm:

List three (3) similar projects at treatment or industrial facilities that have been successfully completed by the Contractor within the last five (5) years and the contract amount of each project, together with the Owner's name and telephone number, and the Engineer's name:

Project Name	Contract Amount	Owner	Phone	Engineer's Name

BID PROCEDURES AND CONDITIONS

List the major pieces of equipment which are anticipated to be used on this project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

Bank Reference: _____

Surety Reference: _____

How many general superintendents or other responsible employees in a supervisory position do you have at this time, and how long have they been with the firm?

Identify who will be the general superintendent and/or project superintendent on this project. Also, list the number of years each person identified has been with firm.

Have you changed bonding companies within the last three years? _____

If so, why? _____

Have you ever been a party to a lawsuit or an arbitration proceeding in any way relating to a construction project? _____

Identify the proceeding and parties and describe the claims asserted by all parties. _____

What was the disposition of the case?

Do you have any outstanding payments due to the Department of Revenue?

If yes, explain.

Bidder agrees that the Owner shall have the right to obtain credit reports.

Yes ____ No ____

BID PROCEDURES AND CONDITIONS

Washington State:

Department of Labor and Industries Workmen's Compensation Account No.: _____

Department of Licenses Contractor's Registration No.: _____

Employment Security Department Number: _____

Excise Tax Registration Number: _____

IRS Employer Number: _____

Percentage of work to be performed by General Contractor: _____

BIDDER

By (signed)

TITLE

LIST OF SUBCONTRACTORS

Each Bidder is advised of the requirements of Washington Law, RCW 39.30.060. Pursuant to Title 39 of the Revised Code of Washington, each bidder is required to submit as part of the bid or within one hour after the published bid submittal time, the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning; plumbing as described in RCW 18.106 and electrical as described in RCW 19.28 or to name itself for the work. The Bidder shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the bidder must indicate which subcontractor will be used for which alternate. Failure of the bidder to submit the names of such subcontractors or to name itself to perform such work or the naming of two or more subcontractors to perform the same work shall render the bidder's bid non-responsive and, therefore, void.

List subcontractors appropriately

ELECTRICAL

Subcontractor Name: _____

OTHER SUBCONTRACTORS (whose work is equal to or greater than 10% of the bid)
(Note: This is required by this contract and not RCW 39.30.060)

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

NON-COLLUSION AFFIDAVIT

The undersigned, being duly sworn, deposes and says that the person, firm, association, co-partnership or corporation herein named, has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in the preparation and submission of this proposal to the City of Snohomish for its consideration in the award of the contract.

_____	Sole Proprietorship	_____
Legal Name of Bidder	Partnership	_____
	Corporation	_____
	Other	_____

By (Signature) _____

Street Address _____

City State Zip

Telephone _____

State of Washington Contractor's Number _____

STATE OF WASHINGTON)

) SS.

COUNTY OF SNOHOMISH)

On this day personally appeared before me _____ to me known to be the individual described in and who executed the within and foregoing instrument, and acknowledged that _____ signed the same as _____ free and voluntary act and deed, for the uses and purposes therein mentioned.

GIVEN under my hand and official seal this _____ day of _____, 2018

_____, Notary Public in and for the State of Washington, residing at _____

My Commission Expires: _____

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding \$10,000 which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certified, further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract.

As used in this certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or area, in fact, segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed contractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such, certification in this file.

Signature

Date

Name and title of signer (please type)

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

END OF BID PROCEDURES AND CONDITIONS

PUBLIC WORKS CONTRACT

This Contract is made and entered into in duplicate this ____ day of _____, _____ by and between the _____, a non-charter code city of the State of Washington, hereinafter referred to as “the City”, and _____, a _____, and _____, a Washington _____ (“Contractor”) [LEGAL STATUS OF ENTITY SHOULD BE INSERTED i.e., LLC; Sole Proprietor; LLP; Inc., P.S.; Partnership, Foreign Corporation licensed to do business in Washington State] .

WITNESSETH:

Whereas, the City desires to have certain public work performed as hereinafter set forth, requiring specialized skills and other supportive capabilities; and

Whereas, the Contractor represents that it is qualified and possesses sufficient skills and the necessary capabilities to perform the services set forth in this Contract.

NOW, THEREFORE, in consideration of the terms, conditions, and agreements contained herein, the parties hereto agree as follows:

1. Scope of Work.

The Contractor shall do all work and furnish all tools, materials, and equipment in order to accomplish the following project:

Peracetic Acid Disinfection System

in accordance with and as described in

- A. this Contract, and
- B. the Project Manual, which include the attached plans, Specifications, Special Provisions, submittal requirements, attachments, addenda (if any), Bid Form, Performance and Payment Bond, and
- C. the Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation, as may be specifically modified in the attached Specifications and/or Special Provisions, hereinafter referred to as “the standard specifications”,
- D. City of Snohomish Engineering Standards (referenced but not attached)
- E. AWWA Standards and Procedures (referenced but not attached)

F. National Electric Code (Current Edition)

and shall perform any alterations in or additions to the work provided under this Contract and every part thereof.

The Contractor shall provide and bear the expense of all equipment, work, and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in this Contract, except as may otherwise be provided in the Project Manual.

2. Time for Performance and Liquidated Damages / Termination of Contract.

A. Time is of the essence in the performance of this Contract and in adhering to the time frames specified herein. The Contractor shall commence work within ten (10) calendar days after notice to proceed from the City, and said work shall be physically completed within **110** working days after said notice to proceed, unless a different time frame is expressly provided in writing by the City.

B. If said work is not completed within the time for physical completion, the Contractor may be required at the City's sole discretion to pay to the City liquidated damages as set forth in the Project Manual, for each and every day said work remains uncompleted after the expiration of the specified time.

C. Termination of Contract.

1. Except as otherwise provided under this Contract, either party may terminate this Contract upon ten (10) working days' written notice to the other party in the event that said other party is in default and fails to cure such default within that ten-day period, or such longer period as provided by the non-defaulting party. The notice of termination shall state the reasons therefore and the effective date of the termination.

2. The City may also terminate this Contract in accordance with the provisions of Section 1-08.10 of the Standard Specifications.

3. Compensation and Method of Payment.

A. The City shall pay the Contractor for work performed under this Contract as detailed in the bid, as incorporated in the Project Manual.

B. Payments for work provided hereunder shall be made following the performance of such work, unless otherwise permitted by law and approved in writing by the City. No payment shall be made for any work rendered by the Contractor except as identified and set forth in this Contract.

- C. Progress payments shall be based on the timely submittal by the Contractor of the City's standard payment request form.
- D. Payments for any alterations in or additions to the work provided under this Contract shall be in accordance with the Request For Information (RFI) and/or Construction Change Order (CCO) process as set forth in the Project Manual. Following approval of the RFI and/or CCO, the Contractor shall submit the standard payment request form(s).
- E. The Contractor shall submit payment requests with a completed Application for Payment form, an example of which is included in the Attachments to this Contract. This form includes a lien waiver certification and shall be notarized before submission. Applications for payment not signed or notarized shall be considered incomplete and ineligible for payment consideration. The City shall initiate authorization for payment after receipt of a satisfactorily completed payment request form and shall make payment to the Contractor within approximately thirty (30) days thereafter.

4. Independent Contractor Relationship.

The relationship created by this Contract is that of independent contracting entities. No agent, employee, servant, or representative of the Contractor shall be deemed to be an employee, agent, servant, or representative of the City, and the employees of the Contractor are not entitled to any of the benefits the City provides for its employees. The Contractor shall be solely and entirely responsible for its acts and the acts of its agents, employees, servants, subcontractors, or representatives during the performance of this Contract. The Contractor shall assume full responsibility for payment of all wages and salaries and all federal, state, and local taxes or contributions imposed or required, including, but not limited to, unemployment insurance, workers compensation insurance, social security, and income tax withholding.

5. Prevailing Wage Requirements.

The Contractor shall comply with applicable prevailing wage requirements of the Washington State Department of Labor & Industries, as set forth in Chapter 39.12 RCW and Chapter 296-127 WAC. The Contractor shall document compliance with said requirements and shall file with the City appropriate affidavits, certificates, and/or statements of compliance with the State prevailing wage requirements. The Washington State Prevailing Wage Rates For Public Works Contracts, Snohomish County, incorporated in this Contract have been established by the Department of Labor & Industries and are included as an Attachment to this Contract. The Contractor shall also ensure that any subcontractors or agents of the Contractor shall comply with the prevailing wage and documentation requirements as set forth herein.

6. Indemnification and Hold Harmless.

- A. The Contractor shall defend, indemnify, and hold harmless the City, its officers, officials, employees, and volunteers against and from any and all claims, injuries,

damages, losses, or suits, including attorney fees, arising out of or in connection with the performance of this Contract, except for injuries and damages caused by the sole negligence of the City.

- B. The Contractor's duty to indemnify the City shall not apply to liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of the City or its elected officials, agents, officers and/or employees.
- C. The Contractor's duty to indemnify the City for liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the concurrent negligence of (a) the City and/or its elected officials, agents, officers and/or employees, and (b) the Contractor and/or its directors, officers, agents, employees, consultants, and/or subcontractors, shall apply only to the extent of negligence of Contractor and/or its directors, officers, agents, employees, consultants, and/or subcontractors
- D. Should a court of competent jurisdiction determine that this Contract is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the City, its officers, officials, employees, and volunteers, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence.

It is further specifically and expressly understood that the indemnification provided herein constitutes the Contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties.

- E. Nothing contained in this section or Contract shall be construed to create a liability or a right of indemnification by any third party.
- F. The provisions of this section shall survive the expiration or termination of this Contract.

7. Insurance.

A. **Insurance Term.**

The Contractor shall procure and maintain for the duration of the Agreement, insurance against claims for injuries to persons or damage to property which may arise, as required in this Section, without interruption from or in connection with the performance commencement of the Contractor's work through the term of the work hereunder by the Contractor, their agents, representatives, employees or subcontractors contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated herein.

B. No Limitation

Contractor's maintenance of insurance, its scope of coverage and limits as required herein shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the City's recourse to any remedy available at law or in equity.

C. Minimum Scope of Insurance.

Contractors required insurance shall be of the types and coverage as stated below:

1. Automobile Liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on at least as broad as Insurance Services Office (ISO) form CA Automobile 00 01 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.

2. Commercial General Liability insurance shall be written on at least as broad as ISO occurrence form CG 00 01 and shall cover liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal injury and advertising injury, and liability assumed under an insured contract. The Commercial General Liability insurance shall be endorsed to provide the per project general aggregate limit using ISO form CG 25 03 05 09 or an equivalent endorsement. There shall be no exclusion for liability arising from explosion, collapse or underground property damage. The City shall be named as an additional insured under the Contractor's Commercial General Liability insurance policy with respect to the work performed for the City using ISO Additional Insured endorsement CG 20 10 10 01 and Additional Insured- Completed Operations endorsement CG 20 37 10 01 or substitute endorsements providing at least as broad of coverage.

3. Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington

4. ☐ Required. Builders Risk insurance covering interests of the City, the Contractor, Subcontractors, and Sub-contractors in the work. Builders Risk insurance shall be on a special perils policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood, earthquake, theft, vandalism, malicious mischief, and collapse. The Builders Risk insurance shall include coverage for temporary buildings, debris removal and damage to materials in transit or stored off-site. This Builders Risk insurance covering the work will have a deductible of \$5,000 for each occurrence, which will be the responsibility of the Contractor. Higher deductibles for flood and earthquake perils may be accepted by the City upon written request by the Contractor and written acceptance by the City. Any increased deductibles accepted by the City will remain the responsibility of the Contractor. The Builders Risk insurance shall be maintained until final acceptance of the work by the City.

5. ☐ Required. Contractors Pollution Liability insurance covering losses caused by pollution conditions that arise from the operations of the Contractor. Contractors Pollution Liability insurance shall be written in an amount of at least \$1,000,000 per loss, with an annual aggregate of at least \$1,000,000. Contractors Pollution Liability shall cover bodily injury, property damage, cleanup costs and defense including costs and expenses incurred in the investigation, defense, or settlement of claims.

If the Contractors Pollution Liability insurance is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning from the time that work under the contract is completed.

The City shall be named by endorsement as an additional insured on the Contractors Pollution Liability insurance policy.

If the scope of services as defined in this contract includes the disposal of any hazardous materials from the job site, the Contractor must furnish to the City evidence of Pollution Liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under this contract. Coverage certified to the City under this paragraph must be maintained in minimum amounts of \$1,000,000 per loss, with an annual aggregate of at least \$1,000,000.

Pollution Liability coverage at least as broad as that provided under ISO Pollution Liability-Broadened Coverage for Covered Autos Endorsement CA 99 48 shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached.

D. Minimum Amounts of Insurance.

The Contractor shall maintain the following insurance limits:

1. Automobile Liability insurance with a minimum combined single limit for bodily injury and property damage of \$1,000,000 per accident.

2. Commercial General Liability insurance shall be written with limits no less than \$3,000,000 each occurrence, \$3,000,000 general aggregate and a \$2,000,000 products-completed operations aggregate limit.

3. ☐ Required. Builders Risk insurance shall be written in the amount of the completed value of the project with no coinsurance provisions.

4. ☐ Required. Contractors Pollution Liability shall be written in the amounts set forth above.

E. **City Full Availability of Contractor Limits**

If the Contractor maintains higher insurance limits than the minimums shown above, the City shall be insured for the full available limits of Commercial General and Excess or Umbrella liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by this contract or whether any certificate of insurance furnished to the City evidences limits of liability lower than those maintained by the Contractor.

F. **Other Insurance Provisions.**

The Contractor's insurance coverage shall be primary insurance with respect to the City. Any insurance, self-insurance, or insurance pool coverage maintained by the City shall be in excess of the Contractor's insurance and shall not contribute with it.

G. **Acceptability of Insurers.**

Insurance is to be placed with insurers with a current A.M. Best rating of not less than A:VII.

H. **Verification of Coverage.**

The Contractor shall furnish the City with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsement, evidencing the Automobile Liability and Commercial General Liability insurance of the Contractor before commencement of the work. Throughout the term of this Contract, upon request by the City, the Contractor shall furnish certified copies of all required insurance policies, including endorsements, required in this contract and evidence of all subcontractors' coverage.

☐ Required. Before any exposure to loss may occur, the Contractor shall file with the City a copy of the Builders Risk insurance policy that includes all applicable conditions, exclusions, definitions, terms and endorsements related to this Project.

☐ Required. Before any exposure to loss may occur, the Contractor shall file with the City a copy of the Pollution Liability insurance that includes all applicable conditions, exclusions, definitions, terms and endorsements related to this Project.

I. **Contractor's Insurance for Other Losses.**

The Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools, Contractor's employee owned tools, machinery, equipment, or motor vehicles owned or rented by the Contractor, or the Contractor's agents, suppliers or subcontractors as well as to any temporary structures, scaffolding and protective fences.

J. Subcontractors.

The Contractor shall include all subcontractors as insured under its policies or shall furnish separate certifications and endorsements for each subcontractor. All coverage for subcontractors shall be subject to all of the same insurance requirements as stated herein for the Contractor.

The Contractor shall cause each and every Subcontractor to provide insurance coverage that complies with all applicable requirements of the Contractor-provided insurance as set forth herein. The Contractor shall ensure that the City is an additional insured on each and every Subcontractor's Commercial General liability insurance policy using an endorsement at least as broad as ISO Additional Insured endorsement CG 20 38 04 13.

K. Waiver of Subrogation.

The Contractor and the City waive all rights against each other, any of their subcontractors, lower tier subcontractors, agents and employees, each of the other, for damages caused by fire or other perils to the extent covered by Builders Risk insurance or other property insurance obtained pursuant to the Insurance Requirements Section of this Contract or other property insurance applicable to the work. The policies shall provide such waivers by endorsement or otherwise.

L. Notice of Cancellation of Insurance.

The Contractor shall provide the City and all Additional Insureds for this work with written notice of any policy cancellation within two business days of their receipt of such notice.

M. Failure to Maintain Insurance

Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the City may, after giving five business days' notice to the Contractor to correct the breach, immediately terminate the contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the City on demand, or at the sole discretion of the City, offset against funds due the Contractor from the City.

8. Compliance with Laws.

- A. The Contractor shall comply with all applicable federal, state, and local laws, including regulations for licensing, certification, and operation of facilities and programs, and accreditation and licensing of individuals, and any other standards or criteria as set forth in the Project Manual.
- B. The Contractor shall pay any applicable business and permit fees and taxes which may be required for the performance of the work.

- C. The Contractor shall comply with all legal and permitting requirements as set forth in the Project Manual.

9. Non-discrimination.

During the performance of this Contract, the Contractor shall comply with all applicable equal opportunity laws and/or regulations and shall not discriminate on the basis of race, age, color, sex, sexual orientation, religion, national origin, creed, veteran status, marital status, political affiliation, or the presence of any sensory, mental or physical handicap. This provision shall include but not be limited to the following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, selection for training, and the provision of work and services under this Contract. The Contractor further agrees to maintain notices, posted in conspicuous places, setting forth the provisions of this nondiscrimination clause. The Contractor understands that violation of this provision shall be cause for immediate termination of this Contract and the Contractor may be barred from performing any services or work for the City in the future unless the Contractor demonstrates to the satisfaction of the City that discriminatory practices have been eliminated and that recurrence of such discriminatory practices is unlikely.

- A. The parties will maintain open hiring and employment practices and will welcome applications for employment in all positions from qualified individuals who are members of the above-stated minorities.
- B. The parties will comply strictly with all requirements of applicable federal, state or local laws or regulations issued pursuant thereto, relating to the establishment of nondiscriminatory requirements in hiring and employment practices and assuring the service of all patrons and customers without discrimination with respect to the above-stated minority status.

10. Assignment and Subcontractors.

- A. The Contractor shall not assign this Contract or any interest herein, nor any money due to or to become due hereunder, without first obtaining the written consent of the City.
- B. The Contractor shall not subcontract any part of the services to be performed hereunder without first obtaining the consent of the City and complying with the provisions of this section.
- C. In the event the Contractor does assign this contract or employ any subcontractor, the Contractor agrees to bind in writing every assignee and subcontractor to the applicable terms and conditions of the contract documents.
- D. The Contractor shall, before commencing any work, notify the Owner in writing of the names of any proposed subcontractors. The Contractor shall not employ any subcontractor or other person or organization (including those who are to

furnish the principal items or materials or equipment), whether initially or as a substitute, against whom the Owner may have reasonable objection. Each subcontractor or other person or organization shall be identified in writing to the Owner by the Contractor prior to the date this Contract is signed by the Contractor. Acceptance of any subcontractor or assignee by the Owner shall not constitute a waiver of any right of the Owner to reject defective work or work not in conformance with the contract documents. If the Owner, at any time, has reasonable objection to a subcontractor or assignee, the Contractor shall submit an acceptable substitute.

- E. The Contractor shall be fully responsible for all acts and omissions of its assignees, subcontractors and of persons and organization directly or indirectly employed by it and of persons and organizations for whose acts any of them may be liable to the same extent that it is responsible for the acts and omissions of person directly employed by it.
- F. The divisions and sections of the specifications and the identifications of any drawings shall not control the Contractor in dividing the work among subcontractors or delineating the work to be performed by any specific trade.
- G. Nothing contained in the contract documents shall create or be construed to create any relationship, contractual or otherwise, between the Owner and any subcontractor or assignee. Nothing in the contract documents shall create any obligation on the part of the Owner to pay or to assure payment of any monies due any subcontractor or assignee.
- H. The Contractor hereby assigns to the City any and all claims for overcharges resulting from antitrust violations as to goods and materials purchased in connection with this Contract, except as to overcharges resulting from antitrust violations commencing after the date of the bid or other event establishing the price of this Contract. In addition, the Contractor warrants and represents that each of its suppliers and subcontractors shall assign any and all such claims for overcharges to the City in accordance with the terms of this provision. The Contractor further agrees to give the City immediate notice of the existence of any such claim.
- I. In addition to all other obligations of the contractor, if the contractor does employ any approved subcontractor, the contractor shall supply to every approved subcontractor a copy of the form, provided in the project manual, to establish written proof that each subcontract and lower-tier subcontract is a written document and contains, as a part, the current prevailing wage rates. The contractor, each approved subcontractor and each approved lower-tier subcontractor shall complete and deliver the form directly to the City.

11. Contract Administration and Notices.

This Contract shall be administered for the City by the Insert Project Manager Name, and shall be administered for the Contractor by the Contractor's Contract Representative, Insert Name of Contractor Representative. Unless stated otherwise herein, all notices and demands shall be in writing and sent or hand-delivered to the parties at their addresses as follows:

To City:

Project Manager Name
City of Snohomish
Street Address
City, State ZIP
Telephone Number _____

To Contractor:

Name and Title of Binding Officer
Contractor Business Name
Street Address
City, State ZIP
Telephone Number

or to such addresses as the parties may hereafter designate in writing. Notices and/or demands shall be sent by registered or certified mail, postage prepaid, or hand-delivered. Such notices shall be deemed effective when mailed or hand-delivered at the addresses specified above.

12. Interpretation and Venue. This Contract shall be interpreted and construed in accordance with the laws of the State of Washington. The venue of any litigation between the parties regarding this Contract shall be Snohomish County, Washington.

13. Severability

A. If a court of competent jurisdiction holds any part, term or provision of this Contract to be illegal or invalid, in whole or in part, the validity of the remaining provisions shall not be affected, and the parties' rights and obligations shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

B. If any provision of this Contract is in direct conflict with any statutory provision of the State of Washington, that provision which may conflict shall be deemed inoperative and null and void insofar as it may conflict, and shall be deemed modified to conform to such statutory provision.

14. Non-Waiver.

A waiver by either party hereto of a breach of the other party hereto of any covenant or condition of this Contract shall not impair the right of the party not in default to avail itself of any subsequent breach thereof. Leniency, delay or failure of either party to insist upon strict performance of any Contract, covenant or condition of this Contract, or to exercise any right herein given in any one or more instances, shall not be construed as a waiver or relinquishment of any such Contract, covenant, condition or right.

15. Survival.

Any provision of this Contract which imposes an obligation after termination or expiration of this Contract shall survive the term or expiration of this Contract and shall be binding on the parties to this Contract.

16. Authority.

The person executing this Agreement on behalf of Contractor represents and warrants that he or she has been fully authorized by Contractor to execute this Agreement on its behalf and to legally bind Contractor to all the terms, performances and provisions of this Agreement. The person executing this Contractor on behalf of the City represents and warrants that he or she has been fully authorized by the City to execute this Contractor on its behalf and to legally bind the City to all the terms, performances and provisions of this Contractor.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be executed the day and year first set forth above.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be executed the day and year first hereinabove written.

City of _____

By _____
John Kartak, Mayor

By _____

Approved as to form:

Attest:

Grant K. Weed, City Attorney

Pat Adams, City Clerk

PERFORMANCE and PAYMENT BOND

Bond to the City of Snohomish

Bond # _____

KNOW ALL MEN BY THESE PRESENTS:

That we, the undersigned, _____ as Principal, and _____
_____ a corporation, organized and existing under the
laws of the State of Washington, as a surety corporation, and qualified under the laws of the
State of Washington to become surety upon bonds of contractors with municipal corporations as
surety, are jointly and severally held and firmly bound to the **City of Snohomish** in the penal
sum of \$ _____ for the payment of
which sum on demand we bind ourselves and our successors, heirs, administrators or personal
representatives, as the case may be.

This obligation is entered into pursuant to the statutes of the State of Washington and the
ordinances of the City of Snohomish.

Dated at _____, Washington, this ____ day of _____,
20____.

The conditions of the above obligation are such that:

WHEREAS, the City of _____ has let or is about to let to the said _____
_____ the above
bounded Principal, a certain contract, the said contract being numbered XX-XX, and
providing for ***Peracetic Acid Disinfection System*** (which contract is referred to herein and is
made a part hereof as though attached hereto), and

WHEREAS, the said Principal has accepted, or is about to accept, the said contract, and
undertake to perform the work therein provided for in the manner and within the time set forth;
now, therefore,

If the said Principal, _____, shall faithfully
perform all of the provisions of said contract in the manner and within the time therein set forth,
or within such extensions of time as may be granted under said contract, and shall pay all
laborers, mechanics, subcontractors and materialmen, and all persons who shall supply said
Principal or subcontractors with provisions and supplies for the carrying on of said work, and
shall indemnify and hold the City of Snohomish harmless from any damage or expense by reason
of failure of performance as specified in said contract or from defects appearing or developing in
the material or workmanship provided or performed under said contract within a period of one
year after its acceptance thereof by the City of Snohomish, then and in that event, this obligation
shall be void; but otherwise, it shall be and remain in full force and effect.

Signed this ____ day of _____, 2018.

Surety

Principal

By _____

By _____

Title

Title

Surety Address

Agent Address

Surety Contact and Phone Number

Agent Contact and Phone Number

INSURANCE COVERAGE QUESTIONNAIRE

For:

Project Title: **Peracetic Acid Disinfection System**

Project Owner: **City of Snohomish**

Are the following coverage's and/or conditions in effect?

	Yes	No
The Policy form is ISO Commercial General Liability form GC-00 001 or GC 00 02 (Circle ONE). If no, attach a copy of the policy with required coverages clearly identified.		
The Owner, its officials, officers, employees and volunteers are additional insures as Respects (a) activities performed for the Owner by or on behalf of the Named Insured, (b) products and completed operations of the Named Insured, or (c) premises, owned, leased, or used by the Named Insured.		
Products Completed operation coverage.		
Cross Liability clause (or equivalent wording).		
Personal Injury Liability Coverage (with employee exclusion deleted)		
Broad Form Damage with XCU Hazards included.		
Blanket Contractual Liability coverage applying to this contract or Contractual Liability Coverage applying to this contract		
Employers Liability – Stop Gap		
Written notice of cancellation to the City		

Deductibles or SIRS GL_____ AL_____ Excess_____

Insurer's Best Rating GL_____ AL_____ Excess_____

This questionnaire is issued as a matter of information. This questionnaire is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies indicated on the attached Certificate of Insurance or as required by the Contract Documents

Agency/Broker

Completed by (type)

Address

Completed by (signature)

Name of Person to Contact

Telephone Number

CITY OF SNOHOMISH

**CONTRACTOR'S DECLARATION OF OPTION FOR MANAGEMENT
OF STATUTORY RETAINED PERCENTAGE**

The owner shall withhold the retained percentage for this contract from time-to-time as such retained percentage accrues and in accordance with RCW 60.28.010, 020, and 050.

OPTION A. I hereby elect to have the retained percentage for this contract held in a fund by the owner until thirty five (35) calendar days following final acceptance of the work. (No interest will be earned on the retained percentage amount under this election).

CONTRACTOR:

Date: _____

OPTION B. I hereby elect to have the owner deposit the retained percentage for this contract, from time-to-time, as such retained percentage accrues and in accordance with RCW 60.28.010, 020, and 050.

I hereby designate _____ as the depository for said funds which shall be deposited in an interest earning account subject to joint control by owner and the contractor. All interest earned on said deposits shall belong to the contractor. (If contractor fails to designate the depository then the owner designates)

I hereby further agree to be fully responsible for payment of all costs of fees incurred as a result of establishing said depository account and depositing the retained percentage as authorized by statute. The owner shall not be liable in any way for any costs or fees in connection therewith.

CONTRACTOR:

Date: _____

ATTN: FINANCE DEPARTMENT *This form is for selection of retainage option **ONLY**. **OPTION B** must have a signed Escrow Instruction/Agreement on file prior to processing retainage payment to the bank. Signed Agreement will be secured by the Purchasing Division.*

ESCROW AGREEMENT for RETAINED PERCENTAGE
Project Name, Project XX-XX

Escrow No.: _____
City of Snohomish Contract No. XX-XX
Completion Date: _____

TO:

THIS ESCROW AGREEMENT is for the investment of the retained percentage of the above contract, in accordance with chapter 60.28 of the Revised Code of Washington. It is limited to FDIC insured Washington State Chartered Banks who are covered by the State of Washington Public Deposit Protection Act.

The undersigned, _____, (as "Contractor"), has directed the CITY OF SNOHOMISH (as "City"), to deliver to you its warrants which shall be payable to you and/or the contractor. The warrants are to be held and disposed of by you in accordance with the following instruction:

INSTRUCTIONS

1. Upon delivery the warrants shall be endorsed by you and forwarded to the City for collection. You shall use the monies to purchase investments selected by the Contractor and approved by the City. You may follow the last written direction received by you from the Contractor, for each purchase, provided the direction otherwise conforms with this agreement. Acceptable investments are:
 - A. Bills, certificates, notes or bonds of the United States;
 - B. Other obligations of the United States or its agencies;
 - C. Obligations of any corporation wholly owned by the Government of the United States;
 - D. Indebtedness of the Federal National Mortgage Association;
 - E. Time deposits in commercial banks;
 - F. Other investments, except stocks, selected by the Contractor, subject to express prior written consent of the City.
2. The investments shall be in a form which allows you alone to reconvert them into money if you are required to do so by the City.
3. The investments must mature on or prior to the date set for the completion of the contract, including extension thereof or thirty (30) days following the final acceptance of the work.
4. When interest on the investments accrues and is paid, you shall collect the interest and forward it to the Contractor unless otherwise directed by the Contractor.
5. You are not authorized to deliver to the Contractor all or any part of the investments held by you pursuant to this agreement (or any monies derived from the sale of such investments, or the negotiation of the City's warrants) **except** in accordance with the written instructions from the City. Compliance with such instructions shall relieve you of any further liability related thereto.
6. In the event the City orders you, in writing, to reconvert the investments and return all monies, you shall do so within thirty (30) days of receipt of the order.
7. The Contractor agrees to compensate you for your services in accordance with your current published schedule of applicable escrow fees. Payment of all fees shall be the sole responsibility of the Contractor and shall not be deducted from any monies placed with you pursuant to this agreement until and unless the City directs the release to the Contractor of the investments and monies held hereunder, whereupon you shall be entitled to reimburse yourself from such monies for the entire amount of your fee.
8. This agreement shall not be binding until signed by both parties and accepted by you.
9. This document contains the entire agreement between you, the Contractor, and the City, with respect to this Escrow, and you are not a party to, nor bound by any instrument or agreement other than this. You shall not be required to take notice of any default or any other matter, nor be bound by nor required to give notice or demand, nor required to take any action whatever except as herein expressly provided. You shall not be liable for any loss or damage not caused by your own negligence or willful misconduct.

CONTRACTOR

Federal Tax I.D. No. _____

By: _____

Title: _____

Address: _____

Date: _____

THE ABOVE ESCROW AGREEMENT
RECEIVED AND ACCEPTED on the _____ day
of
_____ 2019.

BANK

By: _____

Title: _____

Address: _____

DISTRIBUTION:
City Clerk
Financial Institution
Contractor
File Copy

CITY OF SNOHOMISH

By: _____

Title: _____

DATE: _____

RETAINAGE RELEASE REQUIREMENTS

The following are the documents required to be on file with the City of Snohomish prior to release of retainage to the Contractor.

No.	Document	Generated by	Contact	Date Received by City
1	Contractor's Notification to City of Completion of Contract Work	Contractor	Utilities Manager	
2	Recommendation of Project Acceptance	City	Utilities Manager	
3	Final Project Acceptance	City / Council	Utilities Manager	
4	Intent to Pay Prevailing Wages	Contractor	Dept. of Labor & Industries	
5	Notification of Completion to Department of Revenue	City	Dept. of Revenue Excise Tax Division	
6	Affidavit of Wages Paid	Contractor	Dept. of Labor & Industries	
7	Certificate of Payment State Excise Tax by Public Works Contractor	State	Dept. of Revenue Excise Tax Division	
8	Release Regarding Industrial Insurance	City	Utilities Manager	
9	Certification of Payment of Contributions	State	Dept. of Employment Security	
10	Receipt for Payment in full or Release of Lien signed by Lien Claimant and filed with City	Contractor	All claims against retainage or payment Bond filed with the City	
11	Operation & Maintenance manuals with warranty documents referencing Performance Bond	Contractor	Utilities Manager	
12	Contractor's As-Built Markups	Contractor	Utilities Manager	

SECTION 2

SPECIAL PROVISIONS

INTRODUCTION TO THE SPECIAL PROVISIONS

(July 31, 2007 APWA GSP)

The work on this project shall be accomplished in accordance with the *Standard Specifications for Road, Bridge and Municipal Construction*, 2018 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter “Standard Specifications”). The Standard Specifications, as modified or supplemented by the Amendments to the Standard Specifications and these Special Provisions, all of which are made a part of the Contract Documents, shall govern all of the Work.

These Special Provisions are made up of both General Special Provisions (GSPs) from various sources, which may have project-specific fill-ins; and project-specific Special Provisions. The project-specific provisions that include supplemental specifications in Construction Specifications Institute (CSI) format are in Part 4 Technical Specifications of the Contract Documents. Each Provision supplements, modifies, or replaces the comparable Standard Specification, or is a new Provision. The deletion, amendment, alteration, or addition to any subsection or portion of the Standard Specifications is meant to pertain only to that particular portion of the section, and in no way should it be interpreted that the balance of the section does not apply.

The project-specific Special Provisions are not labeled as such. The GSPs are labeled under the headers of each GSP, with the date of the GSP and its source. For example:

(May 18, 2007 APWA GSP)
(August 7, 2006 WSDOT GSP)
(May 2014 COS)

Also incorporated into the Contract Documents by reference are:

- *Manual on Uniform Traffic Control Devices for Streets and Highways*, currently adopted edition, with Washington State modifications, if any
- *Standard Plans for Road, Bridge and Municipal Construction*, WSDOT/APWA, current edition and current amendments
- *City of Snohomish Engineering Design and Construction Standards Manual*
- American Water Works Association (AWWA) Standards, current edition
- National Electric Code (NEC), current edition
- Washington State Labor and Industries Standards, Requirements, and Policies

Contractor shall obtain copies of these publications, at Contractor’s own expense.

Wherever reference is made in the Standard Specifications to the Contracting Agency, State, Commission, Department of Transportation, Secretary of Transportation, such reference shall be deemed to be the City of Snohomish through its City Council, employees, and duly authorized representatives.

DIVISION 1 GENERAL REQUIREMENTS

DESCRIPTION OF WORK

(March 13, 1995 WSDOT GSP)

The major items of work to be accomplished on this project consist of the following modifications and additions at the Owner's existing wastewater treatment plant (WWTP):

- Install measures for temporary erosion and sediment control.
- Removal of the existing wooden structure housing the chlorine residual analyzers to clear space for new construction. This includes demolition of the conduit and wire associated with that structure
- Demolition of the existing chlorination and dechlorination equipment in the chlorine contact tank (CCT) and Chlorine Mixing Manhole.
- Demolition of existing concrete slabs and asphalt paving to construct the new PAA disinfection facility and replace damaged slabs.
- Extend potable water service to the new PAA Building.
- Construct a slab on grade for the new PAA Building.
- Install a precast vault for containment of PAA totes including associated grating and level switch.
- Install a pre-engineered metal canopy over the PAA tote storage area, including lighting, outlets and an outdoor emergency shower/eyewash.
- Install the pre-engineered PAA Building complete with the metering pump skid, a relocated residual analyzer, and required building appurtenances.
- Asphalt paving for the new PAA tote storage area.
- Install PAA, carrier water, drain and sample pipelines including associated valves, connectors, heat tracing, insulation, and other appurtenances.
- Install a remote input/output (I/O) panel in the PAA Building and connect it to existing Main Control Panel-2A (MCP-2A).
- Provide power to the PAA Building and carrier water pump from existing EMCC2.
- Modify existing PLC programming in MCP-2A and existing SCADA programming to integrate the new equipment
- Conduct startup and testing of the PAA system.
- Repair cracks in the existing CCT.

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions

(September 12, 2008 APWA GSP)

This Section is supplemented with the following:

All references in the Standard Specifications to the terms “State”, “Department of Transportation”, “Washington State Transportation Commission”, “Commission”, “Secretary of Transportation”, “Secretary”, “Headquarters”, and “State Treasurer” shall be revised to read “Contracting Agency”.

All references to “State Materials Laboratory” shall be revised to read “Contracting Agency designated location”.

The venue of all causes of action arising from the advertisement, award, execution, and performance of the contract shall be in the Superior Court of the County where the Contracting Agency’s headquarters are located.

Additive

A supplemental unit of work or group of bid items, identified separately in the Proposal, which may, at the discretion of the Contracting Agency, be awarded in addition to the base bid.

Alternate

One of two or more units of work or groups of bid items, identified separately in the proposal, from which the Contracting Agency may make a choice between different methods or material of construction for performing the same work.

Contract

The written agreement between the Contracting Agency and the Contractor. It describes, among other things:

1. What work will be done, and by when;
2. Who provides labor and materials; and
3. How Contractors will be paid

The Contract includes the Contract (Agreement) form; bidder’s completed Proposal Form, all required forms, certificates and affidavits, performance, labor and material payment bonds, the 2018 Standard Specifications for Road, Bridge and Municipal Construction and amendments thereto, Contract Provisions, Contract Plans, Standard Plans, City of Snohomish Engineering Standards and Specifications and associated Standard Details, addenda and change orders.

Contract Documents

See definition for “Contract”.

Contract Time

The period of time established by the terms and conditions of the contract within which the work must be physically completed.

Dates***Bid Opening Date***

The date on which the Contracting Agency publicly opens and reads the bids.

Award Date

The date of the formal decision of the Contracting Agency to accept the lowest responsible and responsive bidder for the work.

Contract Execution Date

The date the Contracting Agency officially binds the agency to the contract.

Notice to Proceed Date

The date stated in the Notice to Proceed on which the contract time begins.

Substantial Completion Date

The day the Engineer determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, and only minor incidental work, replacement of temporary substitute facilities, or correction or repair remains for the physical completion of the total contract.

Physical Completion Date

The day all of the work is physically completed on the project. All documentation required by the contract and required by law does not necessarily need to be furnished by the Contractor by this date.

Completion Date

The day all the work specified in the contract is completed and all the obligations of the Contractor under the contract are fulfilled by the Contractor. All documentation required by the contract and required by law must be furnished by the Contractor before establishment of this date.

Final Acceptance Date

The date on which the Contracting Agency accepts the work as complete.

Engineer

The Contracting Agency's representative, which may also be the Contracting Agency itself.

Notice of Award

The written notice from the Contracting Agency to the successful bidder signifying the Contracting Agency's acceptance of the bid.

Notice to Proceed

The written notice from the Contracting Agency or Engineer to the Contractor authorizing and directing the Contractor to proceed with the work and establishing the date on which the contract time begins.

Traffic

Both vehicular and non-vehicular traffic, such as pedestrians, bicyclists, wheelchairs, and equestrian traffic.

1-02 BID PROCEDURES AND CONDITIONS

1-02.1 Prequalification of Bidders

Delete this Section and replace it with the following:

1-02.1 Qualifications of Bidder

(March 25, 2009 APWA GSP)

Bidders must meet the minimum qualifications of RCW 39.04.350(1), as amended:

“Before award of a public works contract, a bidder must meet the following responsibility criteria to be considered a responsible bidder and qualified to be awarded a public works project. The bidder must:

- (a) At the time of bid submittal, have a certificate of registration in compliance with chapter 18.27 RCW;
- (b) Have a current state unified business identifier number;
- (c) If applicable, have industrial insurance coverage for the bidder's employees working in Washington as required in Title 51 RCW; an employment security department number as required in Title 50 RCW; and a state excise tax registration number as required in Title 82 RCW; and
- (d) Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).”
- (e) Have current bonding capacity adequate for this project.
- (f) Not have filed for bankruptcy in the last five (5) years.
- (g) Not have had their Contractor’s license revoked in the last five (5) years.

1-02.1(1) Subcontractor Responsibility

The Contractor shall include the language of this section in each of its first-tier subcontracts, and shall require each of its subcontracts to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Contracting Agency, the Contractor shall promptly provide documentation to the Contracting Agency demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this section apply to all subcontractors regardless of tier. The subcontractor shall:

- a. Have a current certificate of registration as a contractor in compliance with Chapter 18.27 RCW at the time of subcontract bid submittal;

- b. Have a current Washington Unified Business identifier (UBI) number;
- c. If applicable, have:
 - 1. Industrial insurance coverage for the subcontractor's employees working in Washington as required in Title 51 RCW;
 - 2. A Washington Employment Security Department number per Title 50 RCW;
 - 3. Washington Department of Revenue state excise tax registration number as required in Title 82 RCW; and/or
 - 4. An electrical contractor license, if required by Chapter 19.28 RCW.
- d. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).

1-02.1(2) Supplemental Bidder Responsibility Criteria

In addition to the bidder responsibility criteria above, the bidder must meet the following relevant supplemental bidder responsibility criteria applicable to the project:

- a. Bidder shall not be "inactive" or "not in good standing with the Washington State Secretary of State's Office, the Department of Revenue, or the Department of Labor and Industries.
- b. Bidder shall not have been disqualified from entering a construction contract by another governmental agency in the last two (2) years.
- c. Bidder shall not have declared bankruptcy or been in receivership in the last five (5) years.
- d. Bidder, Bidder's designated project manager, and Bidder's designated superintendent/foreman for this project shall each have successfully completed at least three (3) projects of a similar size and scope as required by the Contract Documents for this project within the last ten (10) years. In evaluating whether the project were "successfully completed," the Contracting Agency may check references for the previous projects and may evaluate the bidder's performance including but not limited to, the following areas:
 - 1. Quality control.
 - 2. Safety record.
 - 3. Timeliness of performance.
 - 4. Use of skilled personnel, including subcontractors.
 - 5. Management of subcontractors.
 - 6. Availability of and use of appropriate equipment.
 - 7. Compliance with contract documents.
 - 8. Management of submittals process, change orders and closeout.

- e. Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

For purposes of meeting this criterion, the Contracting Agency has determined that “similar size and scope” means municipal public works projects at wastewater treatment plants having a construction cost in excess of \$500,000.

1-02.1(3) Documentation

As evidence the bidder meets the responsibility criteria above, the Bidder shall complete and submit the following documentation as part of the Bidder's Bid Proposal.

- a. Bidder's Checklist.
- b. Statement of Bidder's Qualifications.

1-02.1(4) Appeals

If the Contracting Agency determines the bidder does not meet the bidder responsibility above and is therefore not a responsible bidder, the Contracting Agency 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 24 hours of receipt of the Contracting Agency's determination by presenting additional information to the Contracting Agency. The Contracting Agency will consider the additional information before issuing its final determination. If the final determination affirms that that bidder is not responsible, the Contracting Agency will not execute a contract with any other bidder until two (2) business days after the bidder determined to be not responsible has received the final determination. For purposes of this section, the date of the Contracting Agency's transmission of the Contracting Agency's determination(s) by facsimile or electronic mail to the bidder at the facsimile number or email address provided by the bidder in its bid shall constitute the date of receipt by the bidder of the written notices provided for herein.

1-02.2 Plans and Specifications

(October 1, 2005 APWA GSP)

Delete this section and replace it with the following:

Information as to where Bid Documents can be obtained or reviewed will be found in the Call for Bids (Advertisement for Bids) for the work.

After award of the contract, plans and specifications will be issued to the Contractor at no cost as detailed below:

To Prime Contractor	No. of Sets	Basis of Distribution
Contract Provisions	2	Furnished automatically upon award.
Large plans (e.g., 22" x 34")	2	Furnished automatically upon award.

Additional plans and Contract Provisions may be obtained from the City if needed upon request.

1-02.4 Examination Of Plans, Specifications And Site Of Work

(March 13, 1995 WSDOT GSP)

1-02.4(1) General

(May 2014 COS)

This Section is supplemented with the following:

Contractor shall review the entire Contract to ensure that the completeness of their Proposal includes all items of Work regardless of where shown on the Plans and in the Contract. Bidders are cautioned that alternate sources of information (copies of the Contract obtained from third parties) are not necessarily an accurate or complete representation of the Plans and Contract. Bidders shall use such information at their own risk.

1-02.5 Proposal Forms

(October 1, 2005 APWA GSP)

Delete this section and replace it with the following:

At the request of a bidder, the Contracting Agency will provide a proposal form for any project on which the bidder is eligible to bid.

The proposal form will identify the project and its location and describe the work. It will also list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for, but are not limited to, unit prices; extensions; summations; the total bid amount; signatures; date; and, where applicable, retail sales taxes and acknowledgment of addenda; the bidder's name, address, telephone number, and signature; the bidder's D/M/WBE commitment, if applicable; a State of Washington Contractor's Registration Number; and a Business License Number, if applicable. Bids shall be completed by typing or shall be printed in ink by hand, preferably in black ink. The required certifications are included as part of the proposal form.

The Contracting Agency reserves the right to arrange the proposal forms with alternates and additives, if such be to the advantage of the Contracting Agency. The bidder shall bid on all alternates and additives set forth in the proposal forms unless otherwise specified.

Any correction to a bid made by interlineation, alteration, or erasure, shall be initialed by the signer of the bid. The bidder shall make no stipulation on the Bid Form, nor qualify the bid in any manner.

A bid by a corporation shall be executed in the corporate name, by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign).

A bid by a partnership shall be executed in the partnership name, and signed by a partner. A copy of the partnership agreement shall be submitted with the Bid Form if any D/M/WBE requirements are to be satisfied through such an agreement.

A bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture. A copy of the joint venture agreement shall be submitted with the Bid Form if any D/W/MBE requirements are to be satisfied through such an agreement.

1-02.7 Bid Deposit

(October 1, 2005 APWA GSP)

Supplement this section with the following:

Bid bonds shall contain the following:

1. Contracting Agency-assigned number for the project;
2. Name of the project;
3. The Contracting Agency named as obligee;
4. The amount of the bid bond stated either as a dollar figure or as a percentage which represents five percent of the maximum bid amount that could be awarded;
5. Signature of the bidder's officer empowered to sign official statements. The signature of the person authorized to submit the bid should agree with the signature on the bond, and the title of the person must accompany the said signature;
6. The signature of the surety's officer empowered to sign the bond and the power of attorney.

The bidder must use the bond form included in the Contract Provisions.

1-02.9 Delivery of Proposal

(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

Each proposal shall be submitted in a sealed envelope, with the Project Name and Project Number as stated in the Advertisement for Bids clearly marked on the outside of the envelope, or as otherwise stated in the Bid Documents, to ensure proper handling and delivery.

1-02.13 Irregular Proposals

(March 25, 2009 APWA GSP)

Revise item 1 to read:

1. A proposal will be considered irregular and will be rejected if:
 - a. The Bidder is not prequalified when so required;

- b. The authorized proposal form furnished by the Contracting Agency is not used or is altered;
- c. The completed proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
- d. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
- e. A price per unit cannot be determined from the Bid Proposal;
- f. The Proposal form is not properly executed;
- g. The Bidder fails to submit or properly complete a Subcontractor list, if applicable, as required in Section 1-02.6;
- h. The Bidder fails to submit or properly complete a Disadvantaged, Minority or Women's Business Enterprise Certification, if applicable, as required in Section 1-02.6;
- i. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
- j. More than one proposal is submitted for the same project from a Bidder under the same or different names.

1-02.14 Disqualification of Bidders

(March 25, 2009 APWA GSP, Option B)

Delete this Section and replace it with the following:

A Bidder will be deemed not responsible if:

- 1. the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or
- 2. evidence of collusion exists with any other Bidder or potential Bidder. Participants in collusion will be restricted from submitting further bids; or
- 3. the Bidder, in the opinion of the Contracting Agency, is not qualified for the work or to the full extent of the bid, or to the extent that the bid exceeds the authorized prequalification amount as may have been determined by a prequalification of the Bidder; or
- 4. an unsatisfactory performance record exists based on past or current Contracting Agency work or for work done for others, as judged from the standpoint of conduct of the work; workmanship; or progress; inability to complete the contract within the allocated contract days on one or more past contracting agency projects; affirmative action; equal employment opportunity practices; termination for cause; or Disadvantaged Business Enterprise, Minority Business Enterprise, or Women's Business Enterprise utilization; or

5. there is uncompleted work (Contracting Agency or otherwise), which in the opinion of the Contracting Agency might hinder or prevent the prompt completion of the work bid upon; or
6. the Bidder failed to settle bills for labor or materials on past or current contracts, unless there are extenuating circumstances acceptable to the Contracting Agency; or
7. the Bidder has failed to complete a written public contract or has been convicted of a crime arising from a previous public contract, unless there are extenuating circumstances acceptable to the Contracting Agency; or
8. the Bidder is unable, financially or otherwise, to perform the work, in the opinion of the Contracting Agency; or
9. there are any other reasons deemed proper by the Contracting Agency.

As evidence that the Bidder meets the bidder responsibility criteria above, the apparent two lowest Bidders must submit to the Contracting Agency within 24 hours of the bid submittal deadline, documentation (sufficient in the sole judgment of the Contracting Agency) demonstrating compliance with all applicable responsibility criteria, including all documentation specifically listed in the supplemental criteria. The Contracting Agency reserves the right to request such documentation from other Bidders as well, and to request further documentation as needed to assess bidder responsibility.

The basis for evaluation of Bidder compliance with these supplemental criteria shall be any documents or facts obtained by Contracting Agency (whether from the Bidder or third parties) which any reasonable owner would rely on for determining such compliance, including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Contracting Agency from owners for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Contracting Agency which is believed to be relevant to the matter.

If the Contracting Agency determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Contracting Agency 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 24 hours of receipt of the Contracting Agency's determination by presenting its appeal to the Contracting Agency. The Contracting Agency will consider the appeal before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Contracting Agency will not execute a contract with any other Bidder until at least two business days after the Bidder determined to be not responsible has received the final determination.

1-02.15 Pre-Award Information

(October 1, 2005 APWA GSP)

Revise this section to read:

Before awarding any contract, the Contracting Agency may require one or more of these items or actions of the apparent lowest responsible bidder:

1. A complete statement of the origin, composition, and manufacture of any or all materials to be used,
2. Samples of these materials for quality and fitness tests,
3. A progress schedule (in a form the Contracting Agency requires) showing the order of and time required for the various phases of the work,
4. A breakdown of costs assigned to any bid item,
5. Attendance at a conference with the Engineer or representatives of the Engineer,
6. Obtain, and furnish a copy of, a business license to do business in the city or county where the work is located.
7. A copy of State of Washington Contractor's Registration, or
8. Any other information or action taken that is deemed necessary to ensure that the bidder is the lowest responsible bidder.

1-03 AWARD AND EXECUTION OF CONTRACT

1-03.3 Execution of Contract

(October 1, 2005 APWA GSP)

Revise this section to read:

Copies of the Contract Provisions, including the unsigned Form of Contract, will be available for signature by the successful bidder on the first business day following award. The number of copies to be executed by the Contractor will be determined by the Contracting Agency.

Within ten (10) working days after the award date, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Contracting Agency, the successful bidder shall provide any pre-award information the Contracting Agency may require under Section 1-02.15.

Until the Contracting Agency executes a contract, no proposal shall bind the Contracting Agency nor shall any work begin within the project limits or within Contracting Agency-furnished sites. The Contractor shall bear all risks for any work begun outside such areas and for any materials ordered before the contract is executed by the Contracting Agency.

If the bidder experiences circumstances beyond their control that prevents return of the contract documents within the calendar days after the award date stated above, the Contracting Agency may grant up to a maximum of ten (10) working additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

1-03.4 Contract Bond
(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

The successful bidder shall provide an executed contract bond for the full contract amount. This contract bond shall:

1. Be on a Contracting Agency-furnished form;
2. Be signed by an approved surety (or sureties) that:
 - a. Is registered with the Washington State Insurance Commissioner, and
 - b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
3. Be conditioned upon the faithful performance of the contract by the Contractor within the prescribed time;
4. Guarantee that the surety shall indemnify, defend, and protect the Contracting Agency against any claim of direct or indirect loss resulting from the failure:
 - a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the contract, or
 - b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, material person, or any other person who provides supplies or provisions for carrying out the work;
5. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).

1-04 SCOPE OF THE WORK

Section 1-04 of the Standard Specifications is supplemented with Section 01010 of the Technical Specifications.

1-04.2 Coordination of Contract Documents, Plans, Special Provisions, Specifications, and Addenda

(October 1, 2005 APWA GSP)

Revise the second paragraph to read:

Any inconsistency in the parts of the contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 2 over 3, 3 over 4, and so forth):

1. Addenda,
2. Proposal Form,
3. Special Provisions, including APWA General Special Provisions, if they are included,
4. Contract Plans (Drawings),
5. Amendments to the Standard Specifications,
6. WSDOT Standard Specifications for Road, Bridge and Municipal Construction current edition,
7. Contracting Agency's Standard Plans (if any), and
8. WSDOT Standard Plans for Road, Bridge, and Municipal Construction.

1-04.6 Variation in Estimated Quantities Replacement

Section 1-04.6 is hereby deleted and replaced with the following:

Payment to the Contractor will be made only for the actual quantities of work performed and accepted in conformance with the contract. When the actual accepted quantity of work performed under a unit item varies from the original proposal quantity, payment will be at the unit contract price for all work and within the original time for completion. No adjustment for increased or decreased quantities will be paid. Payment shall be for only approved actual quantities of work performed and accepted in conformance with the contract.

1-04.11 Final Cleanup

Section 1-04.11 of the Standard Specifications is replaced by Paragraphs 1.02, 1.03 and 1.04 of Section 01710 of the Technical Specifications.

1-05 CONTROL OF WORK

Section 1-05 of the Standard Specifications is supplemented by Section 01500 of the Technical Specifications.

1-05.7 Removal of Defective and Unauthorized Work

(October 1, 2005 APWA GSP)

Supplement this section with the following:

If the Contractor fails to remedy defective or unauthorized work within the time specified in a written notice from the Engineer, or fails to perform any part of the work required by the Contract Documents, the Engineer may correct and remedy such work as may be identified in the written notice, with Contracting Agency forces or by such other means as the Contracting Agency may deem necessary.

If the Contractor fails to comply with a written order to remedy what the Contracting Agency determines to be an emergency situation, the Contracting Agency may have the defective and unauthorized work corrected immediately, have the rejected work removed and replaced, or have work the Contractor refuses to perform completed by using Contracting Agency or other forces. An emergency situation is any situation when, in the opinion of the Contracting Agency or Engineer, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

Direct or indirect costs incurred by the Contracting Agency attributable to correcting and remedying defective or unauthorized work, or work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Engineer from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

No adjustment in contract time or compensation will be allowed because of the delay in the performance of the work attributable to the exercise of the Contracting Agency's rights provided by this Section.

The rights exercised under the provisions of this section shall not diminish the Contracting Agency's right to pursue any other avenue for additional remedy or damages with respect to the Contractor's failure to perform the work as required.

1-05.9 Equipment

Section 1-05.9 of the Standard Specifications is replaced by Sections 01660 and 01730 of the Technical Specifications.

1-05.11 Final Inspection

Delete this section and replace it with the following, which is also supplemented by Paragraph 1.06 of Section 01710 of the Technical Specifications, and Section 01660 of the Technical Specifications:

1-05.11 Final Inspections and Operational Testing

(October 1, 2005 APWA GSP)

1-05.11(1) Substantial Completion Date

When the Contractor considers the work to be substantially complete, the Contractor shall so notify the Engineer and request the Engineer establish the Substantial Completion Date. The Contractor's request shall list the specific items of work that remain to be completed in order to reach physical completion. The Engineer will schedule an inspection of the work with the Contractor to determine the status of completion. The Engineer may also establish the Substantial Completion Date unilaterally.

If, after this inspection, the Engineer concurs with the Contractor that the work is substantially complete and ready for its intended use, the Engineer, by written notice to the Contractor, will set the Substantial Completion Date. If, after this inspection the Engineer does not consider the work substantially complete and ready for its intended use, the Engineer will, by written notice, so notify the Contractor giving the reasons therefore.

Upon receipt of written notice concurring in or denying substantial completion, whichever is applicable, the Contractor shall pursue vigorously, diligently and without unauthorized interruption, the work necessary to reach Substantial and Physical Completion. The Contractor shall provide the Engineer with a revised schedule indicating when the Contractor expects to reach substantial and physical completion of the work.

The above process shall be repeated until the Engineer establishes the Substantial Completion Date and the Contractor considers the work physically complete and ready for final inspection.

1-05.11(2) Final Inspection and Physical Completion Date

When the Contractor considers the work physically complete and ready for final inspection, the Contractor by written notice, shall request the Engineer to schedule a final inspection. The Engineer will set a date for final inspection. The Engineer and the Contractor will then make a final inspection and the Engineer will notify the Contractor in writing of all particulars in which the final inspection reveals the work incomplete or unacceptable. The Contractor shall immediately take such corrective measures as are necessary to remedy the listed deficiencies. Corrective work shall be pursued vigorously, diligently, and without interruption until physical completion of the listed deficiencies. This process will continue until the Engineer is satisfied the listed deficiencies have been corrected.

If action to correct the listed deficiencies is not initiated within 7 days after receipt of the written notice listing the deficiencies, the Engineer may, upon written notice to the Contractor, take whatever steps are necessary to correct those deficiencies pursuant to Section 1-05.7.

The Contractor will not be allowed an extension of contract time because of a delay in the performance of the work attributable to the exercise of the Engineer's right hereunder.

Upon correction of all deficiencies, the Engineer will notify the Contractor and the Contracting Agency, in writing, of the date upon which the work was considered physically complete. That date shall constitute the Physical Completion Date of the contract, but shall not imply acceptance of the work or that all the obligations of the Contractor under the contract have been fulfilled.

1-05.12 Final Acceptance

Section 1-05.12 is supplemented by Paragraph 1.05 of Section 01710 of the Technical Specifications.

1-05.13 Superintendents, Labor and Equipment of Contractor

(March 25, 2009 APWA GSP)

Revise the seventh paragraph to read:

Whenever the Contracting Agency evaluates the Contractor's qualifications pursuant to Section 1-02.14, it will take these performance reports into account.

1-05.15 Method of Serving Notices

(March 25, 2009 APWA GSP)

Revise the second paragraph to read:

All correspondence from the Contractor shall be directed to the Contracting Agency. All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, must be in paper format, hand delivered or sent via mail delivery service to the Contracting Agency. Electronic copies such as e-mails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

Add the following new section:

1-05.16 Water and Power

(October 1, 2005 APWA GSP)

The Contractor shall make necessary arrangements, and shall bear the costs for making and removing temporary connections to available power and water sources necessary for the

performance of the work. Available power and water sources shall be as identified by the Contracting Agency and within the Contract Documents.

Add the following new section:

1-05.17 Oral Agreements
(October 1, 2005 AWP A GSP)

No oral agreement or conversation with any officer, agent, or employee of the Contracting Agency, either before or after execution of the contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the contract. Such oral agreement or conversation shall be considered as unofficial information and in no way binding upon the Contracting Agency, unless subsequently put in writing and signed by the Contracting Agency.

Add the following new section:

1-05.18 Record Drawings
(March 8, 2013 APWA GSP)

The Contractor shall maintain one set of full-size plans for Record Drawings, updated with clear and accurate red-lined field revisions on a daily basis, and within 2 business days after receipt of information that a change in Work has occurred. The Contractor shall not conceal any work until the required information is recorded.

This Record Drawing set shall be used for this purpose alone, shall be kept separate from other Plan sheets, and shall be clearly marked as Record Drawings. These Record Drawings shall be kept on site at the Contractor's field office, and shall be available for review by the Contracting Agency or its representative at all times.

The preparation and upkeep of the Record Drawings is to be the assigned responsibility of a single, experienced, and qualified individual. The quality of the Record Drawings, in terms of accuracy, clarity, and completeness, is to be adequate to allow the Contracting Agency to modify the computer-aided drafting (CAD) Contract Drawings to produce a complete set of Record Drawings for the Contracting Agency without further investigative effort by the Contracting Agency.

The Record Drawing markups shall document all changes in the Work, both concealed and visible. Items that must be shown on the markups include but are not limited to:

- Actual dimensions, arrangement, and materials used when different than shown in the Plans.
- Changes made by Change Order or Field Order.
- Changes made by the Contractor.

- Accurate locations of storm sewer, sanitary sewer, water mains and other water appurtenances, structures, conduits, light standards, vaults, width of roadways, sidewalks, landscaping areas, building footprints, channelization and pavement markings, etc. Include pipe invert elevations, top of castings (manholes, inlets, etc.).
- Include the locations and elevations of existing utilities which may have been encountered during excavation under this contract.
- Show location of new structures, equipment, items and objects by field measurements consisting of at least two (2) ties to permanent surface objects such as hydrants, buildings, etc.

If the Contract calls for the Contracting Agency to do all surveying and staking, the Contracting Agency will provide the elevations at the tolerances the Contracting Agency requires for the Record Drawings.

When the Contract calls for the Contractor to do the surveying/staking, the applicable tolerance limits include, but are not limited to the following:

	<u>Vertical</u>	<u>Horizontal</u>
As-built sanitary & storm invert and grate elevations	± 0.01 foot	± 0.01 foot
As-built monumentation	± 0.001 foot	± 0.001 foot
As-built waterlines, inverts, valves, hydrants	± 0.10 foot	± 0.10 foot
As-built ponds/swales/water features	± 0.10 foot	± 0.10 foot
As-built buildings (fin. Floor elev.)	± 0.01 foot	± 0.10 foot
As-built gas lines, power, TV, Tel, Com	± 0.10 foot	± 0.10 foot
As-built signs, signals, etc.	N/A	± 0.10 foot

Making Entries on the Record Drawings:

- Use erasable colored pencil (not ink) for all markings on the Record Drawings, conforming to the following color code:
 - Additions - Red
 - Deletions - Green
 - Comments - Blue
 - Dimensions - Graphite
- Provide the applicable reference for all entries, such as the change order number, the request for information (RFI) number, or the approved shop drawing number.
- Date all entries.
- Clearly identify all items in the entry with notes similar to those in the Contract Drawings (such as pipe symbols, centerline elevations, materials, pipe joint abbreviations, etc.).

The Contractor shall certify on the Record Drawings that said drawings are an accurate depiction of built conditions, and in conformance with the requirements detailed above. The Contractor shall submit final Record Drawings to the Contracting Agency. Contracting Agency acceptance of the Record Drawings is one of the requirements for achieving Physical Completion.

It is also acceptable to generate pdf record drawings using Acrobat or BlueBeam ReVu provided that the same marking colors and system are used on the pdf Record Drawings.

Release of the final contract retainage and closure of the construction contract for this project will not occur until delivery and approval of the Record Drawings has occurred.

1-06 CONTROL OF MATERIAL

1-06.1 Approval of Materials Prior to Use

Section 1-06.1 of the Standard Specifications is replaced by Sections 01300 of the Technical Specifications.

1-06.2 Acceptance of Materials

Section 1-06.2 of the Standard Specifications is replaced by Section 01400 of the Technical Specifications.

1-06.3 Manufacturer's Certificate of Compliance

Delete Section 1-06.3 of the Standard Specifications.

1-06.5 Owners Manuals and Operating Instructions

Section 1-06.5 of the Standard Specifications is replaced by Section 01730 of the Technical Specifications.

1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 Laws To Be Observed

(May 2014 COS)

Section 1-07.1 of the Standard Specifications is supplemented with Section 01410 of the Technical Specification and the following:

In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

The Contractor shall maintain at the project site office, or other well known place at the project site, all articles necessary for providing first aid to the injured. The Contractor shall establish, publish, and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor's care, persons, including employees, who may have been injured on the project site. Employees should not be permitted to work on the project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

All work under this contract shall be performed in a safe manner. The Contractor all Subcontractors shall observe all rules and regulations of the Washington State Department of Labor and Industries, rules and regulations of OSHA, WISHA or any other jurisdiction, and all other applicable safety standards. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

The Engineer's and Contracting Agency's review of the Contractor's work plan, safety plan, schedule or performance does not and is not intended to include review or approval of the adequacy of the Contractor's safety measures in, on, or near the construction site. The Engineer or Contracting Agency does not purport to be a safety expert, is not engaged in that capacity under the 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 thereof.

The Contractor shall exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees and property. All exposed moving parts of equipment capable of inflicting injury by accidental contact shall be protected with sturdy removable guards in accordance with applicable safety regulations.

1-07.2 State Sales Tax

Delete this section, including its sub-sections, in its entirety and replace it with the following:

1-07.2 State Sales Tax

(October 1, 2005 APWA GSP)

1-07.2(1) General

The Washington State Department of Revenue has issued special rules on the State sales tax. Sections 1-07.2(1) through 1-07.2(4) are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area.

The Contracting Agency will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 1-07.2(3) describes this exception.

The Contracting Agency will pay the retained percentage only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.050). The Contracting Agency may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to this contract or not. Any amount so deducted will be paid into the proper State fund.

1-07.2(2) State Sales Tax — Rule 171

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

1-07.2(3) State Sales Tax — Rule 170

WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Contracting Agency, retail sales tax on the full contract price. The Contracting Agency will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

Exception: The Contracting Agency will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

1-07.2(4) Services

The Contractor shall not collect retail sales tax from the Contracting Agency on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

1-07.5 Environmental Regulations

Section 1-07.5 is supplemented with Section 01410 of the Technical Specifications and the following:

(August 3, 2009 WSDOT GSP)

Environmental Commitments

The following Provisions summarize the requirements, in addition to those required elsewhere in the Contract Documents, or imposed upon the Contracting Agency by the various documents referenced in the Special Provision Section 1-07.6 PERMITS AND LICENSES. Throughout the work, the Contractor shall comply with the following requirements:

General

The Contractor shall ensure that the Project Manager representing the Prime Contractor and all Subcontractors has read and understands this Special Provision. Prior to commencing any work on site, the Contractor shall provide the Contracting Agency with a signed statement from the Project Manager stating that the Project Manager has read, understands and will abide by the conditions of this Special Provision. This statement may be part of the interim operations plan submitted under Section 01040 of the Technical Specifications.

Wetlands and Water Quality

The following restrictions and requirements pertain to work throughout the project limits:

Areas set aside for wash out of concrete delivery trucks, pumping equipment, and tools shall be approved by the Engineer. This area shall not have any possibility of draining to storm drainage infrastructure or waters of the State including wetlands. During any operation involving saw cutting of concrete, a vacuum method to collect all concrete dust and debris shall be used at all times. Additionally, all water generated by the cutting operation shall be controlled and contained, to be disposed of on land with no possibility of entry to waters of the State, including wetlands.

Payment

All costs to comply with this special provision for the environmental commitments and requirements are incidental to the contract and are the responsibility of the Contractor. The Contractor shall include all related costs in the associated bid prices of the contract.

1-07.6 Permits and Licenses

Supplement Section 1-07.6 of the Standard Specifications with Section 01410 of the Technical Specifications.

1-07.15 Environmental Regulations

Supplement Section 1-07.15 of the Standard Specifications with Paragraphs 1.11, 1.12 and 1.13 of Section 01500 of the Technical Specifications.

1-07.16 Protection and Restoration of Property

Supplement Section 1-07.16 of the Standard Specifications with Paragraphs 1.10, 1.14, 1.15, 1.16 and 1.17 of Section 01500 of the Technical Specifications.

1-07.17 Utilities and Similar Facilities

(May 2014 COS)

This Section is supplemented with the following:

Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring or other verification.

Utility Locations

The following addresses and telephone numbers of utility companies known or suspected of having facilities within the project limits are supplied for the Contractor's convenience in the table below:

WWTP City of Snohomish Duane Leach WWTP Senior Operator 360-568-0160	Water Quality Control Specialist City of Snohomish Ann Ray 425-328-0059
Water City of Snohomish Joe Palmer Water Division Lead 425-328-0068	Sewer and Storm Drain City of Snohomish Dereck DeBardi Sewer and Water Division Lead 425-328-6251

Power Snohomish County PUD 360-563-2218	Gas Puget Sound Energy 1-888-225-5773
Cable Comcast 425-754-0064	Phone Frontier 425-231-4609

1-07.17(2) Utility Construction, Removal, or Relocation by Others
(May 2014 COS)

Delete this Section in its entirety and replace with the following:

Any authorized agent of the Contracting Agency or utility owners may enter the right-of-way to repair, rearrange, alter, or connect their equipment. The Contractor shall cooperate with such effort and shall avoid creating delays or hindrances to those doing the work. As needed, the Contractor shall arrange to coordinate work schedules.

The Contractor shall carry out the Work in a way that will minimize interference and delay for all forces involved. Any costs incurred prior to the utility owners anticipated completion (or if no completion is specified, within a reasonable period of time) that results from the coordination and prosecution of the Work regarding utility adjustment, relocation, replacement, or construction shall be at the Contractor's expense.

Payment

All costs to comply with this Section and repair specified in this Section, unless otherwise stated, are incidental to the Contract and are the responsibility of the Contractor. The Contractor shall include all related costs in the bid prices of the Contract.

1-07.18 Public Liability and Property Damage Insurance

Delete this section in its entirety, and replace it with the following:

1-07.18 Insurance
(May 10, 2006 APWA GSP)

1-07.18(1) General Requirements

- A. The Contractor shall obtain the insurance described in this section from insurers approved by the State Insurance Commissioner pursuant to RCW Title 48. The insurance must be provided by an insurer with a rating of A-: VII or higher in the A.M. Best's Key Rating Guide, which is licensed to do business in the state of Washington (or issued as a surplus line by a Washington Surplus lines broker). The Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.

- B. The Contractor shall keep this insurance in force during the term of the contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated (see C. below).
- C. If any insurance policy is written on a claim made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall state that coverage is claims made, and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Final Completion or earlier termination of this contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period (“tail”) or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.
- D. The insurance policies shall contain a “cross liability” provision.
- E. The Contractor’s and all subcontractors’ insurance coverage shall be primary and non-contributory insurance as respects the Contracting Agency’s insurance, self-insurance, or insurance pool coverage.
- F. All insurance policies and Certificates of Insurance shall include a requirement providing for a minimum of 45 days prior written notice to the Contracting Agency of any cancellation in any insurance policy.
- G. Upon request, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s).
- H. The Contractor shall not begin work under the contract until the required insurance has been obtained and approved by the Contracting Agency.
- I. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the Contracting Agency may, after giving five business days notice to the Contractor to correct the breach, immediately terminate the contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Contracting Agency on demand, or at the sole discretion of the Contracting Agency, offset against funds due the Contractor from the Contracting Agency.
- J. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the contract and no additional payment will be made.

1-07.18(2) Additional Insured

All insurance policies, with the exception of Professional Liability and Workers Compensation, shall name the following listed entities as additional insured(s):

- the Contracting Agency and its officers, elected officials, employees, agents, and volunteers

- BHC Consultants, LLC

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, whether primary, excess, contingent or otherwise, irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 1-07.18(3) describes limits lower than those maintained by the Contractor.

1-07.18(3) Subcontractors

Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 1-07.18(5)A and 1-07.18(5)B. Upon request of the Contracting Agency, the Contractor shall provide evidence of such insurance.

1-07.18(4) Evidence of Insurance

The Contractor shall deliver to the Contracting Agency a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. The certificate and endorsements must conform to the following requirements:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in 1-07.18(2) as Additional Insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement. A statement of additional insured status on an ACORD Certificate of Insurance shall not satisfy this requirement.
3. Any other amendatory endorsements to show the coverage required herein.

1-07.18(5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve the Contractor from liability in excess of such limits. All deductibles and self-insured retentions must be disclosed and are subject to approval by the Contracting Agency. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

1-07.18(5)A Commercial General Liability

A policy of Commercial General Liability Insurance, including:

Per project aggregate
Premises/Operations Liability
Products/Completed Operations – for a period of one year following final acceptance of the work.
Personal/Advertising Injury
Contractual Liability
Independent Contractors Liability
Stop Gap / Employers' Liability

Explosion, Collapse, or Underground Property Damage (XCU)

Such policy must provide the following minimum limits:

- \$1,000,000 Each Occurrence
- \$3,000,000 General Aggregate
- \$1,000,000 Products & Completed Operations Aggregate
- \$1,000,000 Personal & Advertising Injury, each offence

Stop Gap / Employers' Liability

- \$1,000,000 Each Accident
- \$1,000,000 Disease - Policy Limit
- \$1,000,000 Disease - Each Employee

1-07.18(5)B Automobile Liability

Automobile Liability for owned, non-owned, hired, and leased vehicles, with an MCS 90 endorsement and a CA 9948 endorsement attached if “pollutants” are to be transported. Such policy(ies) must provide the following minimum limit:

- \$1,000,000 combined single limit

1-07.18(5)C Workers' Compensation

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

1-07.18(5)F Excess or Umbrella Liability

The Contractor shall provide Excess or Umbrella Liability coverage at limits of \$2,000,000 per occurrence and annual aggregate. This excess or umbrella liability coverage shall apply, at a minimum, to both the Commercial General and Auto insurance policy coverage.

1-07.24 Rights of Way

(October 1, 2005 APWA GSP)

Delete this section in its entirety, and replace it with the following:

Limits of project activity are indicated in the Plans. The Contractor's work activities shall be confined within these limits, unless arrangements for use of private property or other City property are made.

Whenever any of the work is accomplished on or through property other than public right of way, the Contractor shall meet and fulfill all covenants and stipulations of any easement agreement obtained by the Contracting Agency from the owner of the private property. However, no easements or rights of entry have been acquired nor are deemed necessary for completion of the work and are considered optional.

The Contractor shall not proceed with any portion of the work in areas where right of way, easements or rights of entry have not been acquired until the Contracting Agency certifies to the Contractor that the right of way or easement is available or that the right of entry has been received. Each property owner shall be given 48 hours notice prior to entry by the Contractor.

The Contractor shall be responsible for providing, without expense or liability to the Contracting Agency, any additional land and access thereto that the Contractor may desire for temporary construction facilities, storage of materials, or other Contractor needs. However, before using any private property, whether adjoining the work or not, the Contractor shall file with the Engineer a written permission of the private property owner, and, upon vacating the premises, a written release from the property owner of each property disturbed or otherwise interfered with by reasons of construction pursued under this contract. The statement shall be signed by the private property owner, or proper authority acting for the owner of the private property affected, stating that permission has been granted to use the property and all necessary permits have been obtained or, in the case of a release, that the restoration of the property has been satisfactorily accomplished. The statement shall include the parcel number, address, and date of signature. Written releases must be filed with the Engineer before the Completion Date will be established.

1-08 PROSECUTION AND PROGRESS

Add the following new section:

1-08.0 Preliminary Matters *(May 25, 2006 APWA GSP)*

Add the following new section:

1-08.0(1) Preconstruction Conference *(October 10, 2008 APWA GSP)*

Prior to the Contractor beginning the work, a preconstruction conference will be held between the Contractor, the Engineer and such other interested parties as may be invited. The purpose of the preconstruction conference will be:

1. To review the initial progress schedule;
2. To establish a working understanding among the various parties associated or affected by the work;
3. To establish and review procedures for progress payment, notifications, approvals, submittals, etc.;
4. To establish normal working hours for the work;
5. To review safety standards and traffic control; and

6. To discuss such other related items as may be pertinent to the work.

The Contractor shall prepare and submit at the preconstruction conference the following:

1. A schedule of values;
2. A preliminary schedule of submittals;
3. A list of subcontractors;
4. Initial Work Schedule.

Add the following new section:

1-08.0(2) Hours of Work

(May 25, 2006 APWA GSP)

Except in the case of emergency or unless otherwise approved by the Contracting Agency, the normal straight time working hours for the contract shall be a consecutive 8-hour period between 7:00 a.m. and 6:00 p.m. with a maximum 1-hour lunch break Monday through Friday, unless otherwise approved by the Contracting Agency. The normal straight time 8-hour working period for the contract shall be established at the preconstruction conference or prior to the Contractor commencing the work.

If a Contractor desires to perform work on holidays, Saturdays, Sundays, or before 7:00 a.m. or after 6:00 p.m. on any day, the Contractor shall apply in writing to the Contracting Agency for permission to work such times. Permission to work longer than an 8-hour period between 7:00 a.m. and 6:00 p.m. is not required. Such requests shall be submitted to the Contracting Agency no later than noon on the working day prior to the day for which the Contractor is requesting permission to work.

Permission to work between the hours of 10:00 p.m. and 7:00 a.m. during weekdays and between the hours of 10:00 p.m. and 9:00 a.m. on weekends or holidays may also be subject to noise control requirements. Approval to continue work during these hours may be revoked at any time the Contractor exceeds the Contracting Agency's noise control regulations or complaints are received from the public or adjoining property owners regarding the noise from the Contractor's operations. The Contractor shall have no claim for damages or delays should such permission be revoked for these reasons.

Permission to work Saturdays, Sundays, holidays or other than the agreed upon normal straight time working hours Monday through Friday may be given subject to certain other conditions set forth by the Contracting Agency. These conditions may include but are not limited to: requiring the Contracting Agency to be present during the work; requiring the Contractor to reimburse the Contracting Agency for the costs in excess of straight-time costs for Contracting Agency employees who worked during such times, on non Federal aid projects; considering the work performed on Saturdays, Sundays, and holidays as working days with regards to the contract time even though the multiple shifts occur in a single 24-hour period. Assistants may include, but are not limited to, WWTP staff, inspectors, and

other Contracting Agency employees when in the opinion of the Contracting Agency, such work necessitates their presence.

1-08.3 Progress Schedule

Section 1-08.3 of the Standard Specifications is replaced by Paragraph 1.06 of Section 01010 of the Technical Specifications.

1-08.4 Prosecution of Work

Section 1-08.4 of the Standard Specifications shall be replaced with following and supplemented by Section 01040 of the Technical Specifications:

1-08.4 Notice to Proceed and Prosecution of the Work

(October 1, 2005 APWA GSP)

Notice to Proceed will be given after the contract has been executed and the contract bond and evidence of insurance have been approved and filed by the Contracting Agency. The Contractor shall not commence with the work until the Notice to Proceed has been given by the Contracting Agency. The Contractor shall commence construction activities on the project site within ten (10) working days of the Notice to Proceed Date, unless otherwise approved in writing. The Contractor shall diligently pursue the work to the physical completion date within the time specified in the contract. Voluntary shutdown or slowing of operations by the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

1-08.5 Time for Completion

(May 2014 COS)

Delete this Section in its entirety and replace with the following:

The Contractor shall complete all Contract Work within the number of “working days” stated in the Contract Provisions or as extended by the Contracting Agency in accordance with Section 1-08.8. In lieu of approved extensions, the Contract Work will be performed within a 160-working day duration. Every day will be counted as a “working day” unless it is a nonworking day or an Engineer determined unworkable day. A nonworking day is defined as a Saturday, a Sunday, a day on which the Contract specifically suspends Work, or one of these holidays: January 1, the third Monday of January, the third Monday of February, Memorial Day, July 4, Labor Day, November 11, Thanksgiving, and Christmas Day. When any of these holidays fall on a Sunday, the following Monday shall be counted a nonworking day. When the holiday falls on a Saturday, the preceding Friday shall be counted a nonworking day. The days between December 25 and January 1 will be classified as nonworking days, provided the Contractor actually suspends performance of the Work.

Any unworkable day is defined as a half or whole day the Engineer declares to be unworkable because of weather or conditions caused by the weather that prevents satisfactory and timely performance of the Work shown on the critical path of the Contractor’s approved

progress schedule. Other conditions beyond the control of the Contractor may qualify for an extension of time in accordance with Section 1-08.8.

The Contract time shall begin on the first working day following the 10th calendar day after the issuance of the written notice to proceed or the first day on which the Contractor begins to perform Work on the site, whichever first occurs, unless approved otherwise by the Contracting Agency. The Contract Provisions may specify another starting date for the Contract time, in which case time will begin on the starting date specified.

Each working day shall be charged to the Contract as it occurs until the Work is physically complete. If requested by the Contractor in writing, the Contracting Agency will provide the Contractor with a weekly statement that shows the number of working days: (1) charged to the Contract the week before; (2) specified for the substantial and physical completion of the Contract; and (3) remaining for the physical completion of the Contract. The statement will also show the nonworking days and any partial or whole days that the Contracting Agency determines to be unworkable. If the Contractor disagrees with any statement issued by the Contracting Agency, 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 Contracting Agency to ascertain the basis for the dispute and the 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. If the Contractor elects and is approved by the Contracting Agency to work 10 hours a day for four days a week (a 4-10 schedule), the fifth day of the week 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 the 4-10 schedule.

The Contracting Agency will give the Contractor written notice of the Completion Date of the Contract after all of the Contractor's obligations under the Contract have been performed by the Contractor. The following events must occur before the Completion Date will be established:

1. The physical Work on the project must be complete; and
2. The Contractor must furnish all documentation required by the Contract and required by law, to allow the Contracting Agency to process final acceptance of the Contract. The following documents must be received by the Project Engineer prior to establishing a Completion Date:
 - a. Certified payrolls (Federal-aid projects);
 - b. Material acceptance certification documents;
 - c. Annual report of amounts paid as MBE/WBE participants or quarterly report of amounts credited as DBE participation, as required by the Contract Provisions
 - d. Final Contract voucher certification;
 - e. Property owner releases if needed as required by Section 1-07.24.

1-08.7 Maintenance During Suspension
(October 1, 2005 APWA GSP)

Revise the second paragraph to read:

At no expense to the Contracting Agency, the Contractor shall provide through the construction area a safe, smooth, and unobstructed roadway, sidewalk, and path for use by the WWTP staff and public, where such access would normally be provided, during suspension (as required in Section 1-07.23 or the Special Provisions). This may include a temporary access road or pathway.

1-09 MEASUREMENT AND PAYMENT

Section 1-09.1 is replaced by Section 01025 of the Technical Specifications.

1-09.6 Force Account
(October 10, 2008 APWA GSP)

Supplement this section with the following:

The Contracting Agency has estimated and included in the Proposal, dollar amounts for all items to be paid per force account, only to provide a common proposal for Bidders. All such dollar amounts are to become a part of Contractor's total bid. However, the Contracting Agency does not warrant expressly or by implication that the actual amount of work will correspond with those estimates. Payment will be made on the basis of the amount of work actually authorized by Contracting Agency.

1-09.7 Mobilization

Section 1-09.7 is replaced by Section 01025 of the Technical Specifications.

1-09.9 Payments

Section 1-09.9 is replaced by Section 01025 of the Technical Specifications.

1-09.13(3) Claims \$250,000 or Less
(October 1, 2005 APWA GSP)

Delete this Section and replace it with the following:

The Contractor and the Contracting Agency mutually agree that those claims that total \$250,000 or less, submitted in accordance with Section 1-09.11 and not resolved by nonbinding ADR processes, shall be resolved through litigation unless the parties mutually agree in writing to resolve the claim through binding arbitration.

END OF DIVISION 1

DIVISIONS 2 THROUGH 9

Replace Divisions 2 through 9 of the standard specifications with Divisions 2 through 17 of the Technical Specifications in Part 4, except where the Technical Specifications specifically reference the Standard Specifications.

END DIVISION 2 THROUGH 9

**SECTION 01010
GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 Project

- A. The work to be performed under this Contract consists of furnishing labor, materials, equipment, and appurtenances necessary for construction of the City of Snohomish Peracetic Acid (PAA) Disinfection System project.

1.02 Project Scope

- A. The major items of work to be accomplished on this project consist of modifications and additions at the Owner's existing wastewater treatment plant (WWTP), including but not limited to the items listed below and other associated items of work as indicated on the Drawings and as specified herein.
1. Install measures for temporary erosion and sediment control.
 2. Removal of the existing wooden structure housing the chlorine residual analyzers to clear space for new construction. This includes demolition of the conduit and wire associated with that structure
 3. Demolition of the existing chlorination and dechlorination equipment in the chlorine contact tank (CCT) and Chlorine Mixing Manhole.
 4. Demolition of existing concrete slabs and asphalt paving to construct the new PAA disinfection facility and replace damaged slabs.
 5. Extend potable water service to the new PAA Building.
 6. Construct a slab on grade for the new PAA Building.
 7. Install a precast vault for containment of PAA totes including associated grating and level switch.
 8. Install a pre-engineered metal canopy over the PAA tote storage area, including lighting, outlets and an outdoor emergency shower/eyewash.
 9. Install the pre-engineered PAA Building complete with the metering pump skid, a relocated residual analyzer, and required building appurtenances.
 10. Asphalt paving for the new PAA tote storage area.
 11. Install PAA, carrier water, drain and sample pipelines including associated valves, connectors, heat tracing, insulation, and other appurtenances.
 12. Install a remote input/output (I/O) panel in the PAA Building and connect it to existing Main Control Panel-2A (MCP-2A).
 13. Provide power to the PAA Building and carrier water pump from existing EMCC2.

14. Modify existing PLC programming in MCP-2A and existing SCADA programming to integrate the new equipment
 15. Conduct startup and testing of the PAA system.
 16. Repair cracks in the existing CCT.
- B. Work to be completed by the Owner includes:
1. Dismantling the wooden structure housing the residual analyzers and disposing of and/or salvaging the structure and items within the structure.
 2. Demolition of the existing chlorine gas disinfection system components inside the existing Chlorination Building.
 3. Demolition of the existing sulfur dioxide gas dechlorination system inside the existing Chlorination Building.
 4. Demolition of the existing gas scrubber inside the existing Chlorination Building.

1.03 Contract Documents

- A. The Contract Documents shall include the following parts:
1. Change orders formally approved by the Owner
 2. Addenda issued prior to bid opening
 3. Proposal Form
 4. Agreement Form
 5. Special Provisions
 6. Contract Plans (i.e., Project Drawings)
 7. Amendments to the Standard Specifications
 8. Standard Specifications
 9. Owner Standard Plans or Details (as referenced)
 10. WSDOT Standard Plans for Road, Bridge, and Municipal Construction
- B. Any inconsistency between the parts of the Contract Documents shall be resolved through precedence in the order of parts listed above (Part No. 1, above shall take precedence over Parts No. 2 through 10; Part No. 2 shall take precedence over Parts No. 3 through 10; and so forth).

1.04 Time for Completion of Project

- A. This Project shall reach SUBSTANTIAL COMPLETION in accordance with these Specifications within **140** working days from the date on the Notice-to-Proceed letter.
- B. This Project shall reach PHYSICAL COMPLETION in accordance with these Specifications within **160** working days from SUBSTANTIAL COMPLETION.

- C. Working days shall be as defined in 1-08.5 of the Standard Specifications.

1.05 Hours of Work

- A. Working hours for this project shall be limited to the period of 7:00 a.m. to 6:00 p.m. Monday through Friday with minimum noise generation prior to 7:00 a.m. The Contractor must comply with the City's noise ordinance, including any equipment running unattended overnight. If extended work hours or work on the weekends is required or desired, a request must be submitted in writing to the Owner for approval prior to commencement.

1.06 Work Schedule

- A. Submit color electronic PDF format copies for review.
- B. Identify the critical path. If the Construction Schedule does not reflect the specified Work, or the Contract Time, it will be returned to the Contractor for modification.
- C. Give the Owner fourteen (14) calendar days' notice prior to requiring any shutdown of equipment or utilities.
- D. Give the Owner three (3) calendar days prior notice of normal work days on which Contractor activity will not take place or of scheduled activity that will not take place.

1.07 Pre-Construction Conference

- A. Prior to beginning the Work, the Contractor and its key personnel and Subcontractors shall attend a project kickoff meeting with the Owner and Engineer. The purpose of the meeting will be to coordinate roles, review safety standards, define responsibilities and lines of communication for the project and establish the project schedule. At this time, the Contractor shall furnish the Owner with the following:
 - 1. A complete list of sub-contractors, including business address, telephone number, items of Work, and Contractor registration number. This list is to be updated during the life of the contract.
 - 2. Name of Contractor's superintendent who will be on the job at all times.
 - 3. An initial work schedule as specified herein.
 - 4. A preliminary schedule of submittals.
 - 5. A Schedule of Values providing a detailed cost breakdown for all lump sum bid items as specified in Section 01025 - Measurement and Payment. The detailed breakdown shall be a fair evaluation of the actual cost of each of the items of Work listed. This information will be used in processing the Contractor's requests for partial payment. Submittal of this breakdown will not otherwise effect the Contract terms.

- B. The Owner will conduct weekly coordination meetings with the Contractor at the job site. Attendance is required by Contractor's project manager and affected Subcontractors. As necessary, the Owner will prepare, maintain and distribute agenda and dated record of: (1) actions required and taken and (2) decisions and made. During the meeting, the Contractor shall provide input on required actions and decisions.

1.08 Permits

- A. As specified in Section 01410, the Contractor is responsible for obtaining a building permit from the City of Snohomish and an electrical permit from Washington State Department of Labor and Industries (L&I) for the project.
- B. The Contractor is responsible for arranging for inspections by the City of Snohomish and L&I.

1.09 Measurements

- A. The Contractor shall make, perform, and be responsible for all measurements required to establish the location and guide the installation of all equipment and appurtenances.

1.10 Contractor's Use of Site and Owners Continued Operations

- A. The Contractor shall confine his use of the site for laydown and staging to areas shown on the Drawings, unless otherwise approved by the Owner. The Contractor's use of the site for daily access of workers, material and equipment shall be arranged and scheduled to minimize interference with the Owner's continued operations.
- B. The Owner intends to continue operation of its existing facility during the project period. The Contractor shall plan and schedule its work to minimize impacting the Owner's continued operations and shall, at all times, maintain safe access for the Owner's operating personnel and equipment.
- C. The Contractor shall be responsible for maintaining safe emergency exiting for the Owner's and Contractor's personnel in all areas affected by the Contractor's work.
- D. If operation of the Owner's existing facility is adversely affected by the Contractor's work, the Owner may suffer a financial loss and may make a claim against the Contractor to recover its loss.

1.11 Document Existing Conditions

- A. Prior to commencing the Work, the Contractor shall tour the site with the Owner. Examine and document photographically and in writing the condition of existing buildings, equipment, improvements, and landscape planting on or adjacent to the site. This record shall serve as a basis for determination of subsequent damage due to the Contractor's operations and shall be signed by all parties making the tour. The Contractor shall record existing conditions with a digital

camera. The photo files shall be titled with the date and areas and provided electronically to the Owner.

1.12 Contractor's Quality Control

- A. The Contractor shall be fully responsible for inspecting the work of its subcontractors to assure that the work when completed will comply with the Contract Documents.
- B. Inspections, periodic observations and testing performed by the Owner are for the Owner's benefit and information only and shall not be construed as partial or incremental acceptance of the work and shall not be deemed to establish any duty on the part of the Owner to the Contractor or its subcontractors.

1.13 Safety

- A. After the issuance of the Notice-to-Proceed and prior to mobilization, the Contractor shall provide to the Owner a Worker Health and Safety Manual that at a minimum addresses and identifies the following:
 - 1. Policies and Rules
 - 2. Roles and Responsibilities
 - 3. Hazard Assessments
 - 4. Safe Work Practices
 - 5. Use of Personal Protective Equipment
 - 6. Preventative Maintenance
 - 7. Training (Managers, Supervisors, Workers, Subcontractors)
 - 8. Inspections
 - 9. Accident/Injury Investigations
 - 10. Emergency Preparedness
 - 11. Recordkeeping and Reporting
 - 12. Waste Management

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 01010

**SECTION 01025
MEASUREMENT AND PAYMENT**

PART 1 - GENERAL

1.01 Summary

- A. This Section covers the method of measuring completed work for payments to the Contractor. Measurement shall be as described under each bid item described herein.
- B. Payment for bid items shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals as necessary to complete the Work in accordance with the requirements of the Contract Documents, including all appurtenances thereto and including all costs of compliance with the regulations of public agencies having jurisdiction, including safety and health requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA) and the Washington Industrial Safety and Health Act (WISHA) Department of Labor and Industries. No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs thereof shall be included in the prices named in the Bid Schedule for the various items of work.
- C. Indirect costs, including but not limited to, supervision and overhead, profit, the general conditions specified in the Contract, all shall be allocated to each bid item as applicable for work defined in the bid item. No separate payment will be made to the Contractor for these items.
- D. No payment will be made for work and materials that are not in compliance with the Contract Documents.

1.02 Progress Payments

- A. Progress payments shall be made monthly for work completed for each bid item and in accordance with the Schedule of Values and shall be based on measurement as specified herein.
- B. Measurement of the quantities for unit price bid items contained in the Schedule of Values shall be made in accordance with the methods specified herein. Determination of the actual quantities shall be made by the Owner's Representative. Payment for Unit Price Items will be made based on the quantities of material actually incorporated into the Work.
- C. Lump sum bid items shall not be measured, but based on estimated progress. Payment for lump sum bid items shall be made as specified herein, and in accordance with the Special Provisions to the Standard Specifications.

- D. Work which is required by the Contract Documents, but is not specifically identified in the bid items in Part 3 below, shall be incidental and shall not be paid for separately, but shall be considered to be included in the various unit price and lump sum items contained in the Schedule of Values.

1.03 Schedule of Values

- A. The Contractor shall submit a Schedule of Values prior to the pre-construction conference. The Schedule of Values shall be subject to review and acceptance by the Owner. No payments will be made until the Schedule of Values is favorably reviewed.
- B. Detailed Breakdown of Contract Award Amount:
1. The Contractor shall submit a complete breakdown of the lump sum bid items, showing the value assigned to each part of the work, including an allowance for profit and overhead. Major line items for the Schedule of Values shall be the bid items listed in the Bid Schedule and herein.
 2. The breakdown shall be sufficient to allow computing the value of progress payments. Detailed breakdown of bid items into major items shall include equipment, piping, valves, demolition, earthwork, paving, precast concrete vaults, pre-engineered buildings, concrete, reinforcing steel, installation, coating, electrical, controls, programming, startup and testing, operation and maintenance manuals, cleanup, training, as-built markups and any other major item as appropriate for each bid item.
 3. The form of the breakdown of each bid item shall separate labor from materials to arrive at a total for each. Breakdown shall be so organized as to facilitate assessment of work.
 4. For items on which progress payments will be requested for stored materials, breakdown the values of cost of material (including delivery and unloading) and installed value.
 5. The Schedule of Values for Bid Item No. 1 shall include a breakdown for mobilization, construction scheduling, bonds and insurance, final cleanup and final deliverables (as specified in Section 01710).
 6. Upon favorable review of the Schedule of Values, the Schedule of Values shall be used as a basis for all progress payments.
 7. No more than 90 percent of the Contract Award amount shall be made before the receipt of the Operations and Maintenance Data is complete and submitted in accordance with Section 01730.
 8. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
 9. The sum of all values listed in the schedule shall equal the Contract Award amount.

10. Upon request by the Owner, support values shall be submitted with data to substantiate their accuracy.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 Mobilization/Demobilization, Bonds and Insurance (Bid Item No. 1)

- A. Payment: Payment for Mobilization/Demobilization, Bonds, and Insurance (Bid Item No. 1) will be made at the lump sum price stated in the Bid Schedule. The lump sum price for Bid Item No. 1 shall include all costs associated with mobilizing and demobilizing personnel, equipment, supplies, offices and other facilities necessary for the work; bond and insurance premiums; coordination, connection, and service charges for temporary and permanent electrical, water, sewer, and telephone utilities; permits required to complete the Work; miscellaneous start-up costs; construction scheduling (including updates); final deliverables; final cleanup; and demobilization.
- B. Measurement: Bid Item No. 1 shall be paid for as a lump sum.
 1. When five (5) percent of the original total Contract Award amount is earned from other bid items, fifty (50) percent of the amount of Bid Item No. 1, or five (5) percent of the total original contract amount, whichever is least, will be paid.
 2. When ten (10) percent of the total original Contract Award amount is earned from other bid items, seventy five (75) percent of the amount of Bid Item No. 1, or ten (10) percent of the total original Contract amount, whichever is least, will be paid.
 3. Upon Physical Completion of the work, payment of any remaining amount for Bid Item No. 1 will be paid.
 4. All costs associated with offsite storage, if necessary, shall be included in this bid item and no other compensation will be made for time and expenses associated with offsite storage and the time to transport materials to/from offsite storage.

3.02 General Site Work (Bid Item No. 2)

- A. Payment: Payment for General Site Work (Bid Item No. 2) will be made at the lump sum price stated in the Bid Schedule. The lump sum price for Bid Item No. 2 shall include all necessary work, equipment, materials, labor, and incidentals for general site work, including but not limited to measures for temporary erosion and sediment control; demolition; temporary piping and utilities; earthwork including structure and trench excavation and associated dewatering, fill, haul, and finish grading; replacing concrete slabs and sidewalks; yard piping, valves, heat trace, insulation and appurtenances; asphalt; site

electrical, including conduit, wire, signal cable, and Ethernet cable; and all other work not otherwise included in the other bid items.

- B. Measurement: Bid Item No. 2 shall be paid for as a lump sum. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.03 PAA Building (Bid Item No. 3)

- A. Payment: Payment for PAA Building (Bid Item No. 3) will be made at the lump sum price stated in the Bid Schedule. The lump sum price for Bid Item No. 3 shall include all necessary work, equipment, materials, labor, and incidentals for the PAA Building, including the construction of the PAA Building foundation; furnishing and installing the pre-engineered building, complete with the packaged PAA system; connecting power and water to the PAA Building; connecting power for new equipment to the panelboard provided with the PAA Building; connecting PAA, carrier water, drain and sample piping to the PAA Building; relocating an existing residual analyzer to the new PAA Building; and conducting startup and testing of the new PAA system as shown and specified in the Contract Documents.
- B. Measurement: Bid Item No. 3 shall be paid for as a lump sum. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.04 PAA Storage and Containment (Bid Item No. 4)

- A. Payment: Payment for PAA Storage and Containment (Bid Item No. 4) will be made at the lump sum price stated in the Bid Schedule. The lump sum price for Bid Item No. 4 shall include all necessary work, equipment, materials, labor, and incidentals for furnishing and installing the pre-engineered canopy and concrete column supports; furnishing, installing and coating the interior of the precast vault for PAA containment; furnishing and installing PAA suction and drain piping, valves, heat trace, insulation and appurtenances; lighting and outlets at the pre-engineered canopy; emergency shower/eyewash at the pre-engineered canopy; and level switch for the PAA containment vault as shown and specified in the Contract Documents.
- B. Measurement: Bid Item No. 4 shall be paid for as a lump sum. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.05 Controls and System Integration (Bid Item No. 5)

- A. Payment: Payment for Controls and System Integration (Bid Item No. 5) will be made at the lump sum price stated in the Bid Schedule. The lump sum price for Bid Item No. 5 shall include all necessary work, equipment, materials, labor, and incidentals for furnishing and installing a remote input/output (I/O) panel in the PAA Building; connecting control conduit and wire to the remote I/O panel; connecting the remote I/O panel to existing Main Control Panel-2A (MCP-2A) in the Chlorination Building; modifying PLC programming for MCP-2A for the new

equipment; modifying the SCADA system to include the new equipment; and performing calibration, functional testing and startup for the new instrumentation and controls as shown and specified in the Contract Documents.

- B. Measurement: Bid Item No. 5 shall be paid for as a lump sum. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.06 CCT Crack Repair (Bid Item No. 6)

- A. Payment: Payment for CCT Crack Repair (Bid Item No. 6) will be made at the unit price stated in the Bid Schedule based on a quantity of 50 lineal feet, which is reflective of known areas requiring crack repair. The unit price for Bid Item No. 6 shall include all necessary work, equipment, materials, labor, and incidentals, including but not limited to inspection and documentation of the interior surfaces of exterior walls and both sides of the chlorine contact tank (CCT) divider wall for significant cracks, popouts, delamination and other significant imperfections; surface cleaning and preparation; drilling and grout injection, and surface repairs as shown and specified in the Contract Documents.
- B. Measurement: Bid Item No. 6 shall be paid based on the unit price stated in the Bid Schedule and the verified quantity of crack repair performed. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.07 Additional CCT Crack Repair (Bid Item No. 7)

- A. Payment: Payment for Additional CCT Crack Repair (Bid Item No. 7) will be made at the unit price stated in the Bid Schedule based on the quantity installed, although the Contract Award amount is to be based on a quantity of 200 lineal feet. The unit price for Bid Item No. 7 shall include all necessary work, equipment, materials, labor, and incidentals, including but not limited to surface cleaning and preparation; drilling and grout injection, and surface repairs to deal with additional structural imperfections as designated and directed by the Owner and as shown and specified in the Contract Documents.
- B. Measurement: Bid Item No. 7 shall be paid based on unit price stated in the Bid Schedule and the verified quantity of crack repair performed. Progress payments will be made in accordance with the submitted and approved Schedule of Values.

3.08 Force Account (Bid Item No. 8)

- A. Payment: A bid allowance of \$20,000 is established as a force account for performance of minor changes to the Work as directed by the Owner. The Owner does not warrant expressly or by implication that the actual amount paid for minor changes will correspond to the \$20,000 allowance. Payment will be made based on the work performed and the corresponding costs as authorized in writing by the Owner.

- B. Measurement: Each authorized minor change shall be paid for as an individual lump sum. Progress payments will be made in accordance with the authorized amount and associated approved cost breakdown.

END OF SECTION 01025

SECTION 01040
CONSTRUCTION CONSTRAINTS AND SEQUENCE

PART 1 - GENERAL

1.01 Sequence

- A. This Section describes the constraints during construction, and the guidelines for construction sequencing that the Contractor shall incorporate into the performance of the Contract. This project shall be constructed in three phases in the following order:
1. Phase 1 generally includes demolition of the wooden structure housing the existing chlorination and dechlorination analyzers and controls and associated conduit and wire, installing measures for temporary erosion and sediment control, and extending potable water service to the location for the new PAA Building.
 2. Phase 2 generally includes installing the PAA system including the PAA Building with metering pump skid, constructing the PAA tote containment and storage area with canopy, installing PAA pipelines and valves, installing PAA diffusers in the chlorine contact tank (CCT) for chemical injection, installing the carrier water pump and pipeline, installing sample piping, relocating the existing residual analyzer, installing the remote input/output (I/O) panel, extending power conduit from the existing pull box near the CCT to the PAA Building and carrier water pump, re-routing an existing control conduit from the existing wooden structure housing chlorination and dechlorination analyzers to the PAA Building, installing power wire to the PAA Building and carrier water pump through the new conduit extensions from existing EMCC2, installing Ethernet cable through the new conduit extension from existing Main Control Panel-2A (MCP-2A), installing power conduit and wiring from the panelboard in the PAA building to equipment and instruments, installing control conduit and wiring from the remote I/O panel in the PAA Building to equipment and instruments, establishing communications and power connections, modifying existing PLC and SCADA programming, and conducting startup and testing of the PAA system.
 3. Phase 3 includes repair of cracks in the existing CCT structure. Crack repairs in the CCT will require a shutdown of the CCT and attenuation of flow in the upstream lagoons. Consequently, this work must be performed between mid-July and mid-September during which the Contractor will be allowed to shutdown the CCT for up to 7 consecutive calendar days. During this time, the Contractor shall also demolish the chlorine gas mechanical mixer in the Chlorine Mixing Manhole, the sulfur dioxide gas mechanical mixer in the CCT, and associated equipment, piping, conduit and wire.

B. Related Sections:

1. Section 01010 - General Requirements
2. Section 01410 - Regulatory Requirements
3. Section 01500 - Construction Facilities and Temporary Controls
4. Section 01660 - Facility Startup and Testing
5. Section 02050 - Demolition

1.02 Continuity of Sewage Flows

- A. The existing wastewater treatment plant (WWTP) continuously receives and treats wastewater, and these functions shall not be interrupted except as specified herein. The Contractor shall schedule and coordinate the work to avoid interference with operation of the existing WWTP, including support utilities, access for operations personnel, and delivery of supplies.
- B. Construct work in phases to accommodate use of and access to the existing CCT and chlorination/dechlorination equipment by the Owner during the construction period. Modify site and structures as required for construction, but make no modifications, excavations, or storage of materials which prevent access, operation, and maintenance of the facilities by the Owner, except as indicated herein. If elements of facilities, except those identified herein, are to be eliminated for the convenience of construction, provide an equivalent temporary facility, pipeline, or piece of equipment capable of performing the same function without adversely affecting or increasing operation or maintenance by the Owner.
- C. Bypasses: No bypassing of the CCT, chlorination/dechlorination system, or any other process is allowed throughout the duration of the project.
1. In the event of a bypass or spill, the Contractor must make notifications immediately in accordance with Section 01500 - Construction Facilities and Temporary Controls.
 2. In the event accidental bypassing or a spill is caused by the Contractor, the Contractor shall immediately take whatever actions are deemed necessary to stop the bypassing or spill. Should the Contractor not take immediate action, the Owner will be entitled to take whatever actions are deemed necessary to stop the bypass or spill.
 3. Costs incurred by the Contractor or Owner, including penalties or claims imposed on the Owner, regulating agency or third party as a result of any bypass or spill caused by the actions of the Contractor, its employees, or subcontractors, shall be borne in full by the Contractor, including legal fees, fines and other expenses to the Contractor or Owner resulting directly or indirectly from the bypass or spill.

D. Work Coordination and Assistance by Owner

1. Operation of the existing disinfection facilities, including those operations which may be necessary to facilitate the Contractor's work, will be provided by the Owner.
2. For minor assistance and operations, the Contractor shall provide a minimum of 3 days advance notice to the Owner. For more major coordination and assistance (such as shutdown of facilities, utilities or equipment), Contractor shall provide a minimum of 14 days advance notice to the Owner.
3. Shutdown, isolation or decommissioning of facilities shall be by the Owner unless otherwise specified or permission is given by the Owner to the Contractor.

1.03 Constraints

A. General:

1. A favorably reviewed Construction Schedule and Interim Operations Plan is required before the Contractor can proceed with demolition of any existing facilities (Phase 1).
2. The Owner will operate and maintain the existing treatment facilities during construction and will operate and maintain the new facilities (after acceptance), except as specifically required by these Contract Documents. The Owner will not operate and maintain temporary facilities used by the Contractor for completion of the Work, unless specifically stated herein.
3. The sequence of work shall be such as to maintain treatment of wastewater at all times in accordance with all requirements of the NPDES permit. All costs of work to maintain wastewater treatment shall be considered incidental to the Contract and shall not constitute a basis for additional compensation or time extensions.
4. The Contractor is responsible for draining all channels, tanks, vaults and pipelines and removing deposits and cleaning surfaces as required to complete the Work. This includes occasional removal of subsequent liquid and solids if existing isolation gates or valves are not watertight.
5. The Contractor shall provide all necessary bulkheads, etc. to isolate the work areas.
6. If the Contractor conducts a shutdown and finds that the planned work will not be completed in the time allotted in the favorably reviewed Interim Operations Plan, the Contractor shall notify the Owner immediately. If the Owner does not approve an extension, the Contractor shall complete the work as necessary to place the system back into service. Extra work to return the system to service and subsequent shutdowns to complete the work shall be at no cost to the Owner. If the Contractor does not return the system to service, the Owner may do so and the resulting damages and costs incurred by the Owner shall be borne by the Contractor.

7. If temporary facilities are required to perform the Work or if temporary shutdowns are required, the Contractor shall provide the temporary equipment and facilities needed to maintain all treatment and conveyance functions.
 8. The Contractor shall schedule and conduct the Work in a manner consistent with achieving these purposes and shall comply with the specific limitations specified herein. Work between trades shall be coordinated to minimize shutdowns. When existing switchboards, motor control centers or other electrical and control panels must be temporarily shut down for work, they shall be returned to service for nights, weekends and holidays unless approved otherwise by the Owner. The Contractor shall limit such shutdowns during working hours to 3 hours at a time.
 9. Any damages and/or disturbances identified by the Owner's Representative through construction activities to the project area and adjacent areas will be restored to pre-construction conditions or as detailed in the Contract at no extra cost to the Owner.
- B. The existing CCT and chlorination/dechlorination equipment and controls shall remain in service and their function not compromised, except for instrumentation to be removed as part of Phase 1.
 - C. All Phase 1 work must be completed before starting Phase 2.
 - D. Complete all PLC and SCADA system programming modifications and, to the extent possible, test the programming modifications prior to PAA system startup under Phase 2.
 - E. Install and test all power conduit and wiring feeding from the new panelboard in the PAA Building prior to PAA system startup under Phase 2.
 - F. Install and test all control conduit and wiring between the remote I/O panel in the PAA Building and new equipment and instruments prior to PAA system startup under Phase 2.
 - G. The Contractor shall have all necessary materials, accessories, personnel and tools onsite and ready before beginning Phase 3.
 - H. The Owner will isolate the CCT under Phase 3 for completion of crack repairs. The Contractor will be responsible for draining and cleaning the CCT.
 - I. Crack repairs must be performed between mid-July and mid-September during which the Contractor will be allowed up to 7 consecutive calendar days to complete the repairs.

1.04 Submittals

- A. Construction Schedule: Prepare a Construction Schedule as defined in Section 01010, based on the constraints and sequence defined herein. The construction schedule should also address the following:

DIVISION 01 – GENERAL REQUIREMENTS
SECTION 01040
CONSTRUCTION CONSTRAINTS AND SEQUENCE

1. Identify connections to or modifications of existing equipment or facilities that require a shutdown. As specified above, the Contractor must give a minimum 14 days' notice to the Owner prior to such major coordination/assistance items being undertaken.
 2. Identify any proposed variances from the constraints described above for consideration by the Owner.
- B. Interim Operations Plan: Prepare an interim operations plan that includes the items listed below. The Contractor shall incorporate input and comments from the Owner, after which the document will be submitted by the Owner to the Washington State Department of Ecology.
1. Name, address, cell phone number, e-mail address and brief resume of the designated superintendent.
 2. Description and contact information for subcontractors and major suppliers, as applicable.
 3. Sequence of activities and roles and responsibilities for maintaining treatment and compliance with the NPDES permit.
 4. Responsibilities for responding to emergency and alarm conditions.
 5. Plan showing intended use of the site for staging, access and operations. Show location of proposed security fencing, access points, parking, work areas (for equipment operation, loading and stockpiling) and storage areas.
 6. Proposed temporary utility (e.g., water and electricity) connections and routing, or the utility source if not utilizing a temporary connection to existing utilities (e.g., electrical generator).

END OF SECTION 01040

**SECTION 01300
SUBMITTALS**

PART 1 - GENERAL

1.01 General

- A. The Contractor shall assemble and submit to the Owner product data, as specified herein, for all equipment and materials to be furnished and installed by the Contractor.
- B. Product Data shall include the specific information and shop drawings described herein.
- C. Submittals shall be provided by the Contractor prior to placement of purchase orders for equipment and materials. No payment will be made for materials and their installation until the materials are favorably reviewed by the Owner and/or Engineer. Equipment and materials which are constructed, installed, or incorporated prior to review and favorable review by the Engineer or Owner may not be accepted by the Owner and shall be removed and replaced by the Contractor, when so ordered by the Owner, at the Contractor's expense.
- D. The review by the Engineer or Owner of submittals is only for conformance with the general design concept of the project, and does not extend to consideration of specific dimensions, structural integrity, safety, detailed installation and construction requirements, or any other obligation of the Contractor. Any action shown is subject to the requirements of the Contract Documents. The review of submittals by the Engineer or Owner shall not relieve the Contractor from his/her obligation to perform fully all contract requirements, nor shall such review give rise to any right of action or suit in favor of the Contractor or third persons against the Engineer or Owner.

1.02 Specific Requirements

- A. The submittal shall be assembled in accordance with utilizing the transmittal forms provided by the Owner, unless otherwise agreed upon by the Owner. Each submittal must be submitted in accordance with the instructions on the form or the submittal may be returned without review. The Owner will, upon completion of the review, return the submittal marked to indicate if the submittal is favorably reviewed (with or without corrections noted) or rejected. If rejected, the Engineer or Owner will indicate the specific reasons for rejection.
- B. The Contractor shall provide up to five (5) copies of submittal packages, a lesser amount, and/or electronic copies as determined at the preconstruction conference.

- C. The Contractor shall be solely and completely 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 specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. All extraneous materials shall be removed, crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Owner in each case where a specific submittal may affect the work associated with another submittal and/or any work which is not described by a submittal. The Contractor shall coordinate submittals among his subcontractors and suppliers including those submittals complying with applicable technical sections.
- D. The Contractor shall coordinate submittals with the work so that work will not be delayed. The Contractor shall allow 14 calendar days for submittal review. He shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with work related to a specific submittal until the submittal process is complete.
- E. The Contractor shall certify on each submittal document that he has reviewed the submittal, verified field conditions, and complied with all requirements of the Contract Documents.

1.03 Limitation on Number of Submittals

- A. The Contractor shall provide submittals for equipment and materials which meet or exceed the requirements of the specifications. Accordingly, it is considered reasonable that the Contractor provide submittals which are complete and receive a favorable review, in the judgment of the Engineer and Owner, by and with the second submission of each submittal package. The Owner reserves the right to and will withhold appropriate amounts from payments due to the Contractor to cover the cost of review by the Engineer of third and subsequent submission(s) of each specific submittal.

1.04 Project Data Submittals

- A. The Contractor shall assemble and submit to the Owner product data and shop drawings for all equipment and materials to be installed as part of the Work and as specified herein.
- B. Project Data Submittals for each and all equipment and materials shall include, but not be limited to, the following:
 - 1. Manufacturer's technical data and documentation of conformance with appropriate standards and detailed specifications included in the Contract Documents.
 - 2. Detailed drawings indicating pertinent dimensions.

3. Additional information as listed in individual sections of the Project Specifications or Project Drawings.
 4. Additional information as requested by the Engineer or Owner.
- C. If the Contractor proposes to provide material, equipment, or method of work which deviates from the Project Specifications or Project Drawings, he shall indicate so on the transmittal form accompanying the submittal copies.
- D. Submittals that do not have all the information required to be submitted, including descriptions of deviations, may be returned without review.
- E. The Engineer's and Owner's review of submittals will not extend to and shall not be assumed by the Contractor to extend to any and all means, methods, techniques, sequences or procedures of construction, or to verifying quantities. Review will not address dimensions, weights or gauges, or fabrication processes or to safety precautions or programs incident thereto. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.
- F. After completion of review, the Owner will return each submittal with annotation and indication of one of the following actions:
1. If the review indicates that the material, equipment or work method complies with the Contract Documents, 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 O&M data, a corrected copy shall be provided. Some clarification response may be requested by the Engineer or Owner to ensure correct interpretation of the comments.
 3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "Revise and Resubmit". Except at his 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 Contract Documents, copies of the submittal will be marked "Rejected". Submittals with deviations which have not been identified clearly may be rejected. Except at his 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".

- G. Review of Project Data regarding materials or equipment the Contractor proposes to provide and install, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Owner or Engineer, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "No Exceptions Taken" or "Make Corrections Noted" indicates a favorable review and shall mean that the Owner and Engineer has no objection to the Contractor, upon and with his own responsibility, providing and installing the materials or equipment proposed.

1.05 Submittals Status Report

- A. The Contractor shall prepare and continuously update a matrix-format report, which indicates the status of all submittals. The status report shall be initially developed to identify all submittals to be assembled and submitted by the Contractor.
- B. The status report shall be expanded and continuously updated by the Contractor to indicate the current status of each submittal package. Expanded and updated status reports shall be provided to the Owner at weekly intervals.
- C. The status reports shall include, but not be limited to the following:
1. General content of each submittal package.
 2. Status (first, corrected, amended and resubmitted, second, or other appropriate designation) of submittal package.
 3. Date of expected submittal to the Owner.
 4. Date of actual submittal to the Owner.
 5. Date of response from the Owner.
 6. Owner's response (Example: No Exceptions Taken, Make Corrections Noted, Revise and Resubmit, etc.)
 7. Intended second submittal or other action in response to determination by the Owner of "Revise and Resubmit" or "Rejected".
 8. Expected date of delivery materials and equipment included in the submittal package.
 9. Actual date of delivery of materials and equipment.

1.06 Request for Substitution

- A. Requests for substitution of specified equipment or material shall be in writing and shall be accompanied with sufficient information to identify the nature and scope of the request. Information to be provided along with the requests for substitution shall include:
1. All submittal information required for the specified equipment or material, including all deviations from the specified requirements necessitated by the proposed substitution and proposed manufacturer and model number.
 2. Materials of construction, including material specifications and references.
 3. Performance data, including performance curves and guaranteed power consumptions, over the range of specified operating conditions.
 4. Dimensional drawings, showing required access and clearances, including any changes to the work required to accommodate the proposed substitution.
 5. Where controls are a part of the proposed substitution, provide process and instrumentation drawings and control descriptions, including any modifications to existing process and instrumentation drawings clearly identified.
 6. Information and performance characteristics for all system components and ancillary devices to be furnished as a part of the proposed substitution.
 7. Marked up contract drawings illustrating the alterations to all structural, architectural, mechanical, electrical, plumbing and HVAC systems required to accommodate the proposed substitution.
 8. A list of installations of the proposed substitution indicating application, location, owner and date of first issue.
 9. Indication of impact to the Work Schedule using the proposed substitution.
 10. Cost information, including a proposal of change, if any, in the contract sum.
 11. Statement from the Contractor that the proposed substitution complies with requirements in the Contract Documents and is appropriate for designated application indicated.
 12. Statement from the Contractor waiving rights to additional payment or time that may be subsequently become necessary because of failure of proposed substitution to produce indicated results. If such failure occurs, the Contractor shall be responsible for remedying the situation by fixing or replacing the equipment in a manner approved by the Owner at no additional cost to the Owner.
- B. Upon receipt of written application for substitution from the Contractor, including the information specified above, an estimate of the cost for evaluating the request will be presented to the Contractor. The Contractor is advised that the

estimate is based upon the best information available at the time; however, the actual cost, based on time and expense, will be documented and applied in the final analysis of the substitution request. If the Contractor wishes to proceed with the request, he shall advise the Owner and Engineer in writing and submit sufficient additional information as may be requested. No evaluation will take place until such time as the Contractor has agreed to the estimate in writing and has authorized deduction of the cost of the evaluation from monthly progress payments due to the Contractor.

- C. The Contractor shall be notified of acceptance or rejection of a proposed substitution within 30 days of authorization of the evaluation.

1.07 List of Division 0 and 1 Submittals

- A. The following table summarizes major submittals required under Divisions 0 and 1 of these Specifications:

SUBMITTAL	SECTION
DIVISION 0 SUBMITTALS <ul style="list-style-type: none"> ▪ BID PROPOSAL ▪ STATEMENT OF BIDDER QUALIFICATIONS ▪ DEPOSIT OR BID BOND FORM ▪ ANTI-DISCRIMINATION CERTIFICATE ▪ INDEMNIFICATION ADDENDUM ▪ CERTIFICATION OF NON-SEGREGATED FACILITIES ▪ CONTRACTOR'S DECLARATION OF OPTION FOR MANAGEMENT OF RETAINED PERCENTAGE ▪ CERTIFICATE OF INSURANCE ▪ ESCROW AGREEMENT (IF APPLICABLE) 	SEE PROPOSAL FORMS
WORK SCHEDULE	01010 1.06 & 01040 1.04
DOCUMENTATION OF EXISTING CONDITIONS	01010 1.11
WORKER HEALTH AND SAFETY MANUAL	01010 1.13
SCHEDULE OF VALUES	01025 1.03
INTERIM OPERATIONS PLAN	01040 1.04
INDEPENDENT TESTING FIRM <ul style="list-style-type: none"> ▪ FIRM QUALIFICATIONS ▪ TESTING REPORTS 	01400 1.03
PERMITS <ul style="list-style-type: none"> ▪ ELECTRICAL PERMIT APPLICATION ▪ BUILDING PERMIT APPLICATION 	01410 1.01
FACILITY STARTUP REPORTS <ul style="list-style-type: none"> ▪ VERIFICATION OF INSTALLATION ▪ FUNCTIONAL AND PERFORMANCE TEST 	01660 2.02
AS-BUILT MARKUPS	01700
PROJECT CLOSEOUT CHECKLIST	01700
OPERATIONS AND MAINTENANCE MANUALS	01730

END OF SECTION 01300

SECTION 01400
MATERIALS TESTING AND QUALITY CONTROL

PART 1 - GENERAL

1.01 General Information

- A. All work under this Contract shall be fully tested in accordance with the provisions of these technical specifications and the Standard Specifications.

1.02 Workmanship

- A. All Work shall be done by competent craftsmen skilled in the specific Work and trade involved. Materials and equipment shall be installed in a neat and workman like manner following the best practice of the trade.
- B. All Work performed by the Contractor which is, in the opinion of the Owner, below normal accepted standards of workmanship for each trade involved shall be remade to the satisfaction of the Owner, at no additional cost to the Owner.

1.03 Inspection and Testing

- A. The Contractor will retain a qualified independent testing firm to perform the special inspection and testing required by work under Divisions 2 thru 5 of these technical specifications and/or as indicated on the Structural Drawings. A copy of all special inspection reports and test results shall be submitted to the Owner. The Contractor shall submit qualifications of the testing firm for review.
- B. The Contractor shall notify the Owner of all scheduled inspections, tests, etc. a minimum of 24 hours in advance to allow the Owner to be present for such inspections.
- C. The Owner will conduct regular and frequent inspections of all materials and completed Work. The Contractor shall keep the Owner apprised of construction progress and current activities to allow proper scheduling of inspections of each completed phase of the Work.
- D. The Contractor shall fully cooperate with the required special inspections and testing. The Contractor shall provide access to the work for testing personnel. Where testing is to be performed in a potentially unsafe or confined work area the Contractor shall stop work and provide all required safety measures to assure the safety of testing personnel.
- E. The Contractor shall anticipate that required testing and inspections may hinder, delay, or complicate execution of the work. The Contractor shall not be entitled to an extension of Contract Time or to any claim for damages because of hindrances, delays, or complications caused by or resulting from completing required inspections and testing.

- F. If work is covered prior to a required inspection, the Contractor shall uncover the work for inspection, at their expense.

1.04 Testing and Inspections by Governing Agencies

- A. Tests and inspections required by codes, ordinances or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and paid by the Contractor, unless otherwise provided in the Contract Documents.
- B. The Contractor shall notify all appropriate governing authorities at proper stages of construction to obtain required inspections, testing, approvals, etc., in accordance with the permit requirements regardless of inspections conducted by the Owner. The Contractor shall notify the Owner of all scheduled inspections, tests, etc. a minimum of 24 hours in advance to allow the Owner to be present for such inspections.
- C. The Contractor shall anticipate that such inspections and tests may hinder, delay, or complicate execution of the work. The Contractor shall not be entitled to an extension of Contract Time or to any claim for damages because of hindrances, delays, or complications caused by or resulting from such inspections and tests.

1.05 Quality Control – Control of Installation

- A. The Contractor has complete responsibility to monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality. In addition, the Contractor shall perform the following activities as part of the Quality Control process:
 - 1. Comply with manufacturers' instructions, including each step in sequence.
 - 2. Should manufacturers' instructions conflict with the Contract Documents, the Contractor shall request clarification from the Owner before proceeding.
 - 3. Comply with specified standards as minimum quality for the work, and shall provide additional efforts where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
 - 4. Perform work by persons qualified to produce required and specified quality.
 - 5. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer. The Contractor shall promptly notify the Owner of any discrepancies.
 - 6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

7. Manufacturer's Certification indicating that products meet or exceed specified requirements shall be submitted when required by individual specification sections.

1.06 Tolerances

- A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from the Owner before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.07 Mock-Up

- A. Tests will be performed under provisions identified in this Section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining work.
- D. Where a mock-up has been accepted by the Owner and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

1.08 Manufacturers' Field Services

- A. When specified in individual specification sections, the Contractor shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, perform testing and commissioning as applicable, and to provide training and instruction when necessary or required.
- B. The Contractor shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.09 Correction of Defective Work

- A. If test results or observations indicate that the work performed, or materials furnished, by the Contractor does not comply with the Contract Documents, the Contractor shall immediately take all necessary measures to correct the defective work, and/or replace defective materials. The independent testing firm, supplier, or manufacturer shall retest the corrected work, at the Contractor's expense, to determine if the corrections are satisfactory.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 Examination

- A. Prior to commencing work, the Contractor shall verify that the site conditions and substrate surfaces are in conformance with the Contract Documents.

3.02 Repair and Protection

- A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
 - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection and testing services.

END OF SECTION 01400

**SECTION 01410
REGULATORY REQUIREMENTS**

PART 1 - GENERAL

1.01 Permits, Codes, and Regulations

- A. The Contractor is responsible for obtaining the following permits and arranging for subsequent inspections:
 - 1. Building Permit – A building permit will be required for the pre-engineered metal canopy, but not for the PAA Building because it is less than 120 square feet in size. The Contractor shall submit the application for the pre-engineered metal canopy once shop drawings and structural calculations have been favorably reviewed.
 - 2. Electrical Permit
- B. Given that the area of ground disturbance needed to complete the project is less than 1 acre, the project has been determined to be exempt from needing coverage under the Construction Stormwater General Permit.
- C. All work shall be in conformance with the requirements of these permits and all additional/other applicable permits, codes, and regulations as may govern the work.
- D. The Contractor shall obtain and pay all fees for any/all licenses, permits, inspections, and approvals required by laws, ordinances, and rules of appropriate governing/approving agencies necessary for proper completion of the work, including those listed in Paragraph 1.01.A above.
- E. All work shall conform with current applicable codes, regulations and standards, which shall be regarded as the minimum standard of quality for material and workmanship. The Contractor shall provide all labor, materials and equipment necessary for compliance with code requirements or interpretations, although not specifically detailed in the Drawings or these Specifications. The Contractor shall be familiar with all applicable codes and standards prior to bidding.
- F. All requests to extend, modify, revise, or renew any environmental permits shall be processed through the Owner. These requests shall be in writing and include a narrative description and adequate drawings that clearly described and depict the proposed action. The Contractor shall not contact any of the regulatory agencies with requests for permit extensions, modifications, revisions, or renewals without the prior written consent of the Owner.

- G. All work and materials shall be in accordance with the latest governing edition of the following codes and standards and such other codes and standards that apply:
1. 2015 International Building Code (IBC)
 2. 2015 International Mechanical Code (IMC)
 3. 2015 Uniform Plumbing Code (UPC)
 4. 2015 Washington State-Non-Residential Energy Code
 5. 2017 National Electric Code (NEC)
 6. 2015 International Fire Code (IFC)
 7. Chapter 18.27 RCW Registration of Contractors
 8. Chapter 19.27 RCW State Building Code
 9. RCW 39.04.180 Trench Excavations-Safety Systems Required
 10. Chapter 51-16 WAC State Building Code Guidelines
 11. Chapter 51-50 WAC State Building Code Adoption and Amendment of the 2015 Edition of the International Building Code
 12. Chapter 51-52 WAC State Building Code Adoption and Amendment of the 2015 Edition of the International Mechanical Code
 13. Chapter 51-54A WAC State Building Code Adoption and Amendment of the 2015 Edition of the International Fire Code
 14. Chapter 51-56 WAC State Building Code Adoption and Amendment of the 2015 Edition of the Uniform Plumbing Code
 15. Chapter 296-24 WAC General Safety and Health Standards
 16. Chapter 296-45 WAC Electric Power Generation, Transmission, and Distribution
 17. Chapter 296-46B WAC Electrical Safety Standards, Administration, and Installation
 18. Chapter 296-62 WAC General Occupational Health Standards
 19. Chapter 296-155 WAC Safety Standards for Construction Work
 20. Chapter 296-200A WAC Contractor Certificate of Registration Renewals-Security-Insurance
 21. City of Snohomish codes and ordinances
 22. Snohomish County code and ordinances
 23. All other codes and standards required by applicable law to be employed and/or met.

1.02 Variations with Codes, Regulations, and Standards

- A. Nothing in the Drawings and these Specifications shall be construed as permitting work not conforming to codes, permits or regulations. The Contractor shall promptly submit written notice to the Owner of any observed variations or discrepancies between the Contract Documents and governing codes and regulations.
- B. Appropriate modifications to the Contract Documents will be made by Contract Change Order to incorporate changes to the work resulting from code and/or regulatory requirements. The Contractor assumes responsibility for all work contrary to such requirements if work proceeds without notice.
- C. The Contractor shall not be relieved from complying with any requirements of these Contract Documents which may exceed, but not conflict with requirements of governing codes.
- D. The Contractor shall comply with all regulatory measures regarding archaeological and historical objects encountered.

1.03 Coordination with Regulatory Agencies

- A. The Contractor shall be responsible for coordination of the work with all appropriate governing/regulating authorities and/or agencies.
- B. The Contractor shall provide advance notification to all proper officials of the project schedule and any schedule revisions necessary throughout the project duration, in order to allow proper scheduling of inspection visits by said authorities at proper stages of work completion.
- C. Regulation coordination shall be aside from any, and all inspections conducted by the Owner. The Contractor shall notify the Owner of any/all scheduled inspections involving outside regulating officials, so as, to allow the Owner to be present for these inspections.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01410

**SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

PART 1 - GENERAL

1.01 Summary

- A. This Section includes the following:
 - 1. Temporary Utilities: Electricity, lighting, ventilation, water, and sanitary facilities.
 - 2. Temporary Controls: Barriers, fencing, protection of work, and security.
 - 3. Construction Facilities: Parking, laydown areas, progress cleaning and offices.
- B. The Contractor is required to make all necessary temporary connections to provide power and water necessary to accomplish the Work. All temporary connections must meet current applicable codes and be made in a manner to assure the safety of Contractor and WWTP staff. All temporary connections must be made by licensed personnel, if required by current code or regulation and in coordination with the Owner and WWTP staff.

1.02 Electricity

- A. 120-volt electrical service for total electrical loads not exceeding 20 amps is available for Contractor's use during this project. The Contractor may make use of available electrical outlets that are not already in use or will not be required by the Owner or WWTP staff for the duration of the project. Any additional power requirements shall be the responsibility of the Contractor to provide by means of a temporary connection to available power (complete with ground fault and over-current protections) or an electrical generator. Electrical generator shall be provided in a sound attenuating enclosure. The Contractor will not be charged by the Owner for onsite power consumption.

1.03 Temporary Ventilation

- A. The Contractor shall ventilate enclosed areas for worker safety, to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.04 Water Service

- A. The Owner will provide access to potable water via existing hydrants. The Contractor will not be charged for potable water use onsite. An approved reduced pressure backflow prevention assembly, flow meter and adequate air gap are required. The Contractor is required to supply the reduced pressure backflow prevention assembly and flow meter and obtain a Hydrant Use Permit

from the City of Snohomish. The connection to existing water service must be tested and approved by an entity acceptable to the Owner and will be inspected by the City of Snohomish. The Contractor may also utilize available hose bibs when not in use by the WWTP staff. Use of hose bibs must be coordinated with the Owner and be limited to sanitary use, tool cleanup, and similar minor uses. The Contractor is responsible for assuring that these sources and available volumes are adequate for their needs. Any additional appurtenances, volume, pressure, storage tanks, etc. required for operation are the responsibility of the Contractor to provide.

1.05 Toilet Facilities

- A. The Contractor shall provide chemical toilets or water closets at appropriate locations within the project site for use by its employees and subcontractors. At the end of the job such toilets shall be removed completely.
- B. The facilities shall conform to governing code requirements and be serviced, cleaned and disinfected frequently.

1.06 Barriers

- A. Contractor shall provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities from damage during construction and demolition operations.
- B. The WWTP currently has fencing and controlled access.

1.07 Construction Personnel Access

- A. Site access is limited to the primary and alternate locations shown on Drawing G-2. The Owner reserves the right to change the access route during the course of the project to best maintain operation of the WWTP. The Contractor shall be responsible for coordinating with all subcontractors and suppliers to assure compliance.

1.08 Contractor's Parking and Laydown Areas

- A. Parking of commuting and work vehicles and staging shall be limited to the laydown areas shown on the site map on Drawing G-2 and as directed by the Owner. All vehicles shall be parked in such a manner to allow ready access to the site by emergency vehicles and maintain Owner access for operation of the WWTP. The Contractor shall be responsible for control of parking by all the Contractor's and subcontractor's work force to assure compliance. The Contractor shall anticipate that there may not be sufficient parking space for all the work force, and shall arrange for carpooling and/or off-site shuttling, as necessary. Additionally, the Contractor shall be responsible for off-site storage area, if deemed necessary for execution of the work.

1.09 Construction Signs

- A. Commercial or advertising signs are not allowed and shall not be placed on site.

1.10 Protection of New Work and Existing Property

- A. Provide all protections necessary to prevent damage to existing WWTP facilities.
 - 1. Protect existing trees and other vegetation against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, or smothering of trees by stockpiling materials within the dripline. Provide necessary temporary guards to protect trees and vegetation. The Contractor shall make every effort to minimize damage to and cutting of major tree roots. Provide protection for larger tree roots exposed and/or cut during excavation operations.
 - 2. The Contractor shall take appropriate measures including but not limited to, shoring and trench boxes to protect against sloughing during site excavation and trench excavation.
 - 3. Protect installed work from damage, weather and other hazards, and provide special protection where specified in the Specifications. Equipment, work or materials found damaged or in other than new conditions will not be accepted by the Owner.
 - 4. Repair or replace damaged structures, work, materials or equipment to a condition equal to or better than prior to the damage at no additional cost to the Owner.

1.11 Protection of Water and Land Resources

- A. All Work under this Contract shall be performed in a manner not to create conditions injurious to fish or aquatic habitat, or which would make the water unsuitable for use.
- B. At all times of the year, special measures shall be taken to prevent chemicals, fuels, oils, grease, bituminous materials, waste washings, herbicides, insecticides, lime, wet concrete, cement, silt or organic or other deleterious material from impacting land or entering waterways or the wastewater lagoons.
- C. Petroleum products, industrial chemicals and similar toxic or volatile materials shall be stored in durable containers approved by the Owner and located in areas so that any accidental spillage will not drain onto land or into any water, including the wastewater lagoons. Substantial quantities of such materials shall be stored in an area surrounded by containment dikes of sufficient capacity to contain an aggregate capacity of all tanks.
- D. Wastes, effluents, trash, garbage, oil, grease, chemicals, cement, bitumen, petroleum and wastes containing such products shall be disposed of offsite in a lawful manner conforming to all applicable local, state and federal laws. Furnish the Owner with documentation showing compliance with this requirement.

- E. Disposal of effluents shall conform to applicable local, state and federal laws. Waters used to wash down equipment shall be disposed of in a manner to prevent their entry into a waterway or the wastewater lagoons. If any waste material is dumped in unauthorized areas, the Contractor shall remove material and restore the area to the condition of adjacent, undisturbed area. If necessary, contaminated ground shall be excavated, disposed of as directed by the Owner and replaced with suitable compacted fill material with surface restored to original condition.

1.12 Dust Control

- A. Dust control shall be required as specified below:
 - 1. The Contractor shall maintain all excavations, embankments, stockpiles, roads, plant sites, waste areas, borrow areas and all other Work areas within the WWTP site free from dust which would cause a hazard or nuisance to others.
 - 2. Approved, temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or equal methods shall be provided to control dust.
 - 3. If sprinkling is used, the sprinkling must be repeated at such intervals as to keep all parts of disturbed areas at least damp at all times.

1.13 Emergency Spill Response Notification

- A. Under state law, The Department of Ecology (Ecology) must be notified when any amount of regulated waste or hazardous material that poses an imminent threat to life, health, or the environment is released to the air, land, or water, or whenever oil is spilled on land or to waters of the state. The spiller is always responsible for reporting a spill. Failure to report a spill in a timely manner may result in enforcement actions. If you are not responsible for a spill, making the initial notification does not make you liable for the spill. However, consult with Ecology's response team before attempting any type of response or cleanup and notify the Owner immediately.
- B. If oil or hazardous materials are spilled to state waters, the spiller must notify both federal and state spill response agencies. The federal agency is the National Response Center at 1-800-424-8802. For state notification, call the Washington Emergency Management Division (EMD) at 1-800-258-5990 or 1-800-OILS-911 AND the appropriate Ecology regional office for your county. An Ecology spill responder will normally call the reporting party back to gather more information. The agency will then determine its response actions. Also, notify the Owner immediately.

1.14 Site Restoration

- A. Unless otherwise specified or shown, restore disturbed areas to original grade and restore damaged surface improvements to their preconstruction condition or better.

1.15 Restoration of Roads

- A. Unless otherwise specified or shown, resurface and bring to original grade and section roads in which the surface is removed, broken or damaged, or in which the ground has caved or settled during the work under this Contract. Restore any curbs or gutters damaged during construction. Clean and repair roads used by the Contractor. Before resurfacing material is placed, trim edges of pavements back far enough to provide clean, solid, vertical faces, free of loose material.

1.16 Maintenance of Traffic and Roadway Closure

- A. Contractor shall conduct its work to interfere as little as possible with site travel, whether vehicular or pedestrian.
- B. Whenever it is necessary to cross, obstruct or close roads, driveways and walks, whether public or private, provide and maintain suitable and safe detours or other temporary expedients for the accommodation of public and private travel, and give reasonable notice to the property owner before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.
- C. The Contractor shall be required to properly warn the public of construction equipment and activities, open trenches, and/or other unsafe conditions by providing all necessary warning equipment. Such equipment shall include warning signs, barricades, fencing, flashing lights and traffic control personnel (flaggers).

1.17 Pipe and Damage Repair Inventory

- A. The Contractor shall prepare and be equipped for repair of piping and utilities that are damaged during construction.

1.18 Removal of Temporary Facilities

- A. Upon completion of the work, and subject to approval of the Owner, the Contractor shall completely remove all temporary facilities. Temporary utilities shall be removed to the temporary service connection point, and capped or terminated.

END OF SECTION 01500

**SECTION 01660
FACILITY STARTUP AND TESTING**

PART 1 - GENERAL

1.01 General

- A. Work and materials specified in this Section include initiation of operation and testing of Contractor supplied equipment and mechanical and electrical systems.

1.02 Scope

- A. All installed equipment and mechanical and electrical systems shall be prepared and adjusted for operation, placed into operation and tested to confirm proper operation and performance. Authorized representatives of the manufacturer of each equipment and system shall conduct and/or direct or assist with installation verification, preliminary adjustment and initiation of operation and functional testing of the equipment and systems.
- B. The Contractor shall coordinate the PLC I/O, equipment and system testing, for all equipment and instrumentation installed as part of this Contract. See Division 17 for further detail on requirements for instrumentation, programming and system integration.
- C. The Contractor shall coordinate with the equipment manufactures and facilitate the startup and testing.
- D. The Contractor shall arrange for, and pay all costs associated with the services of the manufacturer's representatives, for all equipment supplied by the Contractor.

1.03 Submittals

- A. Submittals shall be supplied in accordance with Section 01300 - Submittals, as follows:
 - 1. Detailed plan for initiation of operation and testing.
 - 2. Procedures and data forms for installation verification and preliminary adjustment of each system and equipment.
 - 3. Functional test procedures and test data forms.

1.04 Schedule

- A. Start up and testing shall be scheduled once all the equipment, materials and products are on site. The equipment, materials and products need not be installed but the Contractor shall schedule the testing with enough time for the equipment, material and products to be installed by the Contractor.

- B. The Contractor shall notify the Owner four (4) weeks prior to the Initiation of Operation and Functional Testing of any materials or information required to complete the testing. Any costs associated with delays resulting from failure to notify the Owner of required material or information will be the responsibility of the Contractor.
- C. The Contractor shall present for the Owner's review a detailed schedule showing the following information:
 - 1. Individual equipment testing
 - 2. System testing
 - a. System operation
 - b. System Alarms
 - c. Operator controlled settings
 - 3. Equipment training for Owner Personnel
- D. The Contractor shall schedule sufficient time to complete review of the installation verification and adjustments, equipment checks, functional testing, commissioning and training.
- E. The training shall occur during the same time period as installation verification and functional testing by the manufacturer's representative.
- F. Performance testing, if required per the individual sections of these Specifications, is to be completed following successful functional testing.
- G. All such testing, training and commissioning shall be completed prior to the final inspection.

PART 2 - PRODUCTS

2.01 Test Equipment

- A. The costs for power, gas, labor, material, supplies, and everything else needed to successfully complete the testing, is the responsibility of the Contractor and shall be included in the unit contract prices related to the system being tested.
- B. Provide industry standard test equipment, required for performing the tests specified herein.
- C. Instrumentation shall meet the following standards:
 - 1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
 - 2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.

3. Be maintained in good repair and operation condition throughout the duration of use on this project.
4. Be recalibrated/repared if dropped or damaged in any way since last calibrated.

2.02 Reports

- A. Verification of Installation and Preliminary Adjustment: Provide documentation of installation verification and preliminary adjustments. Identify equipment and components verified, deficiencies noted, corrective action taken, and certification by the manufacturer of equipment and system of approval for operation.
- B. Functional and Performance Test Reports: Provide functional test deficiency reports for the PAA system. Identify deficiencies, corrective action taken, and the dates and initials of the persons making the entries. Document all data recorded during test. Report performance in comparison to the specified performance requirements. Describe observations about the performance that were associated with failures to achieve acceptable results. Identify the cause of failure if such is apparent and corrective actions to be taken.

PART 3 - EXECUTION

3.01 Installation Verification and Preliminary Adjustment

- A. The Contractor and the authorized representative of each manufacturer shall conduct an installation verification audit of each equipment and system. The Contractor shall perform all work required to correct and eliminate all deficiencies disclosed by the audit.
- B. All equipment and systems shall be adjusted and fully prepared for operation by the manufacturer's representative prior to initiation of operation. Preliminary adjustment shall include visual inspection for damage or missing parts, lubrication, alignment check, calibration, and other preparatory work appropriate to the equipment and systems. Any malfunctioning components shall be repaired and/or replaced.
- C. Correction of Deficiencies
 1. Deficiencies identified during and as a result of equipment checks or functional testing shall be completely and permanently eliminated by permanent adjustment of the equipment, replacement of components or replacement of the entire equipment or system. The Owner will not and shall not be obligated to accept any equipment or system which is found to fail functional testing and/or malfunction.
 2. Where so directed by the Owner, equipment and/or systems with deficiencies shall be removed and new equipment and/or systems without deficiencies shall be provided and installed. All correction of deficiencies, including complete replacement of equipment and/or systems, shall be performed and completed at no cost to the Owner.

D. Equipment Checks

1. Electrical Tests shall be performed for all electrical equipment of the new PAA system including pumps and associated instruments and controls and shall include the following tests, as applicable:
 - a. Megger stator and power cables
 - b. Check lubrication
 - c. Check for proper rotation
 - d. Check power supply voltage
 - e. Measure motor operating load and no-load current.
 - f. Check operation and sequence.
 - g. Further testing in accordance with Section 16010 - Electrical General and other applicable sections in Divisions 11 thru 17.

E. Functional Test Procedures

1. Functional test procedures and functional test data sheets shall be developed for each equipment and system based upon actual installed configuration and operational characteristics. Emphasis shall be placed on testing procedures which will conclusively determine actual performance and compliance with specified requirements.
2. Test procedures shall fully describe test configuration and steps required for each test. Test procedures shall result in confirmation of the performance of equipment and systems to the extent of the specified intent and applicable code. Testing shall be conducted to assure that the equipment and system is complete, operates as intended, is correctly installed and adjusted, and that testing documentation is complete.
3. The majority of mechanical equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met. Such standards and conditions could include level, proof-of-flow, non-leak conditions, maximum pressure, etc. Functional performance test procedures shall demonstrate the actual performance of safety shutoffs in a real or closely simulated condition of failure.
4. Alarming, monitoring and recording functions specified in Section 17500 shall be demonstrated.
5. Automated control of the equipment shall be demonstrated to verify that it functions as specified in Section 17500.

3.02 Acceptance of Facility Start Up and Testing Reports

- A. Once all deficiencies have been corrected and functional testing completed, the Reports will be reviewed with the Owner. The Owner will notify the Contractor of any outstanding issues or further training required for the Owner's personnel to feel competent in running the equipment or system.

- B. The Owner will notify the Contractor that initial facility startup and functional testing has been reviewed and considered to be completed and that any specified performance testing period may commence.

3.03 Performance Testing

- A. Performance testing shall be conducted as specified in the individual sections of these Specifications. Once it has been determined by the Engineer that performance testing has been successfully completed, the Owner will notify the Contractor.

3.04 Equipment Failure During Warranty Period

- A. The Contractor shall be responsible for any equipment that fails to operate as specified during the 1-year warranty period that will begin on the date of Final Acceptance. The Contractor shall bear the costs to determine the failure, correct the problem and report to the Owner. If the failure was determined to be Operator error on a system where training was provided, then the Contractor shall be reimbursed those expenses.
- B. The Contractor shall involve the equipment manufacturer if the Contractor cannot determine the failure. The costs associated with having the manufacturer's representative visit the site shall be the Contractor's or manufacturer's. All costs associated with repairing or replacing the failed equipment, and any temporary system shutdowns or reconfiguration to keep the facility operating shall be the responsibility of the Contractor or manufacturer.

END OF SECTION 01660

**SECTION 01710
CLOSEOUT PROCEDURES**

PART 1 - GENERAL

1.01 Summary

- A. Section Includes: Contract closeout requirements including:
 - 1. Final cleaning.
 - 2. Waste Disposal.
 - 3. Touch-Up and Repair.
 - 4. Preparation and submittal of closeout documents.
 - 5. Completion and acceptance.
- B. Related Sections:
 - 1. Section 01660 - Facility Start Up and Testing
 - 2. Section 01730 - Operation and Maintenance Data

1.02 Final Cleaning

- A. Perform final cleaning prior to inspections for Substantial Completion.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials which are recommended by manufacturers for the surfaces to be cleaned.
- D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
- E. Clean channels, pipes and sumps prior to functional testing of the facilities.
- F. Clean roofs, gutters, downspouts; headworks concrete surfaces, railings, grating, and drainage systems.
- G. Broom clean exterior paved surfaces and rake clean other surfaces of sitework. Police yards and grounds to keep clean.
- H. Remove dust, cobwebs, and traces of insects and dirt.
- I. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, fixtures, piping, conduit and equipment.
- J. Remove non-permanent protection and labels.

- K. Clean light fixtures and replace burned-out or dim lamps.

1.03 Waste Disposal

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site. Prior to making disposal on private property, obtain written permission from owner of such property.
- B. Do not fill ditches, washes, or drainage ways that may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to final acceptance of the Work.

1.04 Touch-Up and Repair

- A. Touch-up or repair finished surfaces on structures, equipment, piping, fixtures, and installations that have been damaged prior to inspection for Substantial Completion
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

1.05 Closeout Documents

- A. The following are the documents required to be on file with the City of Snohomish prior to release of retainage to the Contractor.

No.	Document	Generated by	Contact	Date Received by City
1	Contractor's Notification to City of Completion of Contract Work	Contractor	Utilities Manager	
2	Recommendation of Project Acceptance	City	Utilities Manager	
3	Final Project Acceptance	City / Council	Utilities Manager	
4	Intent to Pay Prevailing Wages	Contractor	Dept. of Labor & Industries	
5	Notification of Completion to Department of Revenue	City	Dept. of Revenue Excise Tax Division	

DIVISION 01 – GENERAL REQUIREMENTS
SECTION 01710
CLOSEOUT PROCEDURES

No.	Document	Generated by	Contact	Date Received by City
6	Affidavit of Wages Paid	Contractor	Dept. of Labor & Industries	
7	Certificate of Payment State Excise Tax by Public Works Contractor	State	Dept of Revenue Excise Tax Division	
8	Release Regarding Industrial Insurance	City	Utilities Manager	
9	Certification of Payment of Contributions	State	Dept. of Employment Security	
10	Receipt for Payment in full or Release of Lien signed by Lien Claimant and filed with City	Contractor	All claims against retainage or payment Bond filed with the City	
11	Operation & Maintenance manuals with warranty documents referencing Performance Bond	Contractor	Utilities Manager	
12	Contractor's As-Built Markups	Contractor	Utilities Manager	

1.06 Completion and Acceptance

- A. When all facility startup and testing has been successfully completed, the Owner may certify that new facilities are substantially complete. The Owner and/or the Engineer will perform an initial inspection and submit a list of known items (Punchlist) still to be completed or corrected prior to Physical Completion.
- B. The Punchlist of items to be completed or corrected will be amended as items are resolved by the Contractor.
- C. When all items have been reported as completed or corrected, the Contractor shall submit written certification that the entire work is physically complete in accordance with the Contract Documents and ready for final inspection.
- D. Upon completion of final inspection and receipt of all Closeout Submittals, the Completion Date will be established, and the Owner will either prepare a written acceptance of the entire Work or advise the Contractor of Work not complete. If necessary, inspection procedures will be repeated.
- E. The written acceptance will include a Declaration of Construction Completion as required by the Washington Administrative Code.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 01710

SECTION 01730
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 General Information

- A. The Contractor shall arrange for, and pay all costs associated with the services of the manufacturer to prepare operation and maintenance data for the systems and/or equipment as described in Paragraph 1.02 below.
- B. The Contractor shall submit to the Owner all Material Safety Data Sheets (MSDS) on any chemical or product required for the operation and maintenance of the equipment and processes associated with this Contract.

1.02 Systems and Equipment

- A. Operation and maintenance data for systems and/or equipment shall include, but not be limited to, the following:

<u>Section No.</u>	<u>System or Equipment</u>
11240	PAA Building and Feed Equipment
11330	Submersible Carrier Water Pump
15070	Piping Appurtenances
15100	Valves
Div 17	Control Systems

1.03 Initial Submittal

- A. The Contractor shall submit an electronic PDF file of the initial submittal for review. The initial submittal shall be received by the Owner at least twenty (20) Working Days prior to placement of the system and/or equipment in operation. The submittal shall be prepared by the manufacturer. The initial submittal may be delivered in multiple parts, but shall be complete for each Section specified above.
- B. The initial submittals identified in Paragraph 1.02, above shall include, but not be limited to, the following items, as applicable:

Item No. Description

- | | |
|---|--|
| 1 | <u>Fly sheet indicating:</u> project name; Owner's name; manufacturer's name, address, and telephone number; and local supplier/ representative's name, address, and telephone number. |
| 2 | Detailed index indicating submittal contents, with major headings related to tabbed dividers. |
| 3 | Assembly drawings |
| 4 | Parts list and/or bill of materials, complete with manufacturer's part/ serial numbers and contact information for parts supply |

Item No. Description

5	Wiring diagrams
6	Lubrication instructions, including type and frequency
7	Preventative and periodic maintenance summary
8	Operating instructions
9	Overhaul and parts replacement instructions
10	Source for parts
11	Testing and troubleshooting procedures
12	Performance curves
13	Factory test data
14	List of recommended spare parts
15	List of expendable parts (i.e., air or oil filters)
16	Material Safety Data Sheet on all associated chemicals and products
17	Warranty

- C. Each initial submittal shall be organized in a consistent format with bookmarked dividers for each item. All information shall be specifically for the installed components. Data sheets which cover multiple equipment or list options shall be marked to indicate the installed equipment, including provided options. All other equipment or options shall be crossed out.
- D. The Engineer and/or Owner will review the initial submittal and return it to the Contractor for incorporation of review comments.

1.04 Integrated Document

- A. After the Contractor has received and incorporated review comments for all of the initial submittals as identified in Paragraph 1.02 above, the Contractor shall assemble all revised submittals into an integrated document. The Contractor shall provide both hard copies and electronic PDF files for the integrated submittals. Hard copies of the submittals shall be bound in three-inch capacity, vinyl covered, D-ring binders. The integrated document shall consist of as many volumes as necessary to contain the data. A binder with less than three-inch capacity may be used for the last volume, if appropriate. The electronic PDF files shall be organized in the same volumes as the hard copy and delivered on a flash drive. Each volume shall include, but not be limited to, the following:
1. The front cover and binding edge shall have typed labels identifying the project, Owner, volume number, and plant area included.
 2. Detailed index indicating the contents of the volume by equipment and/or specification section.
 3. Tabbed dividers for each specification section.
 4. Approved operation and maintenance data arranged by specification section number in ascending order, regardless of manufacturer.
 5. Oversize (larger than 11"x17") prints shall be inserted in bound-in kraft or kevlar envelopes at the end of the applicable section or subsection.

- B. The Contractor shall submit one (1) electronic PDF file of the integrated document to the Owner and Owner's Representative within ten (10) Working Days after Substantial Completion of the work. The Owner and Owner's Representative will review the integrated document. If the integrated document does not meet the requirements of this Section, review comments will be provided to the Contractor for corrections. The submittal process shall be repeated until the integrated document is acceptable. The Contractor shall then submit three (3) hard copies and two (2) electronic copies on separate flash drives of the accepted, integrated operation and maintenance document to the Owner. The Contractor shall anticipate that Final Acceptance may be delayed if the integrated document is not acceptable to the Owner.

1.05 Material Safety Data Sheets

- A. The Contractor shall maintain two (2) binders with all the MSDS sheets for all the products and chemicals used for the Project. One (1) binder will be kept in a location designated by the Owner for their use and reference during, and after construction.

1.06 Submittal of Electronic Information

- A. Where specified in the individual sections of these Specifications, the manufacturer shall provide electronic CAD files of submittal and shop drawings and electronic copies of PLC programs to the Contractor for submittal to the Owner.

END OF SECTION 01730

**SECTION 02050
DEMOLITION**

PART 1 - GENERAL

1.01 Summary

- A. Section includes demolition, salvage, and removal and replacement of existing facilities, as depicted in the Drawings (particularly Drawings C-1, C-2, D-1 through D-3, and E-3 through E-6) and as specified herein, as required to allow for completion of the Work.
- B. Items to be demolished include, but are not limited to:
 - 1. Portions of existing chlorine contact tank concrete sidewalks.
 - 2. Portions of existing asphalt cement.
 - 3. Existing chlorine and sulfur dioxide mixers.
 - 4. Existing chlorine and sulfur dioxide solution piping and valves, as indicated on the Drawings.
 - 5. Portions of existing buried electrical conduit, wire and cable.
 - 6. Cutting and alterations for completion of the Work.
 - 7. Removing designated items for Owner's retention.
 - 8. Protecting items designated to remain
 - 9. Removing and disposing of demolished equipment and materials. The removed equipment and materials shall be properly disposed of at the Contractor's expense.
- C. Deliver items indicated to be salvaged to the City Snohomish Public Works shop or other location as designated by the Owner. Items to be salvaged include the following:
 - 1. Existing wooden structure housing the chlorine residual analyzers.
 - 2. Existing chlorine residual analyzers.
- D. The following items are to be removed, rehabilitated/modified and reinstalled:
 - 1. Existing sample pump, as indicated on the Drawings.
- E. Items to be protected in place include, but are not limited to, the following:
 - 1. Existing concrete structures, except as noted.
 - 2. Existing buried piping and conduits, except as noted.
 - 3. Existing slide gates.

4. Existing mixing and outfall manholes
5. Existing fencing and gates.
6. Existing chlorine contact tank grating, and supports
7. Existing chlorine contact tank railings, stairs and landings except as noted.
8. Existing effluent sampler.
9. Existing temperature probe.
10. Existing backflow preventer and yard hydrants.
11. Existing yard hydrants and hose racks.

1.02 Submittals

- A. Refer to Section 01300 - Submittals, for submittal requirements.
- B. Demolition Plan: The demolition plan shall be coordinated with the construction sequence and constraints specified in Section 01040 - Construction Constraints and Sequence.
 1. Indicate overall schedule and interruptions impacting utility services and headworks operations.
 2. Indicate demolition and removal sequence.
 3. Indicate location of items designated for salvage.
 4. Indicate location and construction of temporary work.
 5. Include asbestos survey report.

1.03 Closeout Submittals

- A. Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, subsurface obstructions, and final conditions of the facilities following demolition.

1.04 Quality Assurance

- A. Conform to applicable codes and OSHA requirements for demolition work, dust control, products requiring electrical disconnection and reconnection, and mechanical system decommissioning.
- B. Maintain one copy of the demolition work plan on site.

1.05 Sequencing

- A. Sequence activities in conjunction with the construction sequence and constraints specified in Section 01040.

- B. Complete headworks temporary bypass and temporary screening facilities before any demolition begins on the headworks facilities or associated electrical and control equipment.
- C. Contractor shall conduct salvage operations before demolition begins to remove any equipment or materials the Owner has listed to retain and deliver these items to the location designated by the Owner.

1.06 Scheduling

- A. Schedule work in conjunction with the construction sequence and constraints specified in Section 01040.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owner's operations and continuity of service.
- C. Coordinate utility service interruptions and tie-in to existing facilities with the Owner to minimize disruptions.

1.07 Project Conditions

- A. Cease operation immediately if any structure appears to be in danger, and notify the Owner. Do not resume operations until directed.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 Preparation

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect and maintain temporary barriers and security devices, including warning signs, lights, and similar measures, for protection of the Owner's staff and workers, and existing improvements indicated to remain.
- D. Erect and maintain weatherproof closures for exterior openings.

3.02 Salvage Requirements

- A. Coordinate with Owner and review items to be salvaged, removed and replaced and protected in place as listed in Paragraphs 1.01.C, 1.01.D and 1.01.E above prior to demolition.

- B. Tag components and equipment that Owner designates for salvage, removal and replacement, or protection in place. Protect these items from demolition operations until they can be removed or demolition activities are complete.
- C. Carefully remove components and equipment indicated to be salvaged or removed and replaced.
- D. Disassemble equipment and components as required to permit removal.
- E. Package small and loose parts to avoid loss.
- F. Mark equipment and packages parts to permit identification and consolidation of components of each salvaged item.
- G. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.03 Demolition

- A. Conduct demolition to minimize interference with WWTP operations.
- B. Maintain access road to and around the headworks at all times during demolition.
- C. Cease operations immediately if a structure appears to be in danger and notify the Owner.
- D. Disconnect and remove designated utilities within demolition areas.
- E. Plug and Abandon Pipe and Utilities:
 - 1. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
 - 2. Ductile iron, cast iron, and cement pipe epoxy and plug with non-shrink grout, unless noted otherwise. At a minimum, provide a non-shrink grout plug that is the greater of either 12 inches or 1.5 times the diameter in thickness.
 - 3. PVC pipe shall be plugged with solvent weld end cap for 3-inch diameter and under, 4-inch diameter and larger shall have a cap fitting as required for pressure and gravity systems.
- F. Demolish in orderly and careful manner. Protect existing facilities, supporting structural members and utilities.
- G. Remove demolished materials from site except where specifically noted otherwise. Materials to be properly disposed of at Contractor's expense.
- H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

END OF SECTION 02050

**SECTION 02300
EARTHWORK**

PART 1 - GENERAL

1.01 Description of Work

- A. This section specifies structure and trench excavation and backfilling necessary for the construction of all embankments, structures and trenches associated with the Work.
- B. Work shall be performed in accordance with the provisions set forth in Divisions 2 and 7 of the Standard Specifications and as specified herein. In case of conflict between the Standard Specifications and these Specifications the most stringent requirements, as determined by the City, shall apply.
- C. No source has been provided for any materials necessary for the construction of this improvement. The Contractor shall make his own arrangements to obtain the necessary materials at his own expense, and all costs of acquiring, producing, placing, and compacting this material in the finished work shall be included in the unit contract prices for the various items involved.
- D. If the sources of materials provided by the Contractor necessitates hauling over roads other than City streets, the Contractor shall, at his own cost and expense, make all arrangements for the use of the haul routes.

1.02 Subsurface Conditions

- A. Geotechnical and subsurface investigation was previously conducted in near the facilities to be constructed for design of previous contract work. This Geotechnical Report is provided in Appendix A. Review of the report is recommended prior to bidding.
- B. Any geotechnical or subsurface information that is provided as part of this Contract is based on the best factual information available. Actual subsurface conditions may differ, sometimes significantly, as the subsurface explorations were only conducted at select locations. It is provided without assumption of the responsibility as to its accuracy or for any conclusions that the bidder might draw there from. The information shall not be exclusively relied on by bidders. Bidders are advised to examine the available information and the site and make their own determinations and conclusions.

1.03 General Standards

- A. American Society of Testing and Materials (ASTM)
 - 1. C131 Test for Resistance to Abrasion of Small-Size Coarse Aggregate by Use of the Los Angeles Machine.

- | | | |
|----|-------|---|
| 2. | C136 | Sieve Analysis of Fine and Coarse Aggregates. |
| 3. | D75 | Standard Practice for Sampling Aggregates. |
| 4. | D1556 | Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method. |
| 5. | D1557 | Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. |
| 6. | D6938 | Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). |

1.04 Submittals

- A. Submittals shall be supplied in accordance with Section 01300 - Submittals, as follows:
1. Aggregate and soil information.
 2. Cribbing and shoring plan.
 3. Compaction testing results.

PART 2 - PRODUCTS

2.01 Earthwork Materials

- A. The earthwork materials used on this project shall be provided in accordance with the following sections of the Standard Specification:
1. Crushed Surfacing Top Course – 9-03.9(3).
 2. Crushed Surfacing Base Course – 9-03.9(3).
 3. Structural Fill – shall consist of Gravel Borrow per 9-03.14(1).
 4. Pipe Zone Bedding – 9-03.12(3).
 5. Imported Trench Backfill –Bank Run Gravel for Trench per 9-03.19.
 6. Class A Foundation Material – 9-03.17
 7. Native Backfill – Native material used for trench backfill shall be limited to soils prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material. If the native soil has less than 5 percent fines (material passing a #200 sieve) by dry weight, as based upon the fraction of the test specimen passing the ¾-inch sieve, then it may also be used for structural backfill.
 8. Controlled Density Fill – 2-09.3(1)E.

2.02 Temporary Erosion and Sediment Control (TESC) and Restoration Materials

- A. TESC and restoration materials shall meet the requirements of the sections of the Standard Specifications listed below and as shown on the Drawings:
 - 1. Silt Fence –9-14.5(9).
 - 2. Catch Basin Inserts – Minimum 0.5 cubic feet of storage capacity, has an overflow and the means to dewater stored sediment and can be readily maintained.
 - 3. Polyethylene (PE) Sheeting – 9-14.5(3).

2.03 Warning and Detection Tape

- A. Warning and detection tape shall be minimum 6-inches wide, inert, fade-resistant plastic film resistant to acids, alkalis, and other components likely to be encountered in soil.
- B. Warning tape is to be utilized for metallic pipes and conduits. Warning tape shall be Lineguard Type II Detectable; or approved equivalent.
- C. Detection tape shall be utilized for non-metallic pipes and conduits. Detection tape shall be plastic metallic type consisting of a color coded polyethylene or melinex film, a solid core aluminum foil detection layer, and other layers as required. Detection tape shall be Reef Industries Terra Tape Sentry Line Detectable tape; or equal.
- D. Tape color and lettering shall be as follows:
 - 1. Water Pipelines: Blue, imprinted with “CAUTION WATER LINE BURIED BELOW.”
 - 2. Electrical Conduits: Red, imprinted with “CAUTION ELECTRICAL LINE BURIED BELOW.”
 - 3. Sewer/Drain Pipelines: Green, imprinted with black printing reading “CAUTION SANITARY SEWER BURIED BELOW.”

2.04 Locate Wire

- A. 10 Ga. locate wire shall be installed on all buried pressurized lines.

PART 3 - EXECUTION

3.01 General

- A. Earthwork shall be performed in accordance with Division 2 of the Standard Specifications and in accordance with the following provisions and specifications herein.

3.02 Geotechnical Review

- A. The Contractor shall be aware that a geotechnical consultant will be performing monitoring, testing, and consultation during construction to evaluate whether geotechnical-related construction activities (e.g., placement and compaction of backfill) comply with the Contract requirements and recommendations contained in the Geotechnical Report. The Contractor shall provide access and assistance as necessary to support this work.

3.03 TESC

- A. Install TESC measures as shown on the Drawings.

3.04 Protection of Existing Pipelines and Utilities

- A. The Contractor shall perform such work and furnish and install such materials as required to protect and maintain in continuous service all existing pipelines and utilities. Excavations shall be controlled by shoring of slopes, dewatering, installation of steel sheet piling and/or other means, as may be required, to preclude sloughing of soil from under pipelines and utilities and to maintain proper support of pipelines and utilities. At locations where maintenance of proper soil support is not feasible or appropriate, the Contractor shall furnish and install such temporary structural bracing, supports and beams as may be required to restrain and support the existing pipelines and utilities.

3.05 Classification of Excavated Material

- A. Structural and trench excavation shall include and consist of all encountered in situ materials, regardless of their characteristics. However, reuse of native material for backfill shall be limited as described in Paragraph 2.01 above.

3.06 Disposal of Excavated Material

- A. Excavated material soil that is not designated for use in backfill and/or other earthwork construction shall be disposed offsite by the Contractor in accordance with the Standard Specifications at a suitable location that is permitted and complies with all applicable regulations. Excavated material shall be transported to the disposal site as it is excavated; material shall not be temporarily stored on the work site.

3.07 Dust Control

- A. The Contractor shall include in his operations sufficient labor, equipment and materials to prevent generation of dust. Dust control shall include, but not be limited to, application of water and/or dust suppressants approved by the Washington State Department of Ecology.

3.08 Wet Weather Earthwork

- A. If earthwork must be performed during wet weather, the Contractor shall observe the following procedures:
 - 1. Earthwork should be performed in small areas to minimize subgrade disturbance and additional moisture.
 - 2. Fill material should be placed immediately following excavation and subgrade preparation.
 - 3. Ground surface should be graded to promote run-off of surface water and sediments away from excavations.

3.09 Control of Water

- A. The excavations shall be maintained free of surface runoff and/or groundwater by any and all dewatering methods which provide a stable foundation for the structure and/or pipe and enable proper construction of the structure and/or installation of the pipe. The specific dewatering method or methods to be utilized shall be determined by the Contractor.
- B. The configuration, size, and capacity of the dewatering equipment and systems shall maintain excavations free of water at all times and shall prevent bottom heave, instability of the subbase, collapse of side slopes, and/or similar detrimental occurrences. The Contractor shall determine the size, capacity, and configuration of all equipment required for dewatering and shall furnish, install, maintain in operation all such equipment until placement and compaction of the backfill is completed. The Contractor shall maintain the dewatering equipment and systems in place and in operation for whatever time required to properly dewater the excavation prior to and during excavation operations and during construction of the structure and/or installation of pipe, and placement and compaction of the backfill materials. The Contractor shall make all arrangements for and shall pay all cost of electrical power necessary for operation of pumps.
- C. Groundwater from dewatering operations may be discharged to adjacent streams or surface water runoff areas in accordance with all federal, state, county, and municipal regulations and requirements, regardless of specific jurisdictional requirements. Surface water or sediment-rich groundwater discharged from dewatering operations shall not be discharged to streams or runoff areas without filtration or other means of sediment removal.
- D. Discharge to streams shall be regulated or provided with baffles or other energy-dissipating devices to prevent erosion of the stream banks and/or bed by high velocity water.

3.10 Structural Fill

- A. Structural Fill shall be placed in accordance with Section 2-03.3(14)C of the Standard Specifications.

3.11 Foundation Excavation and Backfill

- A. Prior to placement of Structural Fill or Trench Backfill, construction debris and loose soils shall be removed from the excavation. Water in the bottom of the excavation shall be removed by pumping, or other means.
- B. Structural Backfill shall be placed against the manholes, vaults and structures in lifts no greater than 8 inches and compacted to at least 95 percent of maximum dry density. Prior to placing backfill, remove forms, temporary construction and debris below grade. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour or if the specified strength has been achieved. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of at least 5 feet in order to avoid the build-up of excessive lateral pressures. Compaction within 5 feet of the walls shall be accomplished using hand operated vibratory plate compactors or tamping units. Particular care must be taken to avoid damage to the pipe connections to the structure.
- C. Sides of excavations shall be shored or sloped as required by the insitu soils, provided the resulting side slopes do not extend outside the project area. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

3.12 Trench Excavation, Shoring, Pipe Bedding, and Trench Backfill

- A. Trench excavation shall be performed in accordance with Section 7-08.3(1)A of the Standard Specifications and the following provisions:
 - 1. All trenches within areas open to the public shall be excavated, bedded, utilities installed and tested, and backfilled in one continuous operation to prevent excessive sloughing and inconvenience or danger to the public. Excavations remaining open for combined utilities shall be closed as soon as possible, and proper barricading, flagging, etc., shall be provided for public safety. The Contractor shall not, when possible, open trenches until all provisions have been made to install all utilities at one time.
 - 2. Excavation of pipe trenches shall be performed to the lines and grades necessary for proper installation of pipe, bedding and backfill. Trenches greater than 4 feet deep shall be sloped at a minimum of 1.5H:1V or as required by the insitu soils, provided the resulting side slopes do not extend outside the project area, or unless sheeting and shoring is provided. Excavations below the water table may require flatter side slopes, refer to Geotechnical Report for additional information.

3. The Contractor shall expect to perform some hand excavation in work areas where access by machinery is limited or where damage to existing utilities or structures might occur.
 4. Prior to installation of bedding and pipe, the trench bottom shall be cleaned of all roots, loose stones and debris. Bedding shall be placed only upon firm, undisturbed material, or on Foundation Material, and any soil at the bottom of the trench which is disturbed or loosened by the trenching operations or any muddy soils shall be removed, and additional bedding materials shall be placed as a foundation.
- B. Shoring shall be provided in accordance with Section 7-08.3(1)B of the Standard Specifications and in accordance with the following provisions:
1. Shoring shall be provided by the Contractor to maintain stable excavation sides, regardless of slope of the adjacent ground surface.
 2. Trench boxes shall not be used for excavations within a critical distance to bottom of existing displacement-sensitive structures. The critical distance is defined as the distance equal to 1.5 x depth of excavation. For excavations within this critical distance, sheet pile walls, soldier pile walls or slide rails shall be used.
 3. Place sheeting and other restraints as necessary to preclude any and all heave of the bottom of excavations and provide a stable bottom of excavation that will not settle after backfill.
 4. Damages resulting from improper shoring or during removal of shoring shall be the sole responsibility of the Contractor.
- C. Pipe Bedding shall be placed in accordance with 7-08.3(1)C.
- D. Trench Backfill shall be placed in accordance with 7-08.3(3) of the Standard Specifications and the following provisions:
1. Backfill shall be placed over the compacted Pipe Zone Bedding as required to prevent any damage to or shifting of the pipe. Trench Backfill shall be placed in maximum 12-inch deep layers and then compacted.
 2. Unless otherwise shown on the Drawings, each layer of Trench Backfill shall be compacted to the following densities:
 - a. Along and over the pipe to a depth of one (1) foot above the crown of the pipe – 90 percent of maximum dry density.
 - b. Above one (1) foot above the crown of the pipe 95 percent of maximum dry density, except 90 percent maximum dry density around the Palmer-Bowlus flume manhole replacement north of the headworks.
 3. All new underground utilities shall have warning or detection tape installed above the utilities. Use detection tape above non-metallic utilities to facilitate location. The tape shall be brought to within 6 inches of the surface at each vault, valve, cleanout, manhole, etc.

3.13 Foundation Material

- A. Where organic and/or soft material or other unsatisfactory conditions are found to be present at the bottom of the excavation, the Owner's Representative may require over excavation and placement of Foundation Material and a separation geotextile. Such over excavation shall be carried to the depth required by the Owner's Representative.

3.14 Compaction

- A. The Contractor shall continuously utilize and employ earthwork methods and procedures which will result in strict conformance with all earthen and aggregate density requirements specified herein and as shown on the Drawings.
 - 1. Water settling shall not be employed. The use of compaction equipment directly over the pipes shall be controlled and limited in accordance with installation instructions and recommendations provided by the manufacturer of the pipe.
 - 2. Density testing of bedding, structural fill, structural backfill and trench backfill, crushed surfacing and other earthen materials will be performed by the Contractor's independent testing firm (see Section 01400 - Materials Testing and Quality Control).
- B. No tolerance below or less than the specified minimum density will be permitted or accepted. All bedding and backfill materials which are shown by the density testing to be less than the specified minimum density shall, regardless of the amount of the difference between tested and specified minimum density, shall be removed and reinstalled under different and/or revised methods of placement and compaction determined by the Contractor at no additional cost to the Owner.

3.15 Compaction Testing

- A. The Contractor shall perform the work of placement and compaction of earth and aggregate materials as required to enable field density testing to be performed by the Contractor's independent testing firm on each lift of material placed. Testing will include laboratory testing to define the moisture-density relationships of imported and borrow materials and field testing to determine the in-place density after placement and compaction of the materials. The Contractor shall plan and execute placement and compaction of bedding and backfill materials to include and accommodate, as an integral and coordinated element of the work, the laboratory and in-place density testing.
- B. In-place density testing of compacted bedding and backfill materials will be performed in accordance with ASTM D1556 or ASTM D6938. Laboratory maximum density testing will be performed in accordance with ASTM D1557. Frequency and location of testing will be determined by the Owner's Representative.

- C. The Contractor shall anticipate that extensive laboratory and field density testing will be performed on each lift of bedding and backfill material immediately after the compaction of each lift is completed. Where bedding and backfill material is being placed and compacted in confined working areas, the Contractor shall stop the backfill operations to assure the safety of the field test technician and allow the in-place density testing to be properly performed.

3.16 Finish Grading and Restoration

- A. All excavation and backfilled areas, adjacent transition areas, and all areas disturbed during construction shall be uniformly graded. The finished surface shall be smooth, compacted and free from irregular surface changes and sloped to drain.
- B. Asphalt pavement and crushed surfacing shall be restored in kind or in accordance with the Drawings.

END OF SECTION 02300

**SECTION 02510
ASPHALT CONCRETE PAVING**

PART 1 - GENERAL

1.01 Description of Work

- A. The work covered in this Section includes paving and surfacing with asphaltic concrete pavement (also called hot mix asphalt (HMA) pavement), crushed surfacing base course, and pavement marking.

1.02 Standards and Codes

- A. City of Snohomish Standard Details
- B. Standard Specifications – 2018 Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction.
- C. WSDOT Test Method 705.

1.03 Submittals

- A. In accordance with the requirements of Section 01340 – Project Data Submittals, submit the following Project Data:
 - 1. Asphalt concrete mix design;
 - 2. Liquid asphalts; and
 - 3. Asphaltic concrete aggregate analysis including sieve results, Los Angeles wear, percent sand equivalent, and percent fractured above a No. 10 sieve.

PART 2 - PRODUCTS

2.01 Materials

- A. Materials shall be clean sand/gravel mixture free from organic matter and conforming to the following gradation in the WSDOT Standard Specifications:
 - 1. Asphalt 9-02.1
 - 2. Aggregates for Asphalt Concrete 9-03.8
 - 3. Crushed Surfacing 9-03.9(3)

2.02 Asphalt Concrete Mix Design

- A. The actual proportions of the asphalt and aggregate mixture shall be determined by the Contractor to provide dense grade asphalt concrete that will readily compact to form a finished pavement having a smooth, uniform surface texture.

The actual proportions of the mix shall be within the limits specified herein and shall be changed only upon approval of the Engineer. The mix shall not include recycled asphalt concrete materials.

1. ASPHALT CONCRETE PAVEMENT: Asphalt Concrete for Pavement shall be HMA Class ½". Asphalt concrete shall be manufactured and mixed in accordance with the requirements of Section 5-04 of the WSDOT Standard Specifications.

2.03 Tack Coat

Tack coat used for preparing the existing paved surface for HMA overlay shall be in accordance with Section 5-04.3(4) of the Standard Specifications.

PART 3 - EXECUTION

3.01 General

- A. Asphalt pavement shall be in accordance with the WSDOT Standard Specifications Section 5-04. All asphalt shall be ½ inch commercial HMA with PG 58-22 asphalt binder. Furnish, place, spread and compact HMA to the thickness shown on the District's Standard Details. Pavement shall be rolled with vibratory compactor. Machine width shall match trench patch width.
- B. New surfacing shall be provided for the conditions called out on the Drawings and shall conform to the associated Contract Document requirements. Existing and new manhole and catch basin frames and grates shall be adjusted to finish grade prior to placement of final lift of asphalt concrete paving.

3.02 Preparation for Asphalt Concrete

- A. SUBGRADE PREPARATION FOR ASPHALT CONCRETE PAVEMENT: The area to be paved shall be prepared by excavation and/or filling as required, shaping, grading, and compaction of the subgrade. Roadbed and subgrade preparation shall be in accordance with applicable requirements of the District's Standard Details.
- B. Preparation for asphalt concrete shall include, but is not limited to: saw cutting existing asphalt, removal and proper disposal of subgrade and all existing asphalt being replaced by the new asphalt; joint sealing; grinding at transitions; placing tack coat; furnishing, hauling, placing, and compacting the asphalt pavement; adjusting all utility covers and monument case covers to the new grade as necessary; replacing all disturbed pavement striping and markings; and all associated plans and all work necessary as shown on the Contract Documents.

3.03 Crushed Surfacing Base Course (CSTC)

- A. CSTS in accordance with WSDOT Standard Specification 9-03.9(3) shall be placed and compacted in accordance with the requirements of WSDOT Standard Specification Section 4-04.

3.04 Asphalt Concrete Pavement

- A. Asphaltic concrete pavement shall be placed, shaped, and compacted to the depths shown on the Drawings, with each lift not to exceed 2-inch compacted depth. The asphaltic concrete shall be placed and compacted to form a smooth surface that matches the existing pavement or final grade, as shown on the Drawings.
- B. Asphalt concrete shall be placed and compacted in accordance with the applicable requirements of Section 5-04 of the WSDOT Standard Specifications. The material shall be placed to avoid any segregation of aggregate and to form a smooth surface. The completed surface shall not vary more than $\frac{1}{8}$ inch from the lower edge of a 10-foot straightedge placed in any direction across the completed pavement.
- C. Asphalt concrete shall be placed, leveled, and compacted to conform to the adjacent paved surface. The asphalt concrete shall be compacted to a minimum of 92 percent of the maximum density as determined by WSDOT Test Method 705. If the material still does not meet the compaction requirements it shall be removed and replaced with new material that is properly compacted. All costs for additional testing, removal, and replacement shall be borne by the Contractor.

3.05 Sealing

- A. The edges of the existing asphalt pavements shall be painted with STE-1 cationic special tack emulsion immediately before placement of the adjacent asphalt concrete. All joints between the new and original asphalt pavement shall be painted with CSS-1 emulsified asphalt and covered with clean, dry sand immediately after placement and compaction of the new pavement. Tacking and sealing of asphalt concrete patches shall be in accordance with the requirements of the WSDOT Standard Specifications Section 5-04.

3.06 Pavement Marking and Striping

- A. Pavement marking damaged or removed during construction shall be replaced by the Contractor. Cost for replacement of damaged or removed markings shall be incidental to the contract.
- B. Installation and construction of pavement marking shall comply with City of Snohomish Standards.

END OF SECTION 02510

**SECTION 02535
PRECAST VAULTS**

PART 1 - GENERAL

1.01 Description of Work

- A. This section specifies precast concrete vault to be used for the Overflow Transition Vault.

1.02 Quality Control

- A. Where referenced, the following editions of design standards and references shall apply:
 - 1. American Association of State Highway and Transportation Officials (AASHTO)
 - a. Standard Specification for Highway Bridges, 17th Edition, 2002
 - b. LRFD Bridge Design Specifications, 3rd Edition, 2004
 - 2. American Society of Testing and Materials (ASTM)
 - a. C857-95(2001) Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - b. C858-83(2004) Underground Precast Concrete Utility Structures
 - c. C1619-05 Elastomeric Seals for Joining Concrete Structures
 - 3. American Concrete Institute (ACI)
 - a. 318 -05 Building Code Requirements for Structural Concrete

1.03 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following Project Data:
 - 1. Manufacturer's technical data and documentation for all vaults to verify conformance.
 - 2. Manufacturer's data and documentation on hatches and appurtenances to verify conformance including:
 - a. Layout drawings specific to each hatch indicating the size and location of all components including; door leaf reinforcing, spring lift assemblies, drain couplings, recessed padlock hasp pocket, latch(s), and hinges.

- b. Specifications for frame, door leaves, and all hardware.
- c. Detail drawings for all appurtenances including, but not limited to, spring lift assemblies, recessed padlock hasp pocket, and latch interlock configuration.
- 3. Structural design calculations, including necessary design modifications, and buoyancy calculations assuming the ground water level is at the ground surface. Resistance to buoyancy shall yield a 1.5 safety factor (excluding skin friction).
- 4. Shop drawings.
- 5. Other data and information necessary to verify conformance with the Contract Documents.

1.04 Standard Products

- A. Although the use of standard products by fabricators is generally intended by this specification, some customization will be required, and it is the intent of the specification that the fabricator modify products as necessary to conform to this specification and the Drawings. This may involve revisions to dimensions, forms, reinforcement, concrete mix, and other variations from the fabricator's standard fabrication practice. The Contractor is cautioned to advise suppliers of this requirement to avoid delays in product approvals and misunderstandings in pricing.

PART 2 - PRODUCTS

2.01 Vaults

- A. Design Standards:
 - 1. Vaults shall conform to ASTM C858-83(2004) except as modified below:
 - 2. The minimum specified concrete compressive strength shall be 4500 psi at 28 days.
 - 3. Loading assumptions, unless noted otherwise on the plans, shall conform to ASTM C857-83(2004) except as follows:
 - a. Minimum vehicle load A-16 shall apply (HS20-44). Wheel load distribution shall be in accordance with AASHTO Standard Specification for Highway Bridges, 2002, or AASHTO LRFD Bridge Design Specifications, 2004.
 - b. Calculations shall assume a maximum dry density of soil of 135 pcf, and a soil friction angle $\phi = 30^\circ$. Use the at-rest soil coefficient $K_a = (1 - \sin \phi)$ in lieu of the active soil coefficient K_a with formulas in ASTM C857.
 - c. Live load surcharge pressure of 125 psf shall be assumed in lieu of surcharge pressures in ASTM C858. Surcharge pressure shall be checked with and without simultaneous loading of intersecting walls.

4. Minimum concrete cover over reinforcement shall not be less than that required by ACI 318, if greater than ASTM C858.
5. The Contractor shall submit vault structural design calculations, including buoyancy calculations and shop drawings, stamped by a Professional Engineer registered in the State of Washington.

B. Containment Vault:

1. The containment vault shall have an integral riser section that is connected to the bottom slab and cast as a single piece with the slab. The integral riser shall extend a height of at least 3 feet above the top of the base slab, unless limited by structure height.
2. The bottom slab thickness shall be as required by design calculations, but in no case less than 5 inches thick. Bottom pressure shall be calculated with and without groundwater assuming maximum live load on the top grating that consists of two (2) full intermediate bulk containers.
3. Grouting, as indicated on the drawings, shall be in accordance with Section 03600.
4. Additional Components:
 - a. The top of wall section on the interior shall have stainless steel edgers for grating support. 316 stainless steel angle edgers shall be cast with the vault for grating support, materials and fabrication shall be in accordance with Section 05500, Section 05531 and as shown on the Drawings.
 - b. Grating and intermediate supports shall be provided by the Contractor and installed in the vault in accordance with Section 05500 and Section 05531.
 - c. Containment vault interior shall be applied with a protective coating per Section 09900.

C. Penetrations and Openings:

1. The size and location of openings and pipe penetrations shall be as shown on the Drawings. Provide reinforcement around openings per ACI 318.

D. Intermediate Riser Sections:

1. Intermediate riser sections shall not be permitted.

E. Joints:

1. Joints shall not be permitted

F. Acceptable Manufacturers:

1. Granite Precast and Concrete, Inc

2. Oldcastle Infrastructure
3. Or Equal.

PART 3 - EXECUTION

3.01 General

- A. Installation of vaults shall conform to the requirements of WSDOT Standard Specification 7-05 except as modified herein and shown on the Drawings.

3.02 Vaults

- A. Foundation preparation, bedding and backfill of vaults shall be in accordance with the requirements of Section 02300 - Earthwork, and as shown on the Drawings.
- B. Pipe penetration openings shall be formed in vault walls during vault construction.
- C. Stainless steel angle edgers shall be cast into the top of walls during vault manufacturing.

END OF SECTION 02535

SECTION 03000
CONCRETE – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers general requirements and quality assurance provisions for all cast-in-place concrete.

1.02 Definitions

- A. **CONCRETE FIELD TESTING TECHNICIAN:** A person who has demonstrated knowledge and ability, and has credentials that are current with ACI, ICC, WABO, or other recognized certifying organizations, to perform and record the results of ASTM standard tests on freshly mixed concrete, and to make and cure test cylinders.
- B. **ARCHITECTURAL CONCRETE:** Concrete that is exposed as an interior or exterior surface in the completed structure and which requires special care in the selection of the concrete materials, forming, placing, and finishing to obtain the desired architectural appearance.
- C. **EXPOSED TO PUBLIC VIEW:** Situated so that it can be seen from a public location after completion of the building.
- D. **HIGH EARLY STRENGTH CONCRETE:** Concrete which, through the use of high early strength cement or admixtures, is capable of attaining specified strength at an earlier age than normal concrete.
- E. **LIGHTWEIGHT CONCRETE:** Concrete of substantially lower unit weight than concrete made using gravel or crushed stone aggregates.
- F. **MASS CONCRETE:** Any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change to minimize cracking.
- G. **MASS CONCRETE, PLAIN:** Mass concrete containing no reinforcement or less reinforcement than necessary to be considered reinforced mass concrete.
- H. **MASS CONCRETE, REINFORCED:** Mass concrete containing adequate reinforcement, prestressed or non-prestressed, designed to act together with the concrete in resisting all forces, including those induced by temperature and shrinkage.
- I. **NORMAL WEIGHT CONCRETE:** Concrete having a unit weight of approximately 150 pounds per cubic foot made with gravel or crushed stone aggregates.

- J. POST-TENSIONING: A method of prestressing reinforced concrete in which tendons are tensioned after the concrete has hardened.
- K. PRESTRESSED CONCRETE: Concrete where internal stresses of such magnitude and distribution are introduced that the tensile stresses resulting from the service loads are counteracted to a desired degree; in reinforced concrete, the prestressing is commonly introduced by tensioning tendons.
- L. REFERENCE STANDARDS: Standards of a technical society, organization, or association, including the codes of local or state authorities, which are referenced in the Contract Documents.
- M. STRENGTH TEST: The average of the compressive strengths of two cylinders made from the same sample of concrete and tested at 28 days or at test age designated for determination of f'_c .
- N. STRUCTURAL LIGHTWEIGHT CONCRETE: Structural concrete made with lightweight aggregate; the unit weight usually is in the range of 90 to 115 lb/ft³.
- O. SUBMITTED: Submitted to the Engineer for review and acceptance.
- P. WORK: The entire construction or separately identifiable parts thereof which are required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

1.03 Abbreviations

- A. Abbreviations for organizations issuing documents referred to in the specifications are listed below:
 - 1. AASHTO American Association of State Highway and Transportation Officials
 - 2. ACI American Concrete Institute
 - 3. ASTM American Society for Testing and Materials
 - 4. AWS American Welding Society
 - 5. CRSI Concrete Reinforcing Steel Institute
 - 6. ICC International Code Council
 - 7. PTI Post-Tensioning Institute
 - 8. WABO Washington Association of Building Officials
 - 9. WSDOT Washington State Department of Transportation

1.04 References

- A. Standards of ACI, ASTM, and AWS referred to herein are listed with serial designation and are part of the Specifications. Use the latest edition as of 30 days prior to the bid date.

B. ACI STANDARDS

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| 1. | ACI 117 | Specifications for Tolerances for Concrete Construction and Materials |
| 2. | ACI 347 | Guide to Formwork for Concrete |

C. ASTM STANDARDS

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|-----|------------|---|
| 1. | A82 | Specification for Steel Wire, Plain, for Concrete Reinforcement |
| 2. | A184/A184M | Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement |
| 3. | A185 | Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| 4. | A416/A416M | Specification for Uncoated Seven-Wire, Stress-Relieved Steel Strand for Prestressed Concrete |
| 5. | A421/A421M | Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete |
| 6. | A496 | Specification for Steel Wire, Deformed, for Concrete Reinforcement |
| 7. | A497/A497M | Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement |
| 8. | A615/A615M | Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| 9. | A706/A706M | Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement |
| 10. | A722/A722M | Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete |
| 11. | A767/A767M | Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement |
| 12. | A775/A775M | Specification for Epoxy-Coated Reinforcing Steel Bars |
| 13. | A779/A779M | Specification for Steel Strand, Seven-Wire, Uncoated, Compacted, Stress-Relieved for Prestressed Concrete |
| 14. | A780 | Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| 15. | A884/A884M | Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement |
| 16. | A996/A996M | Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement |

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| 17. | C31/C31M | Practice for Making and Curing Concrete Test Specimens in the Field |
| 18. | C33 | Specification for Concrete Aggregates |
| 19. | C39/C39M | Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| 20. | C42/C42M | Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| 21. | C94/C94M | Specification for Ready-Mixed Concrete |
| 22. | C138/C138M | Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete |
| 23. | C143/C143M | Test Method for Slump of Hydraulic Cement Concrete |
| 24. | C150 | Specification for Portland Cement |
| 25. | C171 | Specification for Sheet Materials for Curing Concrete |
| 26. | C172 | Practice for Sampling Freshly Mixed Concrete |
| 27. | C173/C173M | Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method |
| 28. | C192/C192M | Practice for Making and Curing Concrete Test Specimens in the Laboratory |
| 29. | C231 | Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method |
| 30. | C260 | Specification for Air-Entraining Admixtures for Concrete |
| 31. | C309 | Specification for Liquid Membrane-Forming Compounds for Curing Concrete |
| 32. | C330 | Specification for Lightweight Aggregates for Structural Concrete |
| 33. | C387 | Specification for Packaged, Dry, Combined Materials for Mortar and Concrete |
| 34. | C404 | Specification for Aggregates for Masonry Grout |
| 35. | C494/C494M | Specification for Chemical Admixtures for Concrete |
| 36. | C567 | Test Method for Unit Weight of Structural Lightweight Concrete |
| 37. | C595 | Specification for Blended Hydraulic Cements |
| 38. | C597 | Test method for Pulse Velocity Through Concrete |
| 39. | C618 | Specification for Fly Ash and Raw or Clacined natural Pozzolan for Use as Mineral Admixture in Portland Cement Concrete |

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| 40. | C684 | Test Method for Making, Accelerated Curing, and Testing of Concrete Compression Test Specimens |
| 41. | C685/C685M | Specification for Concrete Made by Volumetric Batching and Continuous Mixing |
| 42. | C803/C803M | Test Method for Penetration Resistance of Hardened Concrete |
| 43. | C805 | Test Method for Rebound Number of Hardened Concrete |
| 44. | C873 | Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds |
| 45. | C881/C881M | Specification for Epoxy-Resin-Base Bonding Systems for Concrete |
| 46. | C900 | Test Method for Pullout Strength of Hardened Concrete |
| 47. | C928 | Specification for Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs |
| 48. | C989 | Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars |
| 49. | C1017/C1017M | Specification for Chemical Admixtures for Use in Producing Flowing Concrete |
| 50. | C1059 | Specification for Latex Agents for Bonding Fresh to Hardened Concrete |
| 51. | C1064/C1064M | Test Method for Temperature of Freshly Mixed Portland Cement Concrete |
| 52. | C1074 | Practice for Estimated Concrete Strength by the Maturity Method |
| 53. | C1077 | Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| 54. | C1107 | Specification for Packaged, Dry, Hydraulic Cement Grout |
| 55. | D98 | Specification for Calcium Chloride |
| 56. | D994 | Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) |
| 57. | D1751 | Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types) |
| 58. | D1752 | Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |

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| 59. | E11 | Specification for Wire-Cloth Sieves for Testing Purposes |
| 60. | E329 | Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction |

D. OTHER REFERENCED STANDARDS

Other standards referenced herein:

- | | | |
|----|--------------------|--|
| 1. | AWS D1.4 | Structural Welding Code-Reinforcing Steel |
| 2. | AASHTO T260 | Sampling and Testing for Total Chloride Ion in Concrete and Concrete Materials |
| 3. | Corps of Engineers | Specification for Rubber Waterstops |
| 4. | CRD C51 | |
| 5. | Corps of Engineers | Specification for Polyvinyl-Chloride Waterstops |
| 6. | CRD C572 | |
| 7. | PTI | Specification for Unbonded Single-Strand Tendons |
| 8. | WSDOT | Standard Specifications for Road, Bridge and Municipal Construction, |

E. CITED PUBLICATIONS

Publications cited in this Specification:

- | | | |
|----|-----------|---|
| 1. | ACI 315 | Details and Detailing of Concrete Reinforcement |
| 2. | ACI 318 | Building Code Requirements for Reinforced Concrete |
| 3. | ACI CPI | Technician Workbook for ACI Certification of Concreted Field Testing Technician – Grade I |
| 4. | ACI SP | Field Reference Manual |
| 5. | CRSI MSP- | Manual of Standard Practice |

1.05 Submittals

- A. Testing agencies shall report results of concrete and concrete materials tests and inspections performed during the course of the work to the Owner, Engineer, Contractor, and the Concrete Supplier. Strength test reports shall include location in the Work where the batch represented by test was deposited and the batch ticket number. Reports of strength tests shall include detailed information of storage and curing of specimens prior to testing. Final reports shall be provided within seven (7) days of test completion.

1.06 Quality Assurance

- A. GENERAL: Concrete materials and operations may be tested and inspected by the Owner as Work progresses. Failure to detect defective work or material shall not prevent rejection later when a defect is discovered nor shall it obligate Engineer for final acceptance.
- B. TESTING AGENCIES: Agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E329. Testing agencies performing the testing shall be acceptable to Engineer prior to performing any work. Tests of concrete shall be made by a Concrete Field Testing Technician.
- C. TESTING RESPONSIBILITIES OF CONTRACTOR
 - 1. Submit data on qualifications of proposed testing agency for acceptance. Use of testing services will not relieve agency for acceptance. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
 - 2. Duties and Responsibilities. Unless otherwise specified in the Contract Documents, the Contractor shall assume the following duties and responsibilities:
 - 3. Qualify proposed materials and establish mixture proportions.
 - 4. Furnish any necessary labor to assist Owner's testing agency in obtaining and handling samples at the project site or at the source of materials.
 - 5. Notify Owner's testing agency at least 24 hours in advance of operations to allow for completion of quality tests and for assignment of personnel.
 - 6. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the job site for initial curing as required by ASTM C31.
 - 7. Submit data and test documentation on materials and mixture proportions.
 - 8. Submit quality control program of the concrete supplier and provide copies of all test reports.
 - 9. When it is necessary to base concrete acceptance on accelerated strength testing, submit a request to use accelerated testing along with correlation data for the standard 28-day compressive strength based on at least 15 sets of test data in accordance with 1.06.E.9 with concrete made with the same materials providing a range of at least f'_{cr} plus or minus 1,000 psi.

D. TESTS REQUIRED OF CONTRACTOR'S TESTING AGENCY

1. Unless otherwise specified in the Contract Documents, Contractor shall provide at no cost to Owner the necessary testing services for the following:
2. Qualification of proposed materials and establishment of design mixtures.
3. Other testing services needed or required by Contractor.

E. TESTING RESPONSIBILITIES OF OWNER'S TESTING AGENCY

1. Unless otherwise specified in the Contract Documents, Owner's Testing Agency will provide the necessary services for the following:
2. Representatives of Owner's testing agency will inspect, sample, and test materials and production of concrete required by the Engineer. When it appears that material furnished or work performed by Contractor fails to conform to Contract Documents, testing agency will immediately report such deficiency to the Engineer, Contractor, and concrete supplier.
3. Testing agency and its representatives are not authorized to revoke, alter, relax, enlarge, or release any requirement of the Contract Documents, nor to accept any portion of the Work.
4. Testing Agency shall report all test and inspection results to Engineer, Contractor, and concrete supplier within seven days after tests and inspections are performed.
5. Testing Services. Review and check-test proposed materials for compliance with Contract Documents.
6. Review and check-test proposed design mixture as required by the Engineer.
7. Obtain production samples of materials at plants or stockpiles during course of the Work and test for compliance with the Contract Documents.
8. Obtain composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
9. Obtain at least one composite sample for each 50 cubic yards, or fraction thereof, of each design mixture of concrete placed in any one day. When the total quantity of concrete with a given design mixture is less than 50 cubic yards, the strength tests may be waived by Engineer if in his judgement adequate evidence of satisfactory strength is provided.
10. Conduct strength tests of concrete during construction in accordance with the following procedures:
 - 1) Mold and cure three cylinders from each sample in accordance with ASTM C31. Record any deviations from the ASTM requirements in the test report.

- 2) Test cylinders in accordance with ASTM C39. Test one specimen at 7 days for information, and two specimens at 28 days for acceptance unless otherwise specified. The compressive strength test results for acceptance shall be the average of the compressive strengths from the two specimens tested at 28 days. If one specimen in a test shows evidence of improper sampling, molding, or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result. If both specimens in a test show any defects, discard the entire test.
 - 3) When accelerated testing of concrete is permitted as an alternative to standard testing, mold and cure two specimens from each composite sample in accordance with ASTM C684. Make at least one accelerated strength test from each composite and one standard 28-day compressive strength test for at least every other accelerated strength test in accordance with ASTM C31. Use these test results to maintain and update the correlation between accelerated and standard 28-day compressive strength tests.
11. Determine slump of each composite sample test and whenever consistency of concrete appears to vary, using ASTM C143.
 12. Determine temperature of each composite sample in accordance with ASTM C1064.
 13. Test concrete required to be air-entrained for air content by ASTM C231, ASTM C173, or ASTM C138. Determine air content of normal weight concrete for each composite sample, or as directed by Engineer. Additional tests shall be performed as necessary for control.
 14. Where concrete will be exposed to deicing salts or is so indicated on the Contract Documents, air content tests will be made on samples from the first three batches in the placement and until three consecutive batches have air contents within the range specified in Section 03310 - Concrete Mixtures, paragraph 2.02.D, Air Content, at which time every fifth batch will be tested. This test frequency will be maintained until a batch is not within the range specified, at which time testing of each batch will be resumed until three consecutive batches have air contents within the range specified. Additional tests may be performed as necessary for control. These air content tests may be taken on composite samples, or on samples from the batch at any time after discharge of 2 cubic feet of concrete.
 15. Additional Testing Services When Required. Owner's testing agency will perform the following services when required by Engineer, at no cost to the Contractor:
 16. Inspect concrete batching, mixing, and delivery operations.
 17. Inspect forms, foundations preparation, reinforcing, embedded items, reinforcing placing, and concrete placing, finishing, and curing operations.

18. Sample concrete at point of placement and other locations as directed by Engineer and perform required tests.
19. Review manufacturer's report for each shipment of cement, reinforcing steel, and prestressing tendons, and conduct laboratory tests or spot checks of the materials received for compliance with specifications.
20. Other testing or inspection services as required by Engineer.
21. Other Testing Services as Needed. Owner's testing agency shall perform the following testing services when necessary, at the Contractor's expense.
22. Additional testing and inspection required because of changes in materials or mixture proportions requested by the Contractor.
23. Additional testing of materials or concrete occasioned by failure to meet specification requirements.

F. TESTS ON HARDENED CONCRETE IN PLACE

1. General. Tests on hardened concrete will be performed by the Owner's testing agency when such tests are needed. Testing and core filling shall be at the Contractor's expense when tests are performed to verify the strength of the structure when required by this specification. Owner will pay costs if tests are at his request and not required by this specification.
2. Non-Destructive Tests. Use of the rebound hammer in accordance with ASTM C805, pulse velocity methods in accordance with ASTM C597, or other non-destructive devices may be permitted by the Engineer in evaluating the uniformity and relative concrete strength in place, or for selecting areas to be cored.
3. Core Tests.
4. Where required by the Engineer, cores shall be obtained and tested in accordance with ASTM C42. If concrete in the structure will be dry under service conditions, the cores shall be air-dried (temperature 60 to 80°F, relative humidity less than 60 percent) for 7 days before testing and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, the core shall be tested after moisture conditioning in accordance with ASTM C42.
5. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores as determined by the Engineer shall impair the strength of the structure as little as possible. If, before testing, cores show evidence of having been damaged subsequent to or during removal from the structure, replacement cores shall be taken.
6. Core holes shall be filled with low slump concrete or mortar of a strength equal to or greater than the original concrete.

G. EVALUATION OF CONCRETE STRENGTH TESTS

1. Standard Molded and Cured Strength Specimens. Test results from standard molded and cured test cylinders shall be evaluated separately for each specified concrete design mixture. Evaluation will be valid only if tests have been conducted in accordance with procedures specified. For evaluation, each specified design mixture shall be represented by at least 5 tests.
2. Nondestructive Tests. Test results will be evaluated by the Engineer and will be valid only if tests have been conducted by properly calibrated equipment in accordance with recognized standard procedures.
3. Core Tests. Core tests will be evaluated by the Engineer and will be valid only if tests have been conducted in accordance with specified procedures.

H. ACCEPTANCE OF CONCRETE STRENGTH

1. Standard Molded and Cured Strength Specimens. The strength level of concrete will be considered satisfactory when the averages of all sets of three consecutive compressive strength test results equal or exceed the specified compressive strength f'_c and no individual strength test result falls below the specified compressive strength f'_c by more than 500 psi. These criteria apply also when accelerated strength testing is specified unless another basis for acceptance is specified in the Contract Documents.
2. Nondestructive Tests. Nondestructive tests shall not be used as the sole basis for accepting or rejecting concrete, but may be used when permitted to evaluate concrete where standard molded and cured cylinders have yielded results not meeting the criteria in 1.07.H.1.
3. Core Tests. Strength level of concrete in the area represented by core tests will be considered adequate when the average compressive strength of the cores are equal to at least 85 percent of specified compressive strength f'_c , and if no single core is less than 75 percent of the specified compressive strength f'_c .

I. FIELD ACCEPTANCE OF CONCRETE

1. Air Content. Concrete not within the limits of air entrainment indicated in Section 03310 and tested in accordance with 1.06.E.13 shall not be used in the Work.
2. Slump. Concrete not within the slump limits of Section 03310 at the point of placement shall not be used in the Work.
3. Temperature. Concrete not within temperature limits of Section 03310 shall not be used in the Work.

1.07 Acceptance of Structure

- A. GENERAL: Completed concrete work shall conform to applicable requirements of this Specification and the Contract Documents.
1. Concrete work that fails to meet one or more requirements of the Contract Documents but subsequently is repaired to bring the concrete into compliance may be accepted.
 2. Concrete work that fails to meet one or more requirements of the Contract Documents and cannot be brought into compliance will be rejected.
 3. Repair rejected concrete work by removing and replacing or by reinforcing with additional construction required by the Engineer. To bring rejected work into compliance, use repair methods that will maintain specified strength and meet all applicable requirements for function, durability, dimensional tolerances, and appearance as determined by the Engineer.
 4. Submit for acceptance the proposed repair methods, materials, and modifications needed to assure that concrete work will meet requirements of Contract Documents.
 5. Contractor shall pay all costs to bring concrete work into compliance with requirements of the specification.
 6. Concrete members cast in the wrong location will be rejected.
- B. DIMENSIONAL TOLERANCES
1. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of ACI 117, may be considered deficient in strength and subject to the provisions of 1.08.D, Strength of Structure.
 2. Formed surfaces resulting in concrete outlines larger than permitted by ACI 117 may be rejected. Excess materials will be subject to removal when required by the Engineer.
 3. Inaccurately formed concrete surfaces that exceed ACI 117 tolerances may be rejected.
 4. Finished slabs exceeding the tolerances in Section 03300 - Cast-in-Place Concrete, may be corrected provided strength or appearance are not adversely affected.
 5. Concrete with tolerances and defects exceeding the limitations of Section 03100 - Concrete Formwork, will be rejected.
- C. APPEARANCE
1. Concrete exposed to view with defects that adversely affect the appearance of the specified finish will be rejected.
 2. Concrete not exposed to view may be rejected for nonconforming appearance.

D. STRENGTH OF STRUCTURE

1. Criteria for Determining Potential Strength Deficiency. Strength will be considered deficient and concrete will be rejected when the Work fails to comply with requirements which control the strength of the structure, including but not limited to the following conditions:
2. Concrete strength failing to comply with requirements of 1.07.H, Acceptance of Concrete Strength.
3. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Section 03200 - Concrete Reinforcement, or other Contract Document Requirements.
4. Concrete elements which differ from the required dimensions or location.
5. Curing not in accordance with Contract Documents.
6. Inadequate protection of concrete from extreme temperature and other environmental conditions during early stages of hardening and strength development.
7. Mechanical injury, construction fires, accidents, or premature removal of formwork resulting in deficient strength.
8. Action Required When Strength is Potentially Deficient. When strength of the structure is considered potentially deficient, the following actions may be required by Engineer:
9. Structural analysis or additional testing, or both.
10. Core tests.
11. If testing is inconclusive or impractical or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with ACI 318.
12. Concrete work rejected by structural analysis or by results of a load test shall be reinforced with additional construction when required by Engineer, or replaced.
13. The Contractor shall document all repair work proposed to bring strength-deficient concrete work into compliance with Contract Documents, and submit the documentation to Engineer for acceptance.

E. DURABILITY

1. Criteria for Determining Potential Durability Deficiency. Durability of concrete will be considered deficient and the concrete work will be rejected when it fails to comply with the requirements which control durability of the structure, including but not limited to the following conditions:
2. Strength failing to comply with 1.07.H, Acceptance of Concrete Strength.
3. Materials for concrete not conforming with the requirements in Section 03310.

4. Concrete not conforming with the air entrainment requirements in Contract Documents or the total air content limits of Section 03310.
5. Curing not in accordance with Contract Documents.
6. Inadequate protection of concrete from temperature and other environmental conditions during early stages of hardening and strength development.
7. Action Required When Durability is Potentially Deficient. When durability of the structure is considered to be deficient, the following actions will be taken by the Engineer:
 8. Require that samples of the ingredient materials used in the concrete be obtained and tested.
 9. Require that samples of hardened concrete be obtained from the structure by coring, sawing, or other acceptable means.
 10. Require a laboratory evaluation of concrete and concrete materials to assess the ability of concrete to resist weathering action, chemical attack, abrasion, or other deterioration.
 11. Concrete rejected for lack of durability shall be repaired or replaced as directed by Engineer.
 12. The Contractor shall document repair work to bring concrete work into compliance with Contract Documents and submit the documentation to Engineer for acceptance.

1.08 Protection of In-Place Concrete

- A. **LOADING AND SUPPORT OF CONCRETE:** Construction loads shall not exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage.
- B. **PROTECTION FROM MECHANICAL INJURY:** During the curing period, the Contractor shall protect concrete from damaging mechanical disturbances, including load stresses, shock, and harmful vibration. The Contractor shall protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and other adverse weather conditions.

1.09 Preconcreting Conference

- A. A preconcreting conference shall be held 5 to 10 working days before placing concrete to discuss construction procedures, personnel, and equipment to be used. Those attending shall include:
 1. **CONTRACTOR**
 2. Project Manager, Superintendent, and all foremen responsible for placement of reinforcement and concrete and construction of forms, and finishing and curing of concrete, including subcontractors, as applicable.
 3. Ready-mix supplier representative. (Optional if less than 25 cubic yards of concrete will be placed on the job.)

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4. Owner.
5. Project Manager/Resident Project Representative.
6. Engineer.
7. Testing lab representative and field special inspection personnel.

END OF SECTION 03000

**SECTION 03100
CONCRETE FORMWORK**

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers design, construction and treatment of formwork to confine and shape concrete to the required dimensions.

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following:
1. Submit the following project data unless otherwise specified:
 - a. Formwork Release Agent. Submit data on formwork release agent proposed for use with each form surface to be used for acceptance.
 - b. Shop Drawings. Submit shop drawings for formwork and formwork supports.
 2. Submit the following data when required:
 - a. Reshoring. When reshoring is permitted or required, submit for acceptance the plan of reshoring procedures and operations in advance.
 - b. Form Liners. Submit samples and catalog data for form liner material when specified.
 3. Submit the following data when alternatives are proposed:
 - a. Formwork Facing Materials. When formwork facing materials other than those specified are proposed for use, submit data for acceptance.
 - b. Control Joints. If construction or control joints other than those indicated on Contract Drawings are desired, submit request for acceptance.
 - c. Testing for Formwork Removal. When methods other than test of cylinders are proposed for determining time for formwork removal, submit data as specified in 3.04.B.

1.03 Delivery, Storage, and Handling

- A. All materials and equipment shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance.

PART 2 - PRODUCTS

2.01 Materials

- A. FORM FACING MATERIALS: Materials for form faces in contact with concrete shall meet the requirements of Section 03300 - Cast-In-Place Concrete, Paragraph 3.03.E, Unspecified Finishes, and the following requirements, unless otherwise specified in the Contract Documents.
1. For Rough Form Finish. No form facing material is specified.
 2. For Smooth Form Finish. Form facing material shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other acceptable material capable of producing the desired finish. Form facing material shall produce a smooth, uniform texture on concrete. Do not use form facing material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of concrete surfaces. Furnish panels in largest practicable sizes to minimize number of joints.
- B. FORM TIES
1. General
 - a. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 - b. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Provide form ties which will not leave a hole larger than 1-inch diameter in the concrete surface.
 - c. Provide tie cones at each end.
 - d. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.
 - e. The use of tie wires as form ties will not be permitted.
 2. Snap Ties
 - a. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used.
 - b. Ties for liquid containment structures and walls below grade shall have a neoprene waterstop, factory applied at the center of the tie.
 3. Taper Ties. Taper ties with plastic or rubber plugs of an approved and proven design may be used. The plugs shall be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the wall. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 Sure Plug as manufactured by Dayton Superior.

- C. **FORMWORK RELEASE AGENT:** Use commercially manufactured form release agent that will prevent formwork absorption of moisture, prevent bond with concrete, not stain the concrete surfaces, and not leave residual matter on surface of concrete or adversely affect proper bonding or subsequent application of other material applied to concrete surface.

For concrete surfaces of reservoirs, tanks, or channels used for conveyance, treatment or storage of water for eventual potable use, form release agents shall be listed in National Sanitation Foundation Standard 61, "Drinking Water System Components – Health Effects."

2.02 Performance and Design Requirements

- A. Design and engineering of formwork and formwork supports shall be the responsibility of the Contractor. Designs of formwork and preparation of formwork drawings shall be under the supervision of a professional engineer registered in the state of Washington and shall conform to ACI 347.
- B. Design formwork for construction loads, lateral pressure and requirements of the applicable building code, and for construction sequence shown on the Contract Drawings, if applicable. Design formwork to withstand the pressure resulting from placement and vibration of concrete and to maintain specified tolerances. The design assumptions for form pressure and rate of fill limitations for wall forms shall be stated on the formwork drawings. Wall forms shall be designed so wall sections can be poured full height between joints shown on the Contract Drawings without horizontal cold joints.
- C. Do not use earth cuts as forms for vertical or sloping surfaces unless required or permitted by Contract Documents.
- D. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be $\frac{1}{240}$ of the span between structural members of the formwork, except for architectural concrete.
- E. Locate and detail formed joints to the following requirements:
1. Locate and form construction joints that least impair strength of the structure and meet the requirements of Section 03300. In general, locate construction joints near the middle of spans of slabs, beams, and girders. When a beam intersects a girder at this point, the joint in the girder shall be offset a distance equal to or greater than twice the width of the beam. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at the top of footings or floor slabs. Make joints perpendicular to the main reinforcement. Any construction joints not shown on the Contract Drawings shall require the approval of the Engineer.
 2. Provide keyways where indicated on Contract Drawings. Where longitudinal keyways are indicated on the Contract Drawings, make them a minimum of 1½-inch deep in joints in walls and between walls and slabs or footings.

3. Provide control joints where indicated on the Contract Documents. The location of control joints other than those indicated on the Contract Documents shall be submitted for acceptance.
- F. For smooth form finish, arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum. Support facing material with studs or other backing capable of preventing excessive deflection within the tolerances specified in 2.02.D.

2.03 Fabrication and Manufacture

- A. Formwork shall be tight to prevent loss of mortar from concrete. Provide watertight formwork when architectural concrete is specified.
- B. Place $\frac{3}{4}$ -inch-minimum chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces and the edges of formed joints.
- C. Provide temporary openings at the base of the column and wall formwork and at other points where necessary to facilitate cleaning and inspection. Clean and inspect immediately before concrete is placed.
- D. Fabricate embedded form ties so ends or end fasteners can be removed with minimum spalling at the faces of concrete.

After the ends or end fasteners of form ties have been removed, terminate the embedded portion of ties not less than 2 diameters, or twice the minimum cross-section dimension of the tie, from the formed concrete surface. In no case shall this distance be less than $\frac{3}{4}$ inch. Repair tie holes in accordance with Section 03300.

- E. Locate waterstops in joints where indicated on Contract Drawings. Use pieces of premolded waterstop with a maximum practicable length to hold the number of end joints to a minimum.

PART 3 - EXECUTION

3.01 Construction and Erection of Formwork

- A. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement by not more than 1 inch.

Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

- B. Unless otherwise specified in Contract Documents, construct formwork so concrete surfaces will conform to tolerance limits of ACI 117. The class of surface as given in ACI 117 shall be as follows:

1. Walls and elevated slabs: Class A
2. Footings: Class C

- C. Provide positive means of adjustment (wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has taken its initial set. Brace formwork securely against lateral deflection.
- D. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface prior to removal of formwork. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.
- E. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.
- F. Fasten form wedges in place after final adjustment of forms and prior to concrete placement.
- G. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.
- H. The Contractor shall form for and leave all openings in the concrete work where required for the installation of his own work and/or for the work of others. He shall carefully examine all drawings for the need of such openings, and in failing to provide openings as shown on the drawings, he shall cut them at his own expense. Except as otherwise noted or specified, all such openings shall be filled with concrete, after the work to be installed therein has been completed.
- I. Provide runways for moving equipment and support runways directly on the formwork or structural member without resting on the reinforcing steel.
- J. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.
- K. Position and support expansion joint material, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
- L. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.
- M. Cover surfaces of formwork with acceptable formwork release agent. Apply form release agent before placing reinforcing steel and concrete. A field-applied formwork release agent or sealer of an acceptable type or an acceptable factory-applied, non-absorptive liner may be used. Do not allow formwork release agent to puddle in the forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed.

N. CLEANOUTS AND ACCESS PANELS

1. Temporary openings shall be provided at the bottom of the wall forms to facilitate cleaning and inspection prior to placing concrete.
2. Shavings, chips and all refuse shall be removed, and the forms shall be broom-cleaned before any concrete is placed. Cleanout openings will not be permitted in exposed concrete without the Engineer's approval.

3.02 Removal of Formwork

- A. When finishing is required, remove formwork as soon as removal operations will not damage concrete, subject to 3.04, Strength of Concrete Required for Removal of Formwork.
- B. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or treatment required at once and follow immediately with specified curing.
- C. Loosen formwork for wall openings when this can be accomplished without causing damage to concrete.
- D. Do not allow removal of formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete to damage the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.
- E. Leave formwork and shoring in place to support the weight of concrete in beams, slabs, and in place structural members until concrete has reached the specified compressive strength f_c' in accordance with 3.04, Strength of Concrete for Removal of Formwork. Formwork and shoring may be removed at a lower compressive strength when otherwise specified or permitted in Contract Documents. When shores and other vertical supports are arranged so the form facing material may be removed without loosening or disturbing the shores and supports, facing material may be removed at an earlier age.
- F. FORM REMOVAL SAFETY
 1. Forms shall be removed in a manner to ensure complete safety of the structure. In no case shall supporting forms or shoring of slabs or other suspended members be removed until members have acquired sufficient strength to support safely their weight and the load thereon.
 2. Care shall be taken by the Contractor to assure that newly unsupported portions of the structure are not subjected to heavy construction or material loading. Additional shores or bracing shall be provided, as required to adequately support the members during the construction period.
 3. All responsibility involved in the removal of forms, shores, and bracing shall rest with the Contractor, and he shall be solely responsible for accidents to persons and property of any nature.

- G. All parts of removed forms, reserved for reuse shall be inspected, cleaned and repair. Any part or panel which has been dented, deformed or otherwise rendered unfit for reuse shall be discarded.
- H. Tie-rod clamps to be entirely removed from the wall shall be loosened 24 hours after concrete is placed, and form ties may be removed at that time.

3.03 Reshoring

- A. When reshoring is permitted or required, submit for acceptance a plan of reshoring procedures and operations prior to their use.
- B. While reshoring is underway, do not permit any construction load on new construction.
- C. During reshoring, do not allow concrete in beam, slab, column, or any structural member to be loaded with combined dead and construction loads in excess of the loads permitted by Engineer for the concrete compressive strength at the time of reshoring.
- D. Place reshores in sequence with stripping operations.
- E. Tighten reshores to carry the required loads without overstressing the concrete members. Leave reshores in place until tests required by 3.04, Strength of Concrete Required for Removal of Formwork, indicate that the concrete compressive strength has attained the minimum value specified in 3.02.E.
- F. For floors supporting shores under newly placed concrete, leave in place the original supporting shores or reshore. The shoring or reshoring system shall have a capacity sufficient to resist the anticipated loads. Reshores shall be located directly under a shore position.
- G. In multi-story buildings, extend reshoring over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads.

3.04 Strength of Concrete Required for Removal of Formwork

- A. When removal of formwork or reshoring is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when either of the following requirements has been met:
 - 1. Test cylinders, field cured along with the concrete they represent, have reached the compressive strength specified for removal of formwork or reshoring. Mold cylinders in accordance with ASTM C31, and cure them under the same conditions for moisture and temperature as used for the concrete they represent. Test cylinders in accordance with ASTM C39.

2. Concrete has been cured in accordance with the specified provisions for the same length of time as laboratory-cured cylinders which have reached the specified strength. Determine the length of time concrete has been cured in the structure by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50°F, and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

Alternatively, when specified, the strength of the concrete may be determined by the methods in 3.04.B.
- B. Alternatively, when specified, use of the following methods for evaluating concrete strength for formwork removal is permitted. Prior to using methods in 3.04.B.1 through 3.04.B.4, submit sufficient data using job materials to demonstrate correlation of measurements on the structure with the compressive strength of laboratory-cured molded cylinders or drilled cores. Correlation data for each alternative method for determining strength shall be submitted for acceptance.
 1. Tests of cast-in-place cylinders in accordance with ASTM C873. This is limited to slabs with concrete depth from 5 to 12 inches.
 2. Penetration resistance in accordance with ASTM C803.
 3. Pullout strength in accordance with ASTM C900.
 4. Acceptable maturity factor procedure in accordance with ASTM C1074.
- C. MINIMUM STRIPPING TIME: Form removal for elevated slabs and beam or girder soffits shall be based on paragraph A or B, above, with required concrete compressive strength equal to the specified 28-day compressive strength, but in no case less than 7 days.

Form removal for columns, walls, and side forms of beams, girders, or footings shall be not less than 12 hours.

3.05 Field Quality Control

- A. Establish and maintain controls and benchmarks in an undisturbed condition until final completion and acceptance of the project.
- B. Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

3.06 Installation of Embedded Items

- A. GENERAL
 1. The Contractor shall notify all trades when construction is ready for the setting of anchor bolts, inserts, sleeves, and other built-in equipment, in order that such material shall be set at the proper time. Before placing concrete, care shall be taken to determine that all items to be embedded in concrete are accurately located, firmly secured in place and protected from damage or displacement until securely held by the concrete.

2. All items shall be thoroughly cleaned, free from rust, scale, dirt, grease or other coating. Any wood used for removable keys shall be thoroughly dampened before concrete is placed against the wood. The Contractor shall be responsible for any displacement of the items caused by his workers.
- B. Electrical conduit may be embedded in concrete, provided the following conditions are met. Conduit runs which cannot satisfy these conditions shall be done at the Contractor's expense.
1. Outside diameter of conduit shall not exceed $\frac{1}{3}$ of the concrete thickness.
 2. Conduit shall not be placed closer than 3 diameters on center.
 3. Conduit shall not be embedded in structural concrete slabs less than 4 inches thick.
 4. Only 2 conduits may cross at any point. The sum of the outside diameter of the crossing conduits shall not exceed $\frac{1}{3}$ of the concrete thickness.
 5. A $1\frac{1}{2}$ -inch-minimum concrete cover shall be provided for conduits in structural concrete slabs.
 6. Conduit shall not be located between bottom of reinforcing steel and bottom of concrete slab.
 7. Conduit is generally not permitted in beams or girders.
 8. Aluminum conduit shall not be embedded in concrete.
 9. Reinforcing steel and/or post-tensioning ducts shall not be repositioned to clear conduit. Adjust conduit positions to clear reinforcement.

END OF SECTION 03100

**SECTION 03200
CONCRETE REINFORCEMENT**

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers materials, fabrication, placement and tolerances of reinforcement and reinforcement accessories.

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following:
1. Submit the following project data unless otherwise specified:
 - a. Placing Drawings. Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement supports.
 - b. Splices. Submit a list and request to use splices not indicated in Contract Documents.
 - c. Mechanical Connections. Submit request for the use of mechanical connections not shown on the Project Drawings.
 - d. Column Dowels. Submit requests for placement of column dowels without the use of templates.
 - e. Field Bending. Submit requests and procedures to field bend or straighten reinforcement partially embedded in concrete.
 2. Submit the following data when required:
 - a. Welding. Submit description of reinforcement weld locations and welding procedures, when welding is permitted in accordance with 2.02.B.
 - b. Supports. If coated reinforcement is required, submit description of reinforcement supports not described in 3.02.D, Reinforcement Supports, and material for fastening coated reinforcement.
 3. Submit the following data when alternatives are proposed:
 - a. Reinforcement Relocation. Submit request to relocate any reinforcement that exceeds placement tolerances.

1.03 Delivery, Storage, and Handling

- A. Prevent bending, coating with earth, oil or other material, or otherwise damaging the reinforcement.

- B. For handling coated reinforcement, use equipment having contact areas padded to avoid damaging the coating. Lift bundles of coated reinforcement at multiple pick-up points to prevent bar-to-bar abrasion from sags in the bundles. Do not drop or drag coated reinforcement. Store coated reinforcement on cribbing that will not damage the coating.

PART 2 - PRODUCTS

2.01 Materials

- A. **REINFORCING BARS:** Bars used as reinforcement shall be deformed except spirals and welded wire fabric, which may be plain unless otherwise designated on the Contract Drawings. Reinforcement shall be grade 60 unless otherwise indicated on the Contract Drawings and shall conform to one of the following:
 - 1. ASTM A615
 - 2. ASTM A996
 - 3. ASTM A706
- B. **COATED REINFORCING:** Reinforcing bar coatings, when required, shall be zinc or epoxy, as indicated on the Contract Drawings.
 - 1. Zinc-coated (galvanized) reinforcement shall conform to ASTM A767. Supplementary requirements S1 and S2 shall apply when fabrication after galvanization includes cutting and bending. Supplementary requirement S2 shall apply when fabrication after galvanization includes only bending.

Repair all coating damage due to shipping, handling and placing in accordance with ASTM A780. The maximum amount of repaired damaged areas shall not exceed 2 percent of the surface area in each linear foot of each bar.
 - 2. Epoxy-coated reinforcement shall conform to ASTM A775. Repair damaged areas with patching material conforming to ASTM A775 and in accordance with the material manufacturer's recommendations. Repair all coating damage due to shipping, handling and placing. The maximum amount of repaired damaged areas shall not exceed 2 percent of the surface area in each linear foot of each bar. Fading of the coating color will not be cause for rejection of epoxy-coated reinforcing bars.
- C. **BAR MATS:** Use bar mats of the clipped type conforming to ASTM A184 assembled from one of the following combinations:
 - 1. Bars conforming to ASTM A615, ASTM A996, or ASTM A706.
 - 2. Zinc-coated (galvanized) bars conforming to ASTM A767 and zinc-coated (galvanized) or non-metallic clips with any damage to coatings repaired in accordance with 2.01.B.1.
 - 3. Epoxy-coated bars conforming to ASTM A775 and epoxy-coated or non-metallic clips with any damage coatings repaired in accordance with 2.01.B.2.

- D. WIRE: Use plain or deformed wire as indicated on the Contract Drawings. Plain wire may be used for spirals.
1. Plain wire shall conform to ASTM A82.
 2. Deformed wire size D4 and larger shall conform to ASTM A496.
 3. Epoxy-coated wire shall conform to ASTM A884.
 4. For wire with a specified yield strength f_y exceeding 60,000 psi, f_y shall correspond to a strain of 0.35 percent.
- E. WELDED WIRE FABRIC
1. Plain Wire Fabric. ASTM A185, with welded intersections spaced not farther apart than 12 inches in the direction of principal reinforcement.
 2. Deformed Wire Fabric. ASTM A497, with welded intersections spaced not farther than 16 inches in the direction of principal reinforcement.
 3. Epoxy-coated welded wire fabric shall conform to ASTM A884.
 4. For welded wire fabric with a specified yield strength f_y exceeding 60,000 psi, f_y shall correspond to a strain of 0.35 percent.
- F. WIRE REINFORCEMENT SUPPORTS: Unless otherwise specified or permitted, use wire reinforcement supports complying with Class 1, maximum protection, or Class 2, moderate protection as indicated in the *CRSI Manual of Standard Practice*, Chapter 3, Bar Supports.
- G. COATED WIRE REINFORCEMENT SUPPORTS
1. For Epoxy-Coated Reinforcement. Use wire reinforcement supports coated with dielectric material, including epoxy or other polymer, for a minimum distance of 2 inches from the point of contact with epoxy-coated reinforcement.
 2. For Zinc-Coated Reinforcement. Use galvanized wire reinforcement supports or wire reinforcement supports coated with dielectric material.
- H. PRECAST CONCRETE REINFORCEMENT SUPPORTS: Precast concrete supports for supporting reinforcement shall not be less than 4 square inches having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed.
- I. ALL-PLASTIC BAR SUPPORTS: All-plastic bar supports may be used for horizontal and vertical reinforcing steel. They may have a snap-on action or other method of attachment. All-plastic supports shall be non-porous and chemically inert in concrete. All-plastic bar supports shall have rounded seatings so as not to punch holes in the formwork and shall not deform under load when subjected to normal temperatures encountered in use, nor shall they shatter or severely crack under impact loadings when used in cold weather.
- J. All-plastic bar supports shall have at least 25% of their gross plane area perforated and shall not be placed closer than 12 inches apart along a bar.

- K. TIE WIRE: No. 16 American Wire Gauge or heavier, black annealed per ASTM A82.

2.02 Fabrication

- A. REINFORCEMENT: Bend all reinforcement cold unless heating is specifically authorized in the Contract Documents or by the Engineer. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.
- B. WELDING
1. When welding of reinforcement is required or permitted, make all welds in conformance with AWS D-1.4. Do not weld crossing bars (tack welding) for assembly of reinforcement, supports, or embedded items.
 2. After completing welds on zinc-coated (galvanized) or epoxy-coated reinforcement, repair coating damage in accordance with requirements in 2.01.B.1 or 2.01.B.2, respectively. Coat welds and steel splice members used to splice reinforcement with the same material used for repair of coating damage.

PART 3 - EXECUTION

3.01 Preparation

- A. When concrete is placed, all reinforcement shall be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum nominal dimensions, nominal weight and the minimum average height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

3.02 Placement

- A. TOLERANCES: Place, support, and fasten reinforcement as shown on the Contract Drawings. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. Placing tolerances shall not reduce cover requirements except as specified in ACI 117.
- B. REINFORCEMENT RELOCATION: When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits or embedded items, submit the resulting arrangement of reinforcement for acceptance.
- C. CONCRETE COVER: Minimum concrete cover for reinforcement, unless otherwise indicated in the Contract Drawings, shall be as indicated below:

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	Minimum Cover (inches)
Slabs & Joists	
Top & bottom bars for dry conditions	
#11 bars and smaller	$\frac{3}{4}$
#14 and #18 bars	$1\frac{1}{2}$
Formed concrete surfaces exposed to earth, water or weather, and over or in contact with sewage and for bottoms bearing on work mat, or slabs supporting earth cover.	
#5 bars and smaller	$1\frac{1}{2}$
#6 through #18 bars	2
Beams & Columns, formed	
For dry conditions	
Stirrups, spirals and ties	$1\frac{1}{2}$
Principal reinforcement	2
Exposed to earth, water, sewage or weather	
Stirrups, spirals and ties	2
Principal reinforcement	$1\frac{1}{2}$
Walls	
For dry conditions	
#11 bars and smaller	$\frac{3}{4}$
#14 and #18 bars	$1\frac{1}{2}$
Formed concrete surfaces exposed to earth, water, sewage, weather, or in contact with ground	2
Footings and Base Slabs	
At formed surfaces and bottoms bearing on concrete work mat	2
At unformed surfaces and bottoms in contact with earth	3
Top of footings	same as slabs
Over top of piles	2

For bundled bars, minimum concrete cover shall be equal to the equivalent diameter of the bundle but need not be greater than 2 inches, except the minimum cover shall not be less than specified above. The equivalent diameter of the bundle shall be based on a single bar of a diameter derived from the equivalent total area.

Tolerances on minimum concrete cover shall meet the requirements of ACI 117.

- D. **REINFORCEMENT SUPPORTS:** Size and spacing of reinforcement supports shall conform to the CRSI Manual of Standard Practice. Reinforcement shown on the Contract Drawings shall not be relocated to serve as bolsters for other bars. The Contractor shall provide additional bars if necessary, to support the reinforcement shown on the Contract Drawings.

Horizontal bars in slabs and beams shall be supported at intervals not greater than 48 inches.

Wall and column reinforcement shall be laterally supported by side form spacers or other means at intervals not greater than 48 inches horizontally or vertically in the case of walls, and not greater than 48 inches vertically and at not less than 90-degree intervals in the case of columns.

Unless otherwise approved by the Engineer, use the following reinforcement supports:

1. Place reinforcement supported from the ground or mud on precast concrete reinforcement supports.
2. Place non-coated reinforcement supported from formwork on reinforcement supports made of concrete, metal or plastic.
3. Place zinc-coated (galvanized) reinforcement supported from formwork on wire reinforcement supports, which are galvanized, coated with dielectric material, or made of dielectric material.
4. Reinforcement and embedded steel items used with zinc-coated (galvanized) reinforcement shall be zinc-coated (galvanized) or coated with non-metal materials.
5. Place epoxy-coated reinforcement supported from formwork on coated wire reinforcement supports, or on reinforcement supports made of dielectric material. Coatings or materials shall be compatible with concrete.
6. When precast reinforcement supports with embedded tie wires or dowels are used with epoxy-coated reinforcement, wires, or dowels shall be coated with dielectric material.
7. Reinforcement used as supports with epoxy-coated reinforcement shall be epoxy-coated.
8. In walls reinforced with epoxy-coated reinforcement, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcement shall be made of corrosion-resistant material or coated with dielectric material.
9. Fasten epoxy-coated reinforcement with tie wires coated with epoxy or other polymer.

- E. **WELDED WIRE FABRIC:** For slabs on grade, extend welded wire fabric to within 2 inches of the concrete edge. Lap edges and ends of fabric sheets a minimum of one-mesh spacing. Welded wire fabric may extend through contraction joints only where permitted. Support welded wire fabric during placing of concrete to assure required positioning in the slab. Do not place welded wire fabric on grade and subsequently raise into position in concrete.
- F. **COLUMN DOWELS:** Furnish and use templates for placement of column dowels unless otherwise permitted.
- G. **Make splices as indicated on the Contract Drawings unless otherwise approved by the Engineer.** Mechanical connections for reinforcement not shown on the Contract Drawings may be used when approved by the Engineer. Reinforcement coating shall be removed in the area of the mechanical connection if so, required by the connection manufacturer. After installing mechanical connections on zinc-coated (galvanized) or epoxy-coated reinforcement, repair coating damage and areas of removed coating in accordance with 2.01.B.1 and 2.01.B.2. Coat exposed parts of mechanical connections used on coated bars with the same material used for repair of coating damage.
- H. **FIELD BENDING OR STRAIGHTENING:** When permitted, bend or straighten reinforcement partially embedded in concrete in accordance with the following procedures.

Reinforcing bar sizes No. 3 through No. 5 may be bent cold the first time provided reinforcing bar temperature is above 32°F. For other bar sizes, preheat reinforcing bars before bending.

1. **Preheating.** Apply heat by any method which does not harm the reinforcing bar material or cause damage to the concrete. Preheat a length of reinforcing bar equal to at least 5 bar diameters in each direction from the center of the bend, but do not extend preheating below the surface of the concrete. Do not allow the temperature of the reinforcing bar at the concrete interface to exceed 500°F.

The preheat temperature of the reinforcing bar shall be 1100 to 1200°F.

Maintain the preheat temperature until bending or straightening is complete.

Measure the preheat temperature by temperature measurement crayons, contact pyrometer, or other acceptable method.

Do not artificially cool heated reinforcing bars until the temperature of the bar is less than 600°F.
2. **Bend Diameters.** Minimum inside bend diameters shall conform to the requirements of the table below unless otherwise permitted. In addition, beginning of the bend shall not be closer to the concrete surface than the minimum diameter of bend.

<u>Bar Size</u>	<u>Minimum Inside Bend Diameter</u>
#3 through #8	6 bar diameters
#9, #10 and #11	8 bar diameters
#14 and #18	10 bar diameters

3. Repair of Bar Coatings. After field bending or straightening zinc-coated (galvanized) or epoxy-coated reinforcing bars, repair coating damage with 2.01.B.1 or 2.01.B.2.

- I. **FIELD CUTTING OF REINFORCEMENT:** Reinforcement shall not be cut in the field except when specifically permitted.
1. When zinc-coated (galvanized) reinforcing bars are cut in the field, coat the ends of the bars with a zinc-rich formulation used in accordance with the manufacturer's recommendations, and repair any coating damage in accordance with 2.01.B.1.
 2. When epoxy-coated reinforcing bars are cut in the field, coat the ends of the bars with the same material used for repair of coating damage, and repair any coating damage in accordance with 2.01.B.2.
- J. **REINFORCEMENT THROUGH EXPANSION JOINT:** Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint and waterstops may extend through the joint.
- K. **WORKER SAFETY:** Workers placing reinforcing steel shall wear safety equipment and harnesses as required by state occupational safety regulations.

END OF SECTION 03200

**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers the production of cast-in-place structural concrete. Included are methods and procedures for obtaining quality concrete through proper handling, placing, finishing, curing, and repair of surface defects.

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following:
1. Submit the following data unless otherwise specified:
 - a. Field Control Test Reports. Maintain and submit accurate records of all test and inspection reports.
 - b. Conveying Equipment. Submit description of conveying equipment.
 - c. Temperature Measurement. Submit proposed method of measuring concrete surface temperature changes.
 - d. Repair Methods. When stains, rust, efflorescence, and surface deposits must be removed as described in 3.07.G, submit the proposed method of removal.
 - e. Placement Notification. Submit notification at least 24 hours in advance of concrete placement.
 - f. Replacement Requirements. Submit requests for acceptance of reinforcement and form placement at least 48 hours in advance of concrete placement.
 - g. Wet Weather Placement. When placement is scheduled during wet weather, submit request for acceptance of protection.
 2. Submit the following data when required:
 - a. Matching Sample Finish. When special finishes are required by Contract Documents, submit sample finish described in 3.03.B.
 - b. Exposed Aggregate Surface. When an exposed aggregate surface is specified and a chemical retarder is proposed to be used, submit specification and data on the retarder and proposed method of use of retarder.

3. Submit the following data when alternatives are proposed:
 - a. Construction Joints. Submit information for acceptance of proposed location and treatment of construction joints proposed but not indicated on the Contract Drawings. The determination of acceptability of proposed construction joints shall be made solely by the Engineer.
 - b. Two-Course Slabs. When a bonding agent other than cement grout is proposed, submit specification and data of bonding agent.
 - c. Underwater Placement. When underwater placement is planned, submit request for acceptance of proposed method.
 - d. Saw Cut Joints. When sawcut joints other than those indicated on the Contract Drawings are proposed, submit request of the proposed method.
 - e. Moisture-Preserving Method. When a moisture-preserving method other than specified in 3.06.C is proposed, submit request of the proposed method.
 - f. Coated Ties. When coated form ties described in 3.07.B are proposed to preclude the requirement to patch tie holes, submit proposed coated tie description.
 - g. Repair Material. When repair material described in 2.01.C, Proprietary Patching Materials, is proposed, submit the repair material specification, data on the proposed patching material, and proposed preparation and application procedure.

1.03 Delivery, Storage, and Handling

- A. DELIVERY: Place concrete within the time limits required in Section 03310 - Concrete Mixtures.
- B. STORAGE AND HANDLING: Store and handle products to retain original quality. Do not use products stored beyond the manufacturer's recommended shelf life.

PART 2 - PRODUCTS

2.01 Materials

- A. CURING COMPOUNDS: Where the use of curing compounds is approved by the Engineer, use curing compounds that conform to ASTM C309. Curing compound shall be translucent with fugitive dye. Combination curing compound/sealer products shall not be used unless sealer is part of the specified finish.

Where concrete is to be coated with moisture- or waterproofing compound or sealer, curing compounds shall not be used unless certified by the manufacturer as not adversely affecting the bond or performance of subsequently applied coatings, or shall be removed after completion of the cure using light water blast in accordance with manufacturer's recommendations.

- B. SHEET MATERIALS FOR CURING CONCRETE: Use sheeting materials that conform to ASTM C171.
- C. PROPRIETARY PATCHING MATERIALS: Use acceptable proprietary patching materials complying with 3.07.F, Repair Materials Other Than Site-Mixed Portland Cement Mortar.
- D. BONDING GROUT: Use bonding grout in accordance with 3.07.D, Preparation of Bonding Grout.
- E. SITE-MIXED PORTLAND CEMENT REPAIR MORTAR: Use repair mortar in accordance with 3.07.E, Site-Mixed Portland Cement Repair Mortar.
- F. FLOOR HARDENER: Floor hardener shall be a graded, iron aggregate base compound for dry-shake application and trowel embedment into fresh concrete. The compound shall be packaged in 90-lb, poly-lined bags and shall contain a dispersing agent, Portland cement and a stable lime-proof pigmentation to color the application gray. Wet cure or use curing compound recommended by the hardener manufacturer.

PART 3 - EXECUTION

3.01 Preparation

- A. Do not place concrete until data on materials and mixture proportions are accepted.
- B. Remove hardened concrete and foreign material from the inner surfaces of conveying equipment.
- C. Before placing concrete in forms, complete the following:
 - 1. Comply with formwork requirements specified in Section 03100 - Concrete Formwork.
 - 2. Remove snow, ice, frost, water, and other foreign material from surfaces, including reinforcement and embedded items, against which concrete will be placed.
 - 3. Comply with reinforcing steel placement requirements in Section 03200 - Concrete Reinforcement.
 - 4. Position and secure in place expansion joint material, anchors, and other embedded items.
 - 5. Obtain acceptance of finished preparation by Engineer or Owner's inspector.
- D. Before placing a concrete slab on grade, clean foreign material from the subgrade and complete the following:
 - 1. Subgrade shall be well drained and of uniform load-bearing nature.

2. In-place density of subgrade soils shall be uniform throughout the area and at least the minimum required by Contract Documents.
 3. Subgrade shall be free from frost or ice.
 4. Subgrade shall be moist with no free water and no muddy or soft spots.
 5. Where slipsheet is indicated on the Contract Drawings, slabs and foundations on grade shall be underlain with two layers of 8 mil. polyethylene sheeting perforated to allow bleedwater to escape.
- E. When high ambient temperatures necessitate protection of concrete immediately after placing or finishing, make provisions in advance of concrete placement for windbreaks, shading, fogging, sprinkling, ponding, or wet covering.
- F. During ambient temperature conditions described in Section 03310, Paragraph 2.02.G, Concrete Temperature, make provisions in advance of concrete placement to maintain the temperature of the concrete as specified in 3.02.A.2. Use heating, covering, or other means adequate to maintain required temperature without overheating or drying of concrete due to concentration of heat. Do not use combustion heaters unless precautions are taken to prevent exposure of the concrete to exhaust gases containing carbon dioxide.

3.02 Placement of Concrete

A. WET CONSIDERATION

1. Wet Weather. Do not begin to place concrete while rain, sleet, or snow is falling unless adequate protection is provided, and approval of protection is obtained from the Engineer.
2. Do not allow rainwater to increase mixing water or to damage the surface of the concrete.
3. Cold Weather. Concrete temperatures and ambient temperatures shall meet minimum temperature requirements of Section 03310, Paragraph 2.02.G, Concrete Temperature.
4. Hot Weather. The temperature of concrete as placed shall not exceed 80° F. Loss of slump, flash set, or cold joints due to temperature of concrete as placed will be rejected. When temperature of steel reinforcement, embedments, or forms is greater than 120°F, fog steel reinforcement, embedments, and forms with water immediately prior to placing concrete. Remove standing water prior to placing concrete.
5. Concrete Placed in Water. No concrete shall be placed underwater or in standing water unless specifically directed or approved by the Engineer and as provided for in these Specifications and shown on the Contract Drawings. Underwater concrete shall be placed using tremies or other special methods subject to approval by the Engineer, and only concrete mixtures specifically formulated for underwater placement shall be used.

- B. CONVEYING: Convey concrete from mixer to the place of final deposit rapidly by methods which prevent segregation or loss of ingredients and will assure the required quality of concrete. Do not use aluminum pipes or chutes.

- C. CONVEYING EQUIPMENT: Use acceptable conveying equipment of a size and design that will prevent cold joints from occurring. Clean conveying equipment before each placement.
1. Use belt conveyors that are horizontal or at a slope that will not cause excessive segregation or loss of ingredients. Project concrete to minimize drying and the effects of temperature rise. Use an acceptable discharge baffle or hopper at the discharge end to prevent segregation. Do not allow mortar to adhere to the return length of the belt.
 2. Use metal or metal-lined chutes having rounded bottoms and sloped between 1 vertical to 2 horizontal and 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used provided the discharge is into a hopper before distributing into the forms.
 3. Use pumping conveying equipment that permits placement rates that avoid cold joints and prevents segregation in discharge of pumped concrete.
- D. DEPOSITING: All concrete shall be delivered, discharged, and placed within the time limits specified in Section 03310, Paragraph 3.02.B, Batch Ticket Information.

Deposit concrete continuously in one layer or in layers to have fresh concrete deposited on in-place concrete that is still plastic. Do not deposit fresh concrete on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section, unless construction joint requirements of 3.02.F are met.

Once concreting is started, it shall be carried on as a continuous operation until the placing of the panel or section is complete. Suspension of operations for more than 1½ hours will not be permitted during a continuous placement, and this limit may be shortened on order by the Engineer.

Concrete shall be placed generally in horizontal layers not more than 24 inches thick, except as otherwise specified. Each layer of concrete is regarded as a unit of masonry to be laid and worked before the succeeding layer can be superimposed in the process of monolithic construction. When a monolithic layer cannot be completed in one operation, it shall be terminated with a vertical bulkhead. Feathering out to less than 6 inches will not be permitted.

Concrete shall be placed so as to prevent segregation of the materials and the displacement of the reinforcement. Where placing operations would involve the dropping of concrete through completed forms from heights of 4 or more feet, concrete so placed shall be pumped or discharged into hoppers feeding into flexible drop chutes to within 2 feet of the concrete's final deposition point. Encrustation of installed reinforcement by concrete spilled on it will be tolerated only for a length of time shorter than the encrusting concrete needs for drying out.

Do not use concrete that has surface dried, partially hardened, or contains foreign material.

When temporary spreaders are used in the forms, remove the spreaders as their service becomes unnecessary. Spreaders made of metal or concrete may be left in place if prior acceptance is obtained.

Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least 1 hour.

Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs.

When placing concrete for columns, do not exceed the top-of-pour elevation indicated on the Contract Drawings for the joint between the column and the slab or drop panel it supports.

When underwater placement is required or permitted, place concrete by an acceptable method. Deposit fresh concrete so concrete enters the mass of the previously placed concrete from within, displacing water with minimum disturbance to the surface of concrete.

- E. **CONSOLIDATING:** Consolidate concrete by vibration. Concrete shall be thoroughly worked around reinforcement and embedded items and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Use internal vibrators of the largest size and power that can properly be used in the work. Workers shall be experienced in use of the vibrators. Do not use vibrators to move concrete within the forms.

The Contractor shall supply enough vibrators to consolidate the concrete (except that placed underwater) according to the requirements of this section. Each vibrator must:

1. Be designed to operate while submerged in the concrete;
2. Vibrate at a rate of at least 7,000 pulses per minute; and
3. Receive the Engineer's approval on its type and method of use.

Immediately after concrete is placed, vibration shall be applied in the fresh batch at the point of deposit. In doing so, the Contractor shall:

4. Space the vibrators evenly, no farther apart than twice the radius of the visible effects of the vibration;
5. Ensure that vibration intensity is great enough to visibly affect a weight of 1-inch slump concrete across a radius of at least 18 inches;
6. Insert the vibrators slowly to a depth that will effectively vibrate the full depth of each layer, penetrating into the previous layer on multilayer pours;

7. Protect partially hardened concrete (i.e., nonplastic, which prevents the vibrator penetration when only its own weight is applied) by preventing the vibrator from penetrating it or making direct contact with steel that extends into it;
8. Not allow vibration to continue in one place long enough to form pools of grout;
9. Continue vibration long enough to consolidate the concrete thoroughly, but not so long as to segregate it;
10. Withdraw the vibrators slowly when the process is complete; and
11. Not use vibrators to move concrete from one point to another in the forms.

When vibrating and finishing top surfaces that will be exposed to weather or wear, the Contractor shall not draw water or laitance to the surface. In high lifts, the top layer shall be shallow and made up of a concrete mix as stiff as can be effectively vibrated and finished.

To produce a smooth, dense finish on outside surfaces, the Contractor shall hand tamp the concrete.

- F. **CONSTRUCTION JOINTS AND OTHER BONDED JOINTS:** Locate construction joints as indicated on the Contract Drawings or as accepted in accordance with 1.02.A.3.a. The use of construction joints not shown on the Drawings is prohibited unless approved by the Engineer. Formed construction joints shall be thoroughly cleaned, laitance removed, and dampened prior to placement of fresh concrete. When bond is required or permitted, it shall be achieved by one of the following:

1. Use an acceptable adhesive applied in accordance with the manufacturer's recommendations.
2. Use an acceptable surface retarder in accordance with the manufacturer's recommendations.
3. Roughen the surface in an acceptable manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damaged concrete at the surface.
4. Use Portland cement grout of the same proportions as the mortar in the concrete in an acceptable manner.

- G. **CONTRACTION/CONTROL JOINTS:** The location of contraction or control joints shall be as shown on the plans or as approved by the Engineer. Contraction joints shall be saw cut, preformed, or tooled ¼ inch wide by ¼ of the slab depth, but not less than 1½ inches deep, unless otherwise detailed on the Contract Drawings. Contraction joints shall be finished with backing rod and sealant.

- H. **PIPE PENETRATIONS:** Where pipes pass through the structure, they shall be cast in place, unless permission is given by the Engineer to do otherwise. Whenever these requirements interfere with the placement of reinforcing steel as indicated by the Contract Drawings, the bars shall be spread and rearranged as directed by the Engineer.

3.03 Finishing Formed Surfaces

- A. **GENERAL:** After removal of forms, in accordance with Table 3.03.A, give each formed surface one or more of the finishes described in 3.03.B, Matching Sample Finish; 3.03.C, As-Cast Finishes; or 3.03.D, Rubbed Finishes. When Contract Documents do not specify a finish, finish surfaces as required by 3.03.E, Unspecified Finishes.

Table 3.03.A	
Location	Finish Type
Backfilled surfaces	Rough form finish
Interior wet well surfaces	Smooth form finish
All other surfaces	Grout-cleaned finish

- B. **MATCHING SAMPLE FINISH:** When the finish is required by the Contract Documents to match a sample panel furnished to the Contractor, reproduce the sample finish on an area at least 100 square feet in a location designated by the Engineer and obtain acceptance before proceeding with that finish in the specified location.
- C. **AS-CAST FINISHES**
1. Rough Form Finish. Patch tie holes and defects. Chip or rub off fins exceeding ¼ inch in height. Leave surfaces with the texture imparted by the forms.
 2. Smooth Form Finish. Patch tie holes and defects. Remove all fins completely.
 3. Architectural Finishes. Produce architectural finishes including special textured finishes, exposed aggregate finish, and aggregate transfer finish in accordance with specifications for Architectural Concrete, if included in the Contract Documents.
- D. **RUBBED FINISHES:** Remove forms as early as permitted by Section 03100, Paragraph 3.02, Removal of Formwork. Produce one of the following finishes on concrete specified to have a smooth form finish:

1. Smooth Rubbed Finish. Remove forms as early as permitted by Section 03100 and perform necessary patching. Produce finish on newly hardened concrete no later than the day following form removal. Wet the surface and rub it with carborundum brick or other abrasive until uniform color and texture are produced. Use no cement grout other than cement paste drawn from the concrete itself by the rubbing process.
 2. Grout-Cleaned Finish. Begin cleaning operations after all contiguous surfaces to be cleaned are completed and accessible. Do not clean surfaces as Work progresses. Wet the surface and apply grout consisting of 1-part Portland cement and 1½ parts fine sand with enough water to produce the consistency of thick paint. Add white cement as needed to match color of surrounding concrete. Scrub grout into all voids and remove all excess grout. When grout whitens, rub the surface and keep the surface damp for 36 hours afterwards.
 3. Cork-Floated Finish. Perform necessary repairs. Remove ties, burrs, and fins. Wet the surface and apply stiff grout of one-part Portland cement and one-part fine sand, filling all voids. Add white cement as needed to match color of surrounding concrete. Use enough water to produce a stiff consistency. Compress grout into voids by grinding the surface with a slow-speed grinder. Produce the final finish with cork float, using a swirling motion.
- E. UNSPECIFIED FINISHES: When a specific finish is not specified in the Contract Documents for a concrete surface, apply the following finishes:
1. Rough form finish on all concrete surfaces not exposed to public view.
 2. Smooth form finish on all concrete surfaces exposed to public view.

3.04 Finishing Unformed Surfaces

- A. PLACEMENT: Place concrete at a rate that allows spreading, straightedging, and darbying or bullfloating before bleed water appears.

Strike smooth the top of walls, buttresses, horizontal offsets, and other similar unformed surfaces, and float them to a texture consistent with finish of adjacent formed surface.

Finish slab surfaces in accordance with one of the finishes in 3.04.B, Finishes, as specified in Table 3.04.A.

Table 3.04.A: Finish Schedule	
Location	Finish Type
Tops of footings or other backfilled surfaces	Floated finish
Exterior slabs, walks, and steps	Broom finish

B. FINISHES

1. Scratched Finish. Place, consolidate, strike off and level concrete, eliminating high spots and low spots. Roughen the surface with stiff brushes or rakes before the final set.
2. Floated Finish. Place, consolidate, strike off and level concrete, eliminating high spots and low spots. Do not work concrete further until it is ready for floating. Begin floating with a hand float, a bladed power float equipped with float shoes, or a powered disk float when the bleed water sheen has disappeared, and the surface has stiffened sufficiently to permit the operation. During or after the first floating, check flatness of surface with a 10-foot straightedge applied in two or more directions. Produce a conventional, straightedge finish in accordance with ACI 117, then refloat the slab immediately to a uniform texture.
3. Troweled Finish. Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled. Tolerance for concrete floors shall be conventional straightedge in accordance with ACI 117, unless otherwise specified. Concrete surfaces intended to support floor covering shall not have defects that will reflect through floor covering.
4. Broom or Belt Finish. Immediately after concrete has received a steel-troweled finish, give the concrete surface a coarse transverse scored texture by drawing a broom or burlap belt across the surface.
5. Dry-Shake Finish. Blend metallic or mineral aggregate floor hardener with Portland cement in the proportions recommended by the aggregate manufacturer, or use bagged premixed material as recommended by the manufacturer. Float finish the concrete surface. Apply approximately two-thirds of the blended material required for coverage to the surface by a method that ensures even coverage without segregation. Float finish the surface after application of the first dry-shake. Apply the remaining dry-shake material at right angles to the first application and in locations necessary to provide the specified minimum thickness. Begin final floating and finishing immediately after application of the dry-shake.

After selected material is embedded by the two floating, complete operation with a broomed, floated, or troweled finish, as designated in the Contract Documents.
6. Heavy Duty Topping for Two-Course Slabs. For heavy duty topping mix, use materials and methods specified in Contract Documents. Place and consolidate concrete for the base slab and creed concrete to the specified depth below the top of the finish surface.

Topping placed the same day as the base slab may be placed as soon as bleed water in the base slab has disappeared and the surface will support a person without appreciable indentation.

When topping placement is deferred, brush the surface with a coarse wire broom to remove laitance and scratch the surface when concrete is plastic. Wet cure the base slab at least three days. Before placing the topping, clean the base slab surface thoroughly of contaminants and loose mortar or aggregate. Dampen the surface, leaving it free of standing water.

Immediately before placing topping, scrub into the slab surface a coat of bonding grout consisting of equal parts of cement and fine sand with enough water to make a creamy mixture. Do not allow grout to set or dry before topping is placed. Bonding agents other than cement grout may be used with prior acceptance.

Spread, compact, and float the topping mixture. Check for trueness of surface and float, trowel, or broom finish as specified.

7. Topping for Two-Course Slab Not Intended for Heavy Duty Service. Preparation of base slab, selection of topping material, mixing, placing, consolidating, and finishing operations shall be as specified in 3.04.B.6, Heavy Duty Topping for Two-Course Slabs, except that the aggregate need not be selected for special wear resistance.
8. Non-Slip Finish. Where a non-slip finish is required, give the surface a broom finish or belt finish or a dry-shake application of crushed aluminum oxide or other abrasive particles, as specified in the Contract Documents. Rate of application shall be not less than 25 pounds per 100 cubic feet.
9. Exposed Aggregate Finish Immediately after surface of the concrete has been leveled to the specified straightedge method tolerance and the bleed water sheen has disappeared, spread aggregate of the color and size specified in Contract Documents uniformly over the surface to provide complete coverage to a depth of one stone.

Tamp the aggregate lightly to embed aggregate in the surface. Float the surface until the embedded stone is fully coated with mortar and the surface has been brought to a true plane within the specified straightedge tolerance. After the matrix has hardened sufficiently to prevent dislodgement of the aggregate, apply water carefully and brush the surface with a fine bristle brush to expose the aggregate without dislodging it.

An acceptable chemical retarder sprayed on freshly floated concrete surface may be used to extend the working time for the exposure of aggregate.
10. Non-Specified Finish When the type of finish is not specified in Contract Documents, use one of the following appropriate finishes and accompanying tolerances.
 - a. *Scratched Finish* — For surfaces intended to receive bonded cementitious mixtures.
 - b. *Floated Finish* — For walks, drives, steps, ramps, and for surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo.

- c. *Troweled Finish* — For floors intended as walking surfaces, floors in manufacturing, storage and warehousing areas, or for reception of floor coverings.

C. FINISHING TOLERANCES FOR SLABS

- 1. Finish floor slabs to meet the requirements of ACI 117 as specified in 3.04.B. Measure floor finish tolerances within 72 hours after slab finishing.
- 2. Unless otherwise specified in the Contract Documents, measure floor tolerances in accordance with the straightedge method in ACI 117.

3.05 Sawed Control Joints

- A. Where saw cut joints are required or permitted, start cutting as soon as concrete has hardened sufficiently to prevent dislodgement of aggregates. Saw a continuous slot to a depth of one-fourth the thickness of the slab but not less than one inch. Complete sawing within 12 hours after placement.

3.06 Curing and Protection

- A.
 - 1. Protect concrete from physical damage or reduced strength due to weather extremes.
 - 2. In cold weather comply with ACI 306R except as modified herein:
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Minimum concrete temperature at the time of mixing:

Outdoor Temperature at Placement (In Shade)	Concrete Temperature at Mixing
Below 30° F	70° F
Between 30-45° F	60° F
Above 45° F	50° F

- c. Do not place heated concrete that is warmer than 80° F.
 - d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50° F for 7 days or 70° F for 3 days.
 - e. Do not allow concrete to cool suddenly.
 - 3. In hot weather comply with ACI 305R except as modified herein:
 - a. At air temperature of 90° F and above, keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90° F at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

- d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.
- B. **GENERAL:** Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Protect concrete during the curing period such that the concrete temperature does not fall below the requirements of Section 03310, Paragraph 2.02.G, Concrete Temperature. Cure concrete in accordance with Table 3.06.A and 3.06.C for 7 days after placement. High early strength concrete shall be cured for 3 days after placement.

Alternatively, moisture retention measures may be terminated when:

1. Tests are made on at least two additional cylinders kept adjacent to the structure and cured by the same methods as the structure, and tests indicate 70 percent of the specified compressive strength f'_c , as determined in accordance with ASTM C39.
2. Temperature of the concrete is maintained at 50°F or higher for the time required to achieve 85 percent of f'_c in laboratory-cured cylinders representative of the concrete in place.
3. Strength of concrete reaches f'_c as determined by accepted non-destructive methods meeting the requirements of Section 03100, Paragraph 3.04.B.

Table 3.06.A: Curing Method Schedule	
Location	Method
WALLS AND FLOOR SLABS OF LIQUID-RETAINING TANKS AND CHANNELS.	Wet method only per 3.06.C.1
All other locations	WET METHOD (3.06.C.1) OR CURING COMPOUND METHOD (3.06.C.2)

During and following curing, do not allow the surface of the concrete to change temperature more than the following:

- 50°F in any 24-hour period for sections less than 12 inches in the least dimension.
- 40°F for sections from 12 to 36 inches in the least dimension.
- 30°F for sections 36 to 72 inches in the least dimension.
- 20°F for sections greater than 72 inches in the least dimension.

The method of temperature measurement shall be accepted by the Engineer.

- C. **FORMED CONCRETE SURFACES:** Keep absorbent wood forms wet until they are removed. After form removal, cure concrete by one of the methods in 3.06.C, Preservation of Moisture.
- D. **PRESERVATION OF MOISTURE:** After placing and finishing, use one of the following methods, as required by Table 3.06.A, to preserve moisture in concrete:
1. Wet Cure Method. Provide continuous moisture by ponding or watering a covering of heavy quilted blankets, by watering and covering with a white reflective-type sheeting, or by wetting the outside surfaces of wood forms. Runoff water shall be collected and disposed of in accordance with all applicable regulations. In no case shall runoff water be allowed to enter any lakes, streams, or other surface waters.

When curing slabs with wet heavy quilted blankets or burlap, a fog or mist spray of water shall be sprayed on the entire surface before the bleed water has evaporated. As soon as the concrete has achieved initial set, the surface shall be covered with presoaked heavy quilted blankets of burlap. The fog or mist spray shall be applied continuously until the presoaked heavy quilted blankets of burlap are placed. If the fog or mist spray cannot be applied continuously, two coats of curing compound shall be applied after the initial fog or mist spray application and before the presoaked heavy quilted blankets or burlap are placed.

Ponding may be used for slabs on grade.
 2. Curing Compound Method. Application of a curing compound conforming to ASTM C309. Apply the compound in accordance with manufacturer's recommendation after water sheen has disappeared from the concrete surface and after finishing operations. The rate of application shall not exceed 150 square feet per gallon. Apply in two applications at right angles to each other, not to exceed 150 square feet per gallon for each coat. Do not use curing compound on any surface where concrete or other material will be bonded unless the curing compound will not prevent bond or unless measures are to be taken to completely remove the curing compound from areas to receive bonded applications.

No later than the morning after applying the curing compound, the Contractor shall cover the top surfaces with white, reflective sheeting, leaving it in place for at least 10 days. Throughout this period, the sheeting shall be kept in place by taping or weighting the edges.

3.07 Repair of Surface Defects

- A. **GENERAL:** Repair tie holes and surface defects immediately after form removal. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.
- B. **REPAIR OF TIE HOLES**
1. Plug tie holes except where stainless steel ties, non-corroding ties, or acceptably coated ties are used, and omission of plugging is approved by the Engineer.

2. When Portland cement patching mortar conforming to 3.07.E, Site Mixed Portland Cement Repair Mortar, is used for plugging, clean and dampen tie holes before applying the mortar.
3. When other materials are used, apply them in accordance with Manufacturer's recommendations.
4. Finish tie holes flush with surrounding wall for concealed surfaces and exposed surfaces of tanks and channels. For other exposed surfaces, finish to leave a reveal δ -inch deep, unless otherwise directed by the Engineer.

- C. REPAIR OF SURFACE DEFECTS OTHER THAN TIE HOLES: Outline honeycombed or otherwise defective concrete with a $\frac{1}{2}$ - to $\frac{3}{4}$ -inch-deep saw cut and remove such concrete down to sound concrete. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges. Dampen the area to be patched, plus another 6 inches around the patch area perimeter. Prepare bonding grout according to 3.07.D, Preparation of Bonding Grout. Thoroughly brush grout into the surface.

When the bond coat begins to lose water sheen, apply patching mortar prepared in accordance with 3.07.E, and thoroughly consolidate mortar into place. Strike mortar leaving the patch slightly higher than the surrounding surface to permit initial shrinkage. Leave the patch undisturbed for 1 hour before finishing. Keep the patch damp for 7 days.

- D. PREPARATION OF BONDING GROUT: For bonding grout, mix approximately one part of cement and one part of fine sand with water to a consistency of thick cream.

E. SITE-MIXED PORTLAND CEMENT REPAIR

1. Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Use not more than one-part cement to two and one-half parts sand by loose damp volume.
2. For repairs in exposed concrete, make a trial batch and check color compatibility of repair material with surrounding concrete. When the repair is too dark, substitute white Portland cement for a part of the gray cement to produce a color closely matching surrounding concrete.
3. Use a repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and manipulate the mortar frequently with a trowel without adding water. Use mortar at a stiff consistency.
4. Repair mortar may be used for holes at least 1-inch deep where the depth is equal to or greater than the smallest surface dimension of the defect, and for narrow slots cut for the repair of cracks. Do not use where lateral restraint cannot be obtained. Place and dry-pack mortar in layers having a compacted thickness of approximately 1 inch.

5. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.
- F. REPAIR MATERIALS OTHER THAN SITE-MIXED PORTLAND CEMENT MORTAR: Materials other than site-mixed Portland cement may be used for repair when prepared by the Engineer. Materials include, but are not limited to:
1. Shotcrete
 2. Commercial Patching Products. Including:
 - a. Portland cement mortar modified with a latex bonding agent, conforming to ASTM C1059 Type II.
 - b. Epoxy mortars and epoxy compounds that are moisture-insensitive during application and after curing, which embody an epoxy binder that conforms to ASTM C881, Type III. The type, grade, and class shall be appropriate for the application as specified in ASTM C881.
 - c. Shrinkage-compensating or non-shrink Portland cement grout, conforming to ASTM C1107.
 - d. Packaged dry concrete repair materials, conforming to ASTM C928.
- G. REMOVAL OF STAINS, RUST, EFFLORESCENCE AND SURFACE DEPOSITS: Remove stains, rust efflorescence and surface deposits considered objectionable by Engineer by acceptable methods.
- H. CONCRETE REPLACEMENT: Use concrete replacement for:
1. Holes extending entirely through concrete sections.
 2. For holes larger than 1 square foot and deeper than 4 inches in which no reinforcement is encountered.
 3. For holes larger than ½ of 1 square foot where reinforcement is exposed.
- Concrete used for replacement shall be the same strength and mixture as used in the structure.

END OF SECTION 03300

**SECTION 03310
CONCRETE MIXTURES**

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers the requirements for materials, proportioning, production and delivery of concrete.

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following:
1. MIXTURE PROPORTIONS: Submit concrete mixture proportions and characteristics.
 2. MIXTURE PROPORTION DATA: Submit field test data used to establish the required average strength in accordance with 2.03.C, Required Average Compression Strength. Submit for acceptance test data used to establish the average compression strength of the mixture in accordance with 2.03.D, Documentation of Required Average Compression Strength.
 3. CONCRETE MATERIALS: Submit the following information for concrete materials, along with evidence demonstrating compliance with 2.01, Materials:
 - a. For Cementitious Materials. Types, classes, producers' names, plant locations, and evidence not more than 90 days old demonstrating compliance with 2.01, Materials.
 - b. For Aggregates. Types, pit or quarry locations, producers' names, gradations, specific gravities and evidence not more than 90 days old demonstrating compliance with 2.01, Materials.
 - c. For Admixtures. Types, brand names, producers, catalog, and certification data.
 - d. For Water and Ice. Source of supply.
 4. FIELD TEST DATA BASIS: When field test data is used as a basis for selecting proportions for a concrete mixture, submit data on materials and mixture proportions, with supporting test results confirming conformance with specified requirements.
 5. MIXTURE PROPORTION ADJUSTMENTS: Submit any adjustments to mixture proportions or changes in materials, along with supporting documentation, made during the course of the Work.
 6. FLOOR CONCRETE: Submit evaluations and test results verifying adequacy of concrete to be placed in floors when cementing content is less than the minimum specified in Table 2.02.A.

7. CALCIUM CHLORIDE: Calcium chloride shall not be added to the concrete.
8. VOLUMETRIC BATCHING: When it is desired to produce concrete by the volumetric batch method, submit request along with description of proposed method.
9. TIME OF DISCHARGE: When it is desired to exceed time for discharge of concrete required by ASTM C94, submit a request along with a description of the precautions to be taken.

1.03 Quality Assurance

- A. The Contractor shall maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the requirements of 2.01, Materials.
- B. The Contractor shall assure that production and delivery of concrete conform to the requirements of 3.01, Measuring, Batching and Mixing and 3.02, Delivery.
- C. The Contractor shall assure that the concrete produced has the specified characteristics in the freshly mixed state and that they are maintained during transport and delivery.

1.04 delivery, Storage, and Handling

- A. CEMENTITIOUS MATERIAL: Store cementitious materials in dry weathertight buildings, bins, or silos which will exclude contaminants.
- B. AGGREGATES: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates to drain freely.

Do not use aggregates that contain frozen lumps.
- C. WATER AND ICE: Protect mixing water and ice from contamination during storage and delivery.
- D. ADMIXTURES: Protect and store admixtures against contamination, evaporation, or damage. Provide agitating equipment for admixtures used in the form of suspensions or non-stable solutions to ensure thorough distribution of ingredients. Protect liquid admixtures from freezing and from temperature changes which would adversely affect their characteristics.

PART 2 - PRODUCTS

2.01 Materials

- A. CEMENTITIOUS MATERIAL: Cementitious material shall consist of portland cement conforming to ASTM C150, with or without the addition of cementitious or pozzolanic mineral admixtures conforming to ASTM C618 or ASTM C989, or blended hydraulic cement conforming to ASTM C595. Unless otherwise specified, cementitious material shall conform to ASTM C150 Type I or Type II, without the addition of cementitious or pozzolanic mineral admixtures. The tricalcium aluminum (Ca_3Al) content of the portland cement shall be less than 8 percent in all concrete. In addition, cement shall meet the heat of hydration limits of Table 4 in ASTM C150. Cement for shrinkage compensating concrete shall conform to ASTM C845.

Cementitious material used in concrete shall be the same brand and type, and from the same plant of manufacture as the cementitious material used in the concrete represented by the submitted field test data or used in the trial mixtures.

- B. AGGREGATES: Aggregates shall conform to ASTM C33 unless otherwise specified. When a single size or a combination of two or more sizes of coarse aggregates are used, the final gradation shall conform to the grading requirements of ASTM C33 unless otherwise specified or permitted.

Aggregates used in concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data or used in trial mixtures.

- C. WATER AND ICE: Mixing water for concrete and water used to make ice shall meet the requirements of ASTM C94.

- D. ADMIXTURES: Admixtures shall meet the requirements of the following:

1. Provide admixtures produced and serviced by an established, reputable manufacturer, used in compliance with Manufacturer's recommendations. All of the admixtures used shall be from the same manufacturer and compatible with each other.
 - a. *Air-entraining admixture*: Conform to ASTM C260. Admixture shall contain no chlorides and shall be capable of maintaining the air percentage as batched, within $\pm 2\%$ at point of placement, for 2 hours.
 - b. *Water-reducing set, set-controlling admixture*: Conform to ASTM C494, Type A or D. Admixture shall contain no chlorides and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the Manufacturer's recommendations to obtain at least 12% water reduction. No retarder shall be used without Engineer's approval. Submit written proposed details of use.

- c. *Non-chloride, non-corrosive accelerators* Conform to ASTM C494, Type E, Admixture, shall be non-chloride and shall not promote corrosion of reinforcing steel in concrete.
- d. *High-range water reducer*: Conform to ASTM C494, Type F or G. The admixture shall be free of chlorides and alkalines. Water reducers shall be batch plant added.
- e. *Fly ash*: ASTM C618, Class F, maximum 2% loss on ignition.
- f. *Fiber reinforcement*: Fiber reinforcement shall be nominal ½-inch fibrillated polypropylene, Fibermesh, W.R. Grace, or other approved polypropylene product designed specifically for control of shrinkage and drying cracking in portland cement concrete.
- g. *Retarding admixture*: Confirm to ASTM A494, Type B.

Admixtures used in concrete shall be the same as those used in the concrete represented by submitted field test data or used in trial mixtures.

- E. **CHANGE OF MATERIALS**: When brand type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data or data from new trial mixtures or evidence which indicates that the change will not adversely affect the relevant properties of the concrete shall be submitted for acceptance prior to use in concrete.

2.02 Performance and Design Requirements

A. CEMENTITIOUS MATERIAL CONTENT

- 1. The cementitious material content shall be adequate for concrete to satisfy the specified requirements for strength, water-cement ratio, and finishing ability. Not more than 20% fly ash may be substituted for portland cement at the Contractor's option. However, mix designs with fly ash shall not be used for floor slabs.
- 2. For concrete used in floors, cement content shall not be less than indicated in Table 2.02.A unless approved by the Engineer. Acceptance of a lower cement content will be contingent upon verification that concrete mixtures with a lower cement content will meet the specified strength requirements and will produce concrete with equal finish quality, appearance, durability, and surface hardness.
- 3. When a history of finishing quality is not available, evaluate the proposed mixture by placing concrete in a slab at the job using job materials, equipment, and personnel. The slab shall be at least 8 feet square and have an acceptable thickness. Slump shall not exceed the specified slump. Submit the evaluation results for acceptance.

Table 2.02.A: Minimum Cement Content Requirements	
Nominal Maximum Size of Aggregate (in.)	Minimum Cement Content (lb/yd)
1½	470*
1	520
¾	540
⅜	610
<i>*Minimum cement content shall be 501 lb/yd³ if concrete will be exposed to freezing and thawing in the presence of de-icing chemicals.</i>	

- B. SLUMP: Concrete shall have, at the point of placement, slump in accordance with Table 2.02.B. Determine the slump by ASTM C143. Slump tolerances shall meet the requirements of ACI 117.

Concrete with a high-range water reducing admixture may exceed the maximum slump by 2 inches while the admixture is effective.

Table 2.02.B: Slump Schedule		
	<u>Minimum</u>	<u>Maximum</u>
Slabs	2"	4"
Footings	3"	1"
Walls	2"	5"

- C. SIZE OF COARSE AGGREGATE: Except when otherwise specified or permitted, nominal maximum size of coarse aggregate shall not exceed ¾ of the minimum clear spacing between reinforcing bars; 1/5 of the narrowest dimension between sides of forms; or α of the thickness of slabs or toppings.

D. AIR CONTENT

1. Unless otherwise specified, all concrete shall be air-entrained. Unless otherwise specified, air content at the point of delivery shall conform to the requirements of Table 2.02.D for severe exposure.
2. For specified compressive strengths above 5,000 psi, the total air contents indicated in Table 2.02.D may be reduced by 1 percent.
3. Air content shall be measured in accordance with ASTM C138, C173, or C231. ASTM C231 shall be the preferred method.
4. Maximum air entrainment shall not exceed 3 percent for interior floor slabs to receive floor hardener and sealing compound.

Table 2.02.D: Total Air Content* of Concrete for Various Sizes of Coarse Aggregate			
Nominal Max. Size of Aggregate (in.)	Total Air Content, + Percent		
	Severe Exposure	Moderate Exposure	Mild Exposure
Less than 3/8	9	7	5
3/8	7.5	6	4.5
1/2	7	5.5	4
3/4	6	5	3.5
1	6	4.5	3
1 1/2	5.5	4.5	2.5
2	5	4	2
3	4.5	3.5	1.5
6	4	3	1
<i>*Measured in accordance with ASTM C138, C173, or C231. +Air content tolerance is +1-1 1/2 percent.</i>			

- E. ADMIXTURES: When admixtures are specified in the Contract Documents for particular parts of the Work, use the types specified.
1. Water-reducing admixtures may be used at the option of the Contractor.
 2. Accelerators shall not be used without the approval of the Engineer.
 3. Provide fiber reinforcement at an application rate of 1.5 lb/fiber per cubic yard of concrete where fiber reinforcement is specified.
- F. CONCRETE CLASS AND LOCATION: The proportions of cement, aggregate, and water for concrete shall be determined by the Contractor and subject to the requirements of this section. Concrete shall meet the following criteria:

Property	Class A	Class B	Class C	Class D
Cement type	C150 Type 2	C150 Type 2	C150 Type 2	C150 Type 2
Max. water/cementitious ratio	0.45	0.50	0.50	0.58
Entrained air	Yes	Yes	Yes	No
Compressive Strength See Structural General Notes				

Class	Location
A	Slabs, equipment base slabs, and floor infills
B	Not used
C	All reinforced concrete other than Class A locations
D	Unreinforced concrete used for thrust blocks, channel filler, and other general uses

G. **CONCRETE TEMPERATURE:** When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40°F for more than 3 successive days, concrete shall be delivered to meet the following minimum temperature immediately after placement:

- 55°F for sections less than 12" in the least dimension
- 50°F for sections 12" to 16" in the least dimension
- 45°F for sections 36" to 72" in the least dimension
- 40°F for sections greater than 72" in the least dimension

The temperature of concrete as placed shall not exceed these values by more than 20°F.

These minimum requirements may be terminated when temperatures above 50°F occur during more than half of any 24-hour duration.

Unless otherwise specified or permitted, the temperature of concrete as delivered shall not exceed 90°F.

H. **WATER-CEMENTITIOUS MATERIAL RATIO:** The compressive strength and, when required, the water-cementitious material ratio of the concrete for each portion of the Work shall be as specified in Paragraph F above.

1. If cementitious or pozzolanic mineral admixtures conforming to ASTM C618 or ASTM C989 are used, the cement portion of the water-cement ratio shall be the total weight of cementitious materials.
2. The maximum weight of fly ash, pozzolan or ground granulated blast-furnace slag that is included in the calculation of water-cementitious material ratio shall not exceed the following percentages of the total weight of Portland cement plus fly ash, pozzolan, and ground granulated blast-furnace slag.

- a. The combined weight of fly ash and pozzolan conforming to ASTM C618 shall not exceed 25 percent of the total weight of cementitious material. The fly ash and pozzolan present in an ASTM Type IP or IPM blended cement conforming to ASTM C595 shall be included in the calculated percentage.
- b. The weight of ground granulated blast-furnace slag conforming to ASTM C989 shall not exceed 50 percent of the total weight of cementitious material. The slag used in manufacture of Type IS or ISM blended hydraulic cement conforming to ASTM C595 shall be included in the calculated percentage.
- c. If fly ash or pozzolan is used in concrete with ground granulated blast-furnace slag, the portland cement constituent conforming to ASTM C150 shall not be less than 50 percent of the total weight of cementitious material. Fly ash or pozzolan shall constitute no more than 20 percent of the total weight of cementitious material.

2.03 Proportioning

- A. Proportion concrete to conform with 2.02, Performance and Design Requirements and the Structural General Notes, to provide workability and consistency so concrete can be worked readily into forms and around reinforcement without segregation or bleeding, and to provide an average compressive strength adequate to meet acceptance requirements of Section 03000 - Concrete - General Requirements, Paragraph 1.06.G.1, Standard Molded and Cured Strength Specimens.

If the production facility has records of field tests performed within the past 12 months and spanning a period of not less than 60 calendar days for a class of concrete within 1,000 psi of that specified for the Work, calculate a standard deviation and establish the required average strength f_c' in accordance with 2.03.B and 2.03.C.1. If field test records are not available, select the required average strength from Table 2.03.C.2.

- B. STANDARD DEVIATION: Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated:

1. Must represent materials, quality control procedures, and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for proposed work.
2. Must represent concrete produced to meet a specified strength or strengths f_c' within 1,000 psi of that specified for the proposed work.
3. Must consist of at least 30 consecutive tests, or two groups of consecutive tests, totaling at least 30 tests, except as provided below.

Where a concrete production facility does not have test records meeting the above requirements but does have a record based on 15 to 29 consecutive tests, a standard deviation must be established as the

product of the calculated standard deviation and the modification factor in Table 2.03.C.1. To be acceptable, the test record must meet the requirements of Items 1 and 2 and represent only a single record of consecutive tests that span a period of not less than 45 calendar days.

C. **REQUIRED AVERAGE COMPRESSIVE STRENGTH:** Calculate the required average compressive strength f'_c for the specified concrete in accordance with one of the following:

1. Use the standard deviation calculated in accordance with 2.03.B to establish the required average compressive strength as follows:

$$\begin{aligned} F'_c &= F_c' + 1.34 \text{ ks} \\ F'_c &+ 2.33 \text{ ks} - 500 \end{aligned}$$

where:

$$\begin{aligned} F'_c &= \text{required average compressive strength} \\ F_c' &= \text{specified compressive strength} \\ s &= \text{Standard deviation calculated in accordance with 2.03.B} \\ k &= \text{factor from Table 2.03.C.1 for increase in standard deviation if the total number of tests is less than 30} \end{aligned}$$

The larger of the two values of F'_c calculated in accordance with 2.03.C.1 shall be used.

Table 2.03.C.1: k-Factor for Increasing the Standard Deviation for Number of Tests Considered	
Total No. of Tests Considered	k-Factor for Increasing Standard Deviation
15	1.16
20	1.08
25	1.03
30 or more	1.00
<i>Linear interpolation for intermediate number of tests is acceptable.</i>	

2. When field test data is not available to establish a standard deviation, select the required average compressive strength F'_c from Table 2.03.C.2.

Table 2.03.C.2: Required Compressive Strength F'_c When Data Is Not Available to Establish a Standard Deviation	
Specified Strength $F'_c N$	Required Average Compressive Strength $F'_c N$
Less than 3,000 psi	$F'_c + 1,000$ psi
3,000 to 5,000 psi	$F'_c + 1,200$ psi
Over 5,000 to 10,000 psi	$F'_c + 1,400$ psi
Over 10,000 to 15,000 psi	$F'_c + 1,800$ psi
Less than 3,000 psi	$F'_c + 1,000$ psi
3,000 to 5,000 psi	$F'_c + 1,200$ psi

- D. **DOCUMENTATION OF REQUIRED AVERAGE COMPRESSIVE STRENGTH:**
Documentation demonstrating that the proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength F_c' shall consist of field strength records or trial mixtures.

1. Field Test Data. If field test data is available and represents a single group of at least 10 consecutive strength tests for one mixture, using the same materials and under the same conditions encompassing a period of not less than 60 days, verify that the average of the field test results equals or exceeds F_c' . Submit for acceptance the mixture proportions along with the field test data.

If the field test data represents two groups of compressive strength tests for two mixtures, plot the average strength X_1 and X_2 , of each group versus the corresponding mixture proportions, and interpolate between corresponding mixture proportions to establish mixture proportions for F_c' .

2. Trial Mixtures. Establish mixture proportions based on trial mixtures in accordance with the following requirements:
 - a. Use materials and material combinations proposed for the Work.
 - b. Determine the required average compressive strength according to 2.03.C.1 if suitable field test data is available or use Table 2.03.C.2.
 - c. Make at least 3 trial mixtures complying with 2.02, Performance and Design Requirements. Each trial mixture shall have a different cementitious material content. Select water-cementitious material ratios that will produce a range of compressive strengths encompassing the required average compressive strength F_c' .
 - d. Proportion trial mixtures to produce a slump within $\frac{3}{4}$ " of the maximum specified, and for air-entrained concrete, an air content with 0.5 percent of the required total air content indicated in Table 2.02.D. The temperature of the freshly mixed concrete shall be recorded and shall be within 10°F of the intended maximum temperature of the concrete as mixed and delivered.
 - e. For each trial mixture, make and cure 3 compressive strength cylinders for each test age in accordance with ASTM C192. Test for compressive strength in accordance with ASTM C39 at 28 days or at the test age specified in the Contract Documents.
 - f. From results of these tests, plot a curve showing the relationship between water-cementitious material ratio and compressive strength.

- g. From the curve of water-cementitious material ratio versus compressive strength, select the water-cementitious material ratio corresponding to the required average compressive strength F_c' . This is the maximum water-cementitious material ratio that may be used to establish mixture proportions unless a lower water-cement ratio is specified in 2.02.H, Water-Cementitious Material Ratio.
 - h. Establish mixture proportions so that the maximum water-cementitious material ratio is not exceeded when slump is at the maximum specified.
- E. FIELD VERIFICATION OF ADEQUACY OF SELECTED PROPORTIONS: Using materials accepted for use in the Work, verify in the field the adequacy of the selected proportions to produce concrete with the required total air content and consistency, and with workability compatible with the intended placing method. Make suitable corrections as necessary and submit for acceptance the adjusted proportions.
- F. REVISIONS TO CONCRETE MIXTURES: When 15 consecutive compressive strength test results become available from the field, calculate the actual average compressive strength and standard deviation. Calculate a revised value for the average required compressive strength F_c' in accordance with 2.03.B.1. Verify that both of the requirements of Section 03000, Paragraph 1.06.G.1, Standard Molded and Cured Strength Specimens, are met.
 - 1. When the actual average compressive strength exceeds the revised value of F_c' and requirements of 2.03.F are met, the required average compressive strength of the concrete F_c' may be decreased if the requirements of 2.02. are met.
 - 2. If the actual average compressive strength is less than the revised value of F_c' , or if either of the two requirements in 2.03.F are not met, take immediate steps to increase average compressive strength of the concrete.
 - 3. Revised mixture proportions shall be submitted for acceptance prior to placing in the Work.

PART 3 - EXECUTION

3.01 Measuring, Batching and Mixing

- A. Production facilities shall produce concrete of the specified quality and conforming to the requirements of this section.
 - 1. READY-MIXED AND SITE-PRODUCED CONCRETE: Unless otherwise specified, measure, batch and mix concrete materials and concrete in conformance with ASTM C94.
 - 2. CONCRETE PRODUCED BY VOLUMETRIC BATCHING AND CONTINUOUS MIXING: When concrete made by volumetric batching and continuous mixing is permitted, it shall conform to the requirements of ASTM C685.

3. PREPACKAGED DRY MATERIALS USED IN CONCRETE: If packaged dry combined materials are used, they shall conform to the requirements of ASTM C387.

3.02 Delivery

- A. Deliver concrete which will possess the specified characteristics in the freshly mixed state at the point of placing. Transport and deliver concrete in equipment conforming to the requirements of ASTM C94.

1. SLUMP ADJUSTMENT: When concrete arrives at the point of delivery with a slump below that which will result in the specified slump at the point of placement and is unsuitable for placing at that slump, the slump may be adjusted to the required value by adding water up to the amount allowed in the accepted mixture proportions when permitted by the Engineer. Addition of water shall be in accordance with ASTM C94. Do not exceed the specified water-cementitious material ratio or slump. Do not add water to concrete containing a plasticizing or a high-range, water-reducing admixture. Do not add water to concrete delivered in equipment not acceptable for mixing.

Measure slump and air content of air-entrained concrete, after slump adjustment, to verify compliance with specified requirements.

2. TIME OF DISCHARGE: Time for completion of discharge shall be within 60 minutes of the first addition of cement to the truck.

This length of time may be extended, on a case-by-case basis, an additional 30 minutes at the discretion of the Engineer or the Owner's Resident Project Representative provided the mix remains fluid and placeable and shows no signs of stiffening or set.

If delivery logistics make it impractical to discharge concrete within the above time limits, the Contractor may use an approved retarder admixture, delay the introduction of mixing water until the truck is closer to the job site, or propose other means, subject to approval by the Engineer, to assure that concrete is in acceptable condition at the time of discharge.

- B. BATCH TICKET INFORMATION

1. The manufacturer of the concrete shall furnish to the Contractor and to the Owner's Representative with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped, or written, information concerning said concrete as follows:
 - a. Name of ready-mix batch plant
 - b. Serial number of ticket
 - c. Date
 - d. Truck number
 - e. Name of purchaser

- f. Specific designation of job (name and location)
 - g. Specific class or designation of the concrete in conformance with that employed in job specifications
 - h. Amount of concrete in cubic yards (or cubic meters)
 - i. Time elapsed from first mixing of cement and aggregates
 - j. Water added by receiver of concrete and his initials
 - k. Reading of revolution counter at the first addition of water
 - l. Type and brand, and amount of cement
 - m. Type and brand, and amount of admixtures
 - n. Information necessary to calculate the total mixing water added by the producer. Total mixing water includes free water on the aggregates, water, and ice batched at the plant, and water added by the truck operator from the mixer tank
 - o. Maximum size of aggregate
 - p. Weights of fine and coarse aggregate
 - q. Ingredients certified as being previously approved
 - r. Signature or initials of ready-mix representative
2. The Contractor shall keep a record of where in the Work each batch was placed.

END OF SECTION 03310

SECTION 03600 GROUT

PART 1 - GENERAL

1.01 Description of Work

- A. This section covers the supply of materials, mixing of materials, and the installation of various grades of grouts utilized in the project, for general purposes.

1.02 References

- A. 2015 International Building Code
- B. ASTM Standards
 - 1. C5 Specification for Quicklime for Structural Purposes
 - 2. C33 Specification for Concrete Aggregates
 - 3. C107 Method of Panel Spalling Testing High-Duty Fireclay Brick
 - 4. C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
 - 5. C150 Specification for Portland Cement
 - 6. C404 Specification for Aggregates for Masonry Grout
 - 7. C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - 8. C939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
 - 9. C1107 Specification for Packaged, Dry, Hydraulic Cement Grout

1.03 Submittals

- A. In accordance with the requirements of Section 01300 - Project Data Submittals submit the following:
 - 1. Manufacturer's data on all products.

PART 2 - PRODUCTS

2.01 Epoxy-Resin-Base Bonding System

- A. For all grouted pipe penetrations, where called for on the drawings and in all cases where less than a 1-inch thickness of grout or mortar overlays existing concrete or green concrete, a bonding system complying with ASTM C881 shall be used, such as Sonobond by Sonneborn or approved equal.

2.02 Precision Grout

- A. Filling of anchor bolt pockets, handrail pockets, and under equipment and column base plates shall be classified as precision grouting. Grout used for precision grouting shall be a pre-packaged, non-shrink grout using a mixture of metallic and natural aggregates, and shall conform to the most current version of ASTM C107 Grade B or C when tested at a fluid consistency of 25-30 seconds per ASTM C939 at temperature extremes of 45 and 90°F and an extended working time of 30 minutes. Master Builders Embeco 636 or 885 are acceptable brand and grout types conforming to this specification.
- B. All material used, including water, mixer and pre-packaged grout must be initially at the 45 and 90°F limits when testing is initiated. Manufacturer shall provide independent certification of ASTM C1107, compliance without modification of standard methods, and certify that the grout's post-hardening, non-shrink property is not based on gas expansion.
- C. Grout shall have strengths of 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days when cured at 72°F, as well as meet the 3-, 7-, and 28-day strengths when tested and cured at the 45 and 90°F limits, and shall not bleed when placed at a fluid consistency.
- D. The Contractor shall engage an independent testing laboratory to run a 24-hour grout evaluation of any grout submitted for approval and shall submit written certification from the laboratory of conformance to all aspects of this section.

2.03 Portland Cement Grout

- A. Portland Cement Grout shall be used to provide flow concentration in channels, at the bottom of high walls, and in other locations where a general-purpose grout is required. Portland cement grout shall be mixed with sand on a ratio of one-part cement to two parts sand with an expansive agent included to limit drying shrinkage. Sufficient water shall be added for placement while maintaining a minimum 4,000 psi 28-day compressive strength.

2.04 Topping Course Grout

- A. This grout shall be used for leveling the bottom of structures. This mix shall contain 6½ sacks of cement per cubic yard of concrete, use sand and 3/8-inch coarse aggregate, size No. 89 in ASTM C404, and use water-reducing and expansive additives. The minimum compressive strength shall be 4,000 psi in 28 days. Topping grout over floor slabs shall be reinforced with WWR 6x6 W1.4xW1.4.

2.05 Rapid Cure Grout

- A. Rapid cure grout shall be mixed with aggregate as recommended by the manufacturer. The grout shall be Master Builders Set 45 or approved equal.

2.06 Self-Leveling Underlayment

- A. Self-leveling cement underlayment shall be Ardex K-15. The compressive strength shall be 4,000 psi per ASTM C109 and shall be capable of feather-edge thickness application. Self-leveling cement underlayment shall be used to level floors where noted on the drawings.

PART 3 - EXECUTION

3.01 Mixing

- A. All parts of the respective grouts shall be proportioned by volume measurement. Mixing shall be accomplished using a mechanical mixer suitable to the required quantities. Each batch shall be mixed for not less than 5 minutes. The respective grouts and mortars shall be mixed with sufficient water to maintain the fluidity required while attaining the minimum compressive strength indicated.

3.02 Retempering and Time Limit

- A. Do not retemper or use mortar which has become harsh and nonplastic. When mortar has been maintained plastic and grout fluid, they may be used up to, but not more than, one hour after original mixing.

3.03 Temperature

- A. Grouting operations shall not commence when the ambient temperature has dropped below 45°F or when the surface to which it is being applied is less than 40°F.

3.04 Protection

- A. All grouting operations shall be protected against moisture intrusion and a sealer, linseed oil or Thoroclear 777, shall be applied at the completion of the work.

3.05 Surface Preparation

- A. The existing concrete surface that the respective grout or mortar shall be placed against shall be cleaned as follows:
 - 1. If the existing surface has been exposed to sludge, chlorine, or other solutions, or was previously painted or treated, the surface shall be sandblasted and steam-cleaned, then treated with a diluted solution of muriatic acid neutralized with an alkaline solution and flushed with clean water.
 - 2. If the existing surface was not exposed to solution other than water, then the surface shall be washed with a diluted (2 parts water to 1-part acid) solution of muriatic acid, neutralized with an alkaline solution, and flushed with clean water.

3.06 Precision Grouting

- A. This section describes additional special provisions for the grouting of anchor bolts, handrail pockets, and column and equipment baseplates, defined herein as precision grouting.
- B. All grout used for precision grouting shall be placed in a fluid consistency, with an efflux time of 25 to 30 seconds through a standard flow cone as defined by ASTM C939. The Contractor shall have a standard flow cone on-site to verify grout consistency prior to placement.
- C. Contractor shall not mix more grout than can be placed in approximately 10 minutes. Contractor shall not attempt to retemper grout by adding water or remixing after it stiffens.
- D. All grout used for filling under column and machinery base plates shall be placed from one side using a form around the grouted area. A beveled form edge shall be provided on one side to help direct the grout flow under the base plate. Do not vibrate grout. Immediately after placement, trim the surfaces with a trowel and cover the exposed grout with clean, wet rags and maintain this moisture for 4 to 6 hours.
- E. Forms and excess grout shall be removed after the grout has achieved initial set. The grout should offer stiff resistance to penetration with a pointed mason's trowel prior to removing the grout forms. Exposed shoulders shall be finished and wet cured immediately after form removal, and until grout has reached final set, but not less than 48 hours, followed by two coats of curing compound.

END OF SECTION 03600

**SECTION 05500
METAL FABRICATIONS**

PART 1 - GENERAL

1.01 Summary

- A. Section includes all steel framing and miscellaneous iron, steel, aluminum or other non-ferrous metal work, not specifically described in other sections.

1.02 References

- A. Unless noted otherwise, this section incorporates by reference the latest revision of the following documents. In case of conflict between the requirements of this section and that of the listed documents, the requirements of this section shall prevail:
 - 1. American Institute of Steel Construction (AISC),
 - a. “Code of Standard Practice for Steel Buildings and Bridges”, 2016, excluding:
 - 1) Section 4.4 Approval;
 - 2) Section 7 Erection, and;
 - 3) Section 9 Contracts.
 - 2. Research Council on Structural Connections
 - a. Specification for Structural Joints Using ASTM A325 or A490 Bolts.
 - 3. American National Standards Institute (ANSI):
 - a. A14.3 Ladders - Fixed - Safety Requirements.
 - 4. American Welding Society Standards (ASTM)
 - a. D1.1/D1.1M Structural Welding Code - Steel.
 - b. D1.2/D1.2M Structural Welding Code – Aluminum.
 - c. D10.4-86R Recommended Practices for Welding Austenitic Chromium Nickel Stainless Steel Piping and Tubing.
 - 5. American Society for Testing and Materials (ASTM) Standards
 - a. A6 General Requirements for Rolled Steel, Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - b. A36 Carbon Structural Steel.
 - c. A47 Standard Specification for Ferritic Malleable Iron Castings.

d.	A48	Standard Specification for Gray Iron Castings.
e.	A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
f.	A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
g.	A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
h.	A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
i.	A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
j.	A197/A197M	Standard Specification for Cupola Malleable Iron
k.	A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
l.	A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
m.	A276	Standard Specification for Stainless Steel Bars and Shapes.
n.	A307	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
o.	A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
p.	A325	Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
q.	A380	Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems.
r.	A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
s.	A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
t.	A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
u.	A536	Standard Specification for Ductile Iron Castings.
v.	A554	Standard Specification for Welded Stainless Steel Mechanical Tubing.
w.	A563	Carbon and Alloy Steel Nuts.

x.	A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
y.	A666	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
z.	A668	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
aa.	A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
bb.	A786	Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
cc.	A967	Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
dd.	A992	Structural Steel Shapes.
ee.	A1011	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability.
ff.	A1064	Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
gg.	A1554	Anchor Bolts, Steel, 36, 55 and 105-KSI Yield Strength.
hh.	B209	Aluminum and Aluminum-Alloy Sheet and Plate.
ii.	B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
jj.	F467	Standard Specification for Nonferrous Nuts for General Use.
kk.	F468	Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
ll.	F593	Stainless Steel Bolts, Hex Cap Screws, and Studs.
mm.	F594	Stainless Steel Nuts.
nn.	F835	Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws.
oo.	F879	Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
pp.	F959	Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
qq.	F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

- | | | |
|-----|-------|--|
| rr. | F1789 | Standard Terminology for F16 Mechanical Fasteners. |
| ss. | F1852 | “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength. |

1.03 Submittals

- A. In accordance with the provisions of Section 01300 - Submittals, submit the following:
1. Complete detail drawings of all steel framing and miscellaneous metal items specified herein or shown on the Drawings.
 2. Certifications of conformance to specifications for nuts and bolts.
 3. Certification of conformance with ASTM A380 for handling and cleaning of stainless steel.
 4. Individual welder AWS certifications for field welders and AISC/AWS certification for fabricator performing shop welding.
 5. Material data and certification for steels and weld electrodes.
 6. Product data for manufactured items.
 7. Manufacturer's installation instructions.
 8. Provide manufacturer's standard allowable load tables for the following:
 - a. Grating and checkered plate.
 - b. Expansion anchor bolts.
 - c. Adhesive anchor bolts.
 9. Contractor designed systems and components, including but not limited to, landings and ladders:
 - a. Certification that manufactured units meet all design loads specified.
 - b. Shop Drawings and engineering design calculations:
 - 1) Indicate design live loads.
 - 2) Sealed by a professional structural engineer.
 - 3) Engineer will review for general compliance with Contract Documents.

1.04 Definitions

- A. Fasteners: As defined in ASTM F1789.
- B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

- C. Hardware: As defined in ASTM A153/A153M.
- D. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.

1.05 Delivery, Storage, and Handling

- A. Deliver and handle fabrications to avoid damage.
- B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.01 General Materials

- A. STRUCTURAL STEEL: ASTM A36 (rolled shapes other than wide flange shapes), ASTM A500 Grade B (tubing), ASTM A53, Grade B (pipe), ASTM A6/A6M (general requirements).
 - 1. Filler metal strength for welding shall be not less than 70 ksi, low hydrogen type.
 - 2. Wide flange shapes and structural tee sections fabricated from wide flange shapes shall be ASTM A992.
 - 3. Structural tee sections shall be straightened after cutting if necessary to meet the tolerances of ASTM A6.
- B. MISCELLANEOUS CARBON STEEL SHEET AND STRIP:
ASTM A1011/A1011M, "Structural Quality," Grade 36 or better.
- C. ALUMINUM: ASTM B209 or B221, type 6061 or 6063.
 - 1. Welding shall be with an inert gas shielded arc or resistance welding process.
 - 2. No welding process that requires a welding flux shall be used.
 - 3. Weld filler shall conform to type recommended by AWS D1.2 for the alloys joined.
- D. STAINLESS STEEL: ASTM A666, type 304 or 316. Use 304L or 316L for shapes to be welded.
 - 1. Filler metals for welding shall be as specified in ANSI/AWS A5.9 Specification for Corrosion-Resisting Chromium and Chromium-Nickel Steel Bare and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods.
 - 2. Molybdenum content of filler metal shall be not less than 6 percent.

- E. IRON:
1. Ductile iron: ASTM A536.
 2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).
 3. Malleable iron: ASTM A47, ASTM A197.
- F. BOLTS, WASHERS, AND NUTS: Bolts, washer, and nuts shall meet the requirements of the following specifications:
1. Anchor rods. All anchor bolts, nuts and washers shall be stainless steel unless called out otherwise on the Drawings or specified. Stainless steel anchor rods shall be ASTM F593 or all thread ASTM A193 Grade B8M. Where specifically called out on Drawings or in specifications, galvanized anchor rods may be used. Galvanized anchor rods shall conform to ASTM F1554, Grade 36, with ASTM A563 or A194 nuts. Anchor rods shall be headed stud type. "L" or "J" type bolts shall not be used.
 2. Expansion bolts. Bolts, nuts and washers shall be 316 stainless steel; wedges shall be double plated spring steel.
 3. Stainless steel bolts and nuts. Stainless steel bolts shall conform to ASTM F593. Stainless steel nuts shall conform to ASTM F594. Bolts and nuts to be Alloy Group 1 or 2, Condition CW1 if 5/8" or less, otherwise CW2.
 4. Washers shall be the same material and alloy as found in accompanying bolts and nuts.
- G. METAL TYPE: Unless otherwise specified or noted on the Drawings, metal fabrications exposed to potable water or sewage, shall be 316/316L stainless steel. All carbon steel fabrications shall be galvanized, unless otherwise specified or noted on the Drawings.

2.02 Fabrication

- A. FABRICATION-GENERAL
1. Workmanship. Conform to accepted shop practices.
 - a. Form work true to detail, with clean, straight, sharply defined profiles.
 - b. Unless otherwise shown or specified, finish exposed welds flush and smooth.
 2. Joints and Connections. Weld all joints, unless other fastening methods are shown, specified, or specifically approved.
 - a. Close fit exposed joints; make joints where least conspicuous.
 - b. Unless otherwise shown or specified, use flat and countersunk headed bolts or screws in exposed connections.

3. Cutting, Drilling. Perform coping, cutting, drilling and punching required for accurate fitting and assembly work.
 - a. Perform similar operations as required for attachment of work of other trades, provided that directions for such work are supplied prior to project data approval.
 - b. Where galvanized assemblies, punched holes shall be reamed; use flame cutting rather than cold shearing; avoid cold forming to prevent galvanizing vent holes in closed assemblies in accordance with Zinc Institute recommendations.
 4. Provisions for Attachment to Structure. Furnish miscellaneous metal items complete with framing, supports, hangers, bracing, anchors and other devices shown, specified or necessary for reinforcement and proper, secure setting or attachment.
 5. Dissimilar Materials Protection. Insulate aluminum surfaces in contact with plaster, concrete, or metals other than galvanized or stainless steel. See General Structural Notes for coating requirements.
 6. Workmanship. Fabricate all items neatly and rigidly in accordance with the details.
 - a. Form curved metal neatly to radii indicated.
 - b. Provide members of sizes indicated and weld, bolt or rivet securely together.
 - c. Furnish bolts, nuts, washers, and other fastening devices required for anchoring and securing work.
 7. Welding. Use electric shielded-arc process in accordance with Welding Specifications of American Welding Society.
 - a. Use only welding operators properly trained, highly skilled, and AWS-certified in arc welding.
 - b. Grind smooth all surface welds exposed to view.
- B. SPECIAL REQUIREMENTS FOR STAINLESS STEEL FABRICATIONS
1. Welds and joint areas shall be cleaned before and after welding in accordance with gross inspection requirements of ASTM A380.
 2. Observe precautions against contamination with free iron and protection of cleaned surfaces in accordance with ASTM A380.
- C. Fabricate grating, checkered plate, stairs, ladders and accessories using galvanized steel unless shown otherwise on Drawings:
1. Finish:
 - a. Mill, unless noted otherwise.
 - b. Coat surfaces in contact with dissimilar materials.

2.03 Hot-Dip Galvanizing

- A. Steel items called out on the Drawings or specified herein, as galvanized, or hot-dip galvanized shall be hot-dip coated in accordance with one or more of the following, as is applicable:

Reference	Title
ASTM A90/A90M	Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A123/A123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143/A143M	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153/A153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A384/A384M	Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A385	Providing High Quality Zinc Coatings (Hot-Dip)
MILSPEC DOD-P-21035	Paint, High Zinc Dust Content, Galvanizing Repair

2.04 Pipe Bollards

- A. As indicated on the Drawings.
- B. Hot-dip galvanize, per Paragraph 2.03, after fabrication.

PART 3 - EXECUTION

3.01 Preparation

- A. Provide items to be built into other construction in time to allow their installation:
1. If such items are not provided in time for installation, cut in and install.
- B. Prior to installation, inspect and verify condition of substrate.
- C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

3.02 Installation

- A. GENERAL: Install work in strict accordance with the Drawings and manufacturer's installation instructions. Perform cutting, drilling and fitting required. Accurately set, place and properly, securely attach work in true plans, alignment, plumb and level; properly adequately reinforce and stiffen.

- B. PRIME COAT TOUCHUP: After installation of steel items, touch up field bolts, field welds, uncoated connections, and abrasions to shop protective coatings. Clean items of mud, dirt and other objectionable foreign matter prior to touching up the prime coat and field painting.
- C. GALVANIZED ITEMS: Items that have been drilled, cut, welded, or otherwise damaged shall be touched up using either of the following products:
 - 1. "Galv-Weld," manufactured by Kenco Division of Southern Coating and Chemical Co., Galv-Weld Products, Sumter, South Carolina. Apply in accordance with manufacturer's instructions and to same thickness as specified hot dip coating.
 - 2. Hot stick followed by CRC Zinc Re-nu brush-on cold galvanizing compound with epoxy binder. Apply in accordance with manufacturer's instructions.
- D. ALUMINUM ITEMS: Aluminum items in contact with concrete shall have contact surfaces coated to prevent corrosion. Aluminum items in contact with steel shall be electrically isolated with gaskets and fastener sleeves.
- E. FIELD MEASUREMENTS:
 - 1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
 - 2. Contractor is responsible for the accurate fit of the work.
 - 3. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection:
 - a. Use surveyor's level.
 - b. Notify Engineer of any errors or deviations found by such checking.
 - 4. Erect plumb and level; introduce temporary bracing required to support erection loads.
 - 5. Use light drifting necessary to draw holes together:
 - a. Drifting to match unfair holes is not allowed.
- F. Welding:
 - 1. Conform to AWS D1.1 and requirements of Article 2.4.
 - 2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.
 - 3. Shore existing members when unbolting of common connections is required.
 - 4. Grind welds smooth where field welding is required.

5. Clean stored material of all foreign matter accumulated during erection period.
- G. Bolt Field Connections:
1. Where practicable, conceal fastenings.
 2. Use new bolts for re-bolting connections.
 3. Unless noted or specified otherwise:
 - a. Connect steel members to steel members with 3/4-inch DIA ASTM A325 high strength bolts.
 - b. Provide washers for all bolted connections.
 - c. Where exposed, bolts shall extend a maximum of 3/4 inches and a minimum of 1/2 inches above the top nut:
 - d. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.
 4. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).
 5. Provide hardened washers for all ASTM A325 bolts:
 - a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.
 - b. Provide bearing type connection.
 6. After bolts are tightened, upset threads of ASTM A307 unfinished bolts or anchor bolts to prevent nuts from backing off.
 7. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
 8. Provide full penetration welded splices where continuity is required.
- H. Provide each fabricated item complete with attachment devices as indicated or required to install.
- I. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction:
1. Fill space between bearing surface and bottom of base plate with nonshrink grout:
 - a. Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
 2. Do not remove wedges or shims:
 - a. Where they protrude, cut off flush with edge of base plate.
 3. Fill sleeves around anchor bolts solid with non-shrink grout.

- J. Tie anchor bolts in position to embedded reinforcing steel using wire:
 - 1. Tack welding prohibited:
 - a. Coat bolt threads and nuts with heavy coat of clean grease.
 - 2. Anchor bolt location tolerance:
 - a. 1/16-inch.
 - b. Provide steel templates for all column anchor bolts.
- K. Install bollards in concrete as detailed on the Drawings.
- L. Repair damaged galvanized surfaces in accordance with ASTM A780:
 - 1. Prepare damaged surfaces by abrasive blasting or power sanding.
 - 2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

3.03 Cleaning

- A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.
- B. Provide surface acceptable to receive field applied paint coatings specified in Section 09920 - Protective Coatings.

END OF SECTION 05500

**SECTION 05531
STAINLESS STEEL BAR GRATING**

PART 1 - GENERAL

1.01 Summary

- A. The contractor shall provide all labor, materials, equipment and incidentals as shown and specified and are required to furnish and install grating, stair treads and supports.

1.02 Submittals

- A. Submit under provisions of Section 01300 - Submittals, as follows:
 - 1. Shop drawing showing plan, profiles, sections, accessories, and dimensions.
 - a. Include a layout drawing, appropriate sections, location of connections to adjacent grating and supports, and installation details for each item provided.
 - b. Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
 - c. Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
 - d. Catalog information and catalog cuts.
 - 2. The contractor shall submit the manufacturer's specifications, load tables, anchor details and standard installation details.
 - 3. Certified test reports: Before fabrication of floor grating or floor plates provide certificates, which attest that all material complies with this section.
- B. The contractor may be required to take field dimensions to verify "as built" conditions to ensure proper fit of grating.

1.03 References

- A. Comply with applicable provisions and recommendations of the following:
NAAMM Metal Bar Grating Manuals designated ANSI/NAAMM MBG 531 for Steel, Stainless Steel and Aluminum Gratings and Stair Treads.
- B. Section 05500 - Metal Fabrications

1.04 Qualifications

- A. Design gratings and plates under direct supervision of a professional engineer experienced in structural design of this work with at least 5 years of experience and professionally licensed in the state of Washington.

PART 2 - PRODUCT

2.01 Approved Grating Manufacturers

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable
 - 1. McNichols
 - 2. Or equal.

2.02 General

- A. Grating, supports, and accessories shall all be Type 316 stainless steel
- B. Bearing bars: Rectangular aluminum bars of an appropriate depth and thickness for the required load, on 1 3/16" centers.
- C. Cross Bars: Locked by swaging construction.
- D. Surface: Upper (walking) surface shall be serrated
- E. Loading: At a uniform load of 300 pounds per square foot, deflection shall not exceed ¼ inch or L/360, whichever is smaller, for the given span.
- F. Finish: No finish required for stainless steel bar grating.
- G. Intermediate supports shall be Type 316 stainless steel and in accordance with Section 05500.

PART 3 - EXECUTION

3.01 Shop Fabrication

- A. Grating dimensions and layout shall be per the Drawings and as field verified by the Contractor.
- B. All required cutting, fitting and welding shall be performed in the manufacturers shop in accordance with the approved shop drawings and shall be in compliance with the NAAMM Metal Bar Grating Manual tolerances and welding standards.
- C. All cutouts to clear obstructions shall have a recommended clearance of 1 inch. When banding and toe plates are required, they shall be welded to the grating in accordance with NAAMM standards.
- D. All welds and cuts shall be ground smooth.

3.02 Installation

- A. The grating shall be received at the job site by the contractor, unloaded and protected from damage prior to the requirement for it to be installed.
- B. The installing contractor shall prepare the site for installation, determining that deviations from the approved drawings are corrected prior to grating placement.
- C. Grating shall be installed in accordance with the approved shop drawings and the installation clearances called for in the NAAMM Metal Bar Grating Manual, including the use of the prescribed anchor system.
- D. Pipe penetrations of 4" or less shall be cut in the field. When installed, Grating Cross Bars shall be in alignment.

END OF SECTION 05531

**SECTION 09920
PROTECTIVE COATINGS**

PART 1 - GENERAL

1.01 Summary

- A. Section Includes:
 - 1. Coating system for the containment vault which is part of this Contract.
- B. Related Sections:
 - 1. Section 02535 – Precast Vaults
- C. The Contractor is to base this bid on using the products specified. If the products specified are not available in formulations that meet applicable regulations on volatile organic compound (VOC) levels at time of application, the Contractor is to submit for review products of equivalent quality and function that comply with regulations in effect at that time. A reasonable difference in cost of material between the first named items specified and the products that are required to meet regulations that change after the bid date and are in effect at the time of application may be approved for payment by Change Order.

1.02 References

- A. Where standards of surface preparation are described by citing SSPC specification numbers reference is made to the "SSPC Painting Manual" Volume 2 published by the Society for Protective Coatings.
- B. ASTM International (ASTM):
 - 1. D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications
 - 2. B117 Test Method of Salt Spray (Fog) Testing
 - 3. D714 Method for Evaluating Degree of Blistering of Paints
 - 4. D870 Practice for Testing Water Resistance of Coatings Using Water Immersion
 - 5. D1014 Method of Conducting Exterior Exposure Tests of Paints on Steel
 - 6. D1653 Test Method for Water Vapor Permeability of Organic Coating Films
 - 7. D1654 Method of Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 - 8. D2794: Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

9. D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 10. D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 11. D4585 Practice for Testing the Water Resistance of Coatings Using Controlled Condensation
 12. D5894 Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposure in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
 13. F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
 14. G53 Recommended Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials
 15. G85 Practice for Modified Salt Spray (Fog) Testing
- C. National Association of Pipe Fabricators (NAPF):
1. NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.
- D. National Association of Corrosion Engineers (NACE):
1. NACE SP0188: Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

1.03 Definitions

- A. Definition of Painting Terms ASTM D16.
- B. Dry Film Thickness (DFT) - The prime coat and the sum of all fully cured applied coats for the paint system.
- C. Exterior Surface - Surface that is not inside a building or structure and is exposed to the weather. Epoxy surfaces that are affected by the ultraviolet rays from the sun shall be considered an exterior surface if the sun can shine on the surface.
- D. Stripe Coat - Coating applied to the edge, corner, welds, or bolts, which is applied prior to application of additional system coats. Use an alternating color to ensure all areas are coated.
- E. Submerged - Surfaces that are under water or the vertical extension of those walls that are partly under water during normal operating conditions.

1.04 Submittals

- A. Submit in accordance with Section 01300 - Submittals.

- B. Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used.
- C. Prior to commencing work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings and which coating system is to be applied to each.
- D. Provide the following information on each paint product:
 - 1. Abrasion resistance, ASTM D4060, 1 kg load at 1000 cycles, CS-17 wheel.
 - 2. Impact resistance, ASTM D2794, direct and reverse.
 - 3. Moisture vapor transmission, ASTM F1249.
 - 4. Adhesion, ASTM D4541.
 - 5. Prohesion, ASTM G85 (immersed coatings only)
 - 6. QUV exposure, ASTM D4857 (exterior finish coat only)
 - 7. Fresh waste immersion, ASTM D870 (immersed coatings only)
 - 8. Humidity, ASTM D4585
- E. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Owner's Representative may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five (5) references (no duplicate owners or agencies).
- F. Provide product data sheets and Material Safety Data Sheets (MSDSs) for all products.
- G. Manufacturer's Certifications: That products furnished meet applicable Puget Sound Clean Air Agency regulations as to allowable volatile organic compound (VOC) content for the place of application and use intended. Additional certification stating that the Contractor is certified to apply all coatings for the project.
- H. Information on testing support equipment required in accordance with Part 3.
- I. Field Quality Control Documentation: Provide copies of the Contractor's daily records including:
 - 1. Work dates for each work area and coating system.
 - 2. Weather conditions, ambient air temperature, humidity, dew point and surface temperature.

3. Contractor's efforts to maintain the temperature and humidity within the coating requirements.
4. Wet film and dry film measurements and pinhole and continuity test results.

1.05 Quality Assurance

A. Environmental Regulatory Requirements:

1. All work, material, procedures, and practices under this section shall conform with requirements of the Puget Sound Clean Air Agency. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Products specified herein are, to the best of the Design Owner's Representative's knowledge, in compliance with the applicable VOC levels (measured in grams per liter by weight of coating as applied, excluding water and color added to be base tint) allowable at the date these Specifications were issued for bid.
2. The Puget Sound Clean Air Agency may prohibit the sale or application of paints and enamels containing more than the stipulated percentages of volatile, organic solvents manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture, or if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.
3. If the Contractor applies coatings that have been modified or thinned other than as recommended by manufacturer, the Contractor will be responsible for any fines, costs, remedies, or legal actions that may result.

1.06 Warnings

- A. Be advised that application of paint, epoxy, and protective coating materials may be hazardous. Take all necessary precautions to ensure the safety of workers and property.
- B. Be advised that as a part of this work abrasive blasting may be required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Owner. In addition, abrasive blasting and painting may be called for in, on or around mechanical equipment, which may be damaged by grit, dust, or painting overspray. Mask, wrap, enclose, and provide all protection required to safeguard this equipment at no additional cost to the Owner.
- C. Perform abrasive blasting activities in a manner that will not cause a nuisance to adjacent public and private property and equipment.

1.07 Delivery, Storage, and Handling

- A. Deliver all coating materials in unopened containers with manufacturer's label, which must include name, batch number and date, and VOC content.
- B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner and buckets daily. Store solvents in closed approved storage containers.
- C. Submerge solvent soaked rags in water.

1.08 Project Conditions

- A. Environmental Requirements:
 - 1. Provide ambient temperatures recommended by manufacturer of material to be applied.
 - 2. Provide adequate ventilation.
 - 3. Provide 40- to 50-foot candles of illumination on all surfaces in areas to be painted including floors, walls, and ceiling even though they do not require painting.
 - 4. Use temporary dust barriers to close off areas being painted from areas where other work is being performed.

1.09 Colors

- A. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base. All coatings must be formulated to perform in the climate and environment to which they will be exposed.

PART 2 - PRODUCTS

2.01 Materials

- A. Paints used in paint system to be the product of one manufacturer.
- B. Substituted coating systems shall be of the same generic type, number of coats, and dry film thickness as those specified.
- C. Coating systems shall not contain lead.
- D. Abrasives shall not be classified a hazardous material.
- E. Materials: Paints and protective coatings listed in the Paint System of this section refer to the one manufacturer and are specified as levels of quality. It is understood that the words "or equal" are included herein.

2.02 Paint System

Containment Vault Interior Wall Protective Coating

1 st Coat DFT = 3.5 - 4.5	Epoxy Vinyl Ester	Sherwin Williams: B88C10 - Corobond Vinyl Ester Primer
2 nd Coat Pit/bughole/etc. repair	Polyester Putty	Sherwin Williams: 00970B703 - Poly-Glass Polyester Putty
3 rd Coat DFT = 60 - 65	Epoxy Novolac Based Vinyl Ester	Sherwin Williams: B88C00020 - Cor-Cote® VEN Vinyl Ester Novolac (CLEAR)
4 th Coat DFT = 20 - 30	Epoxy Novolac Based Vinyl Ester	Sherwin Williams: B88C00020 - Cor-Cote® VEN Vinyl Ester Novolac (CLEAR)
5 th Coat DFT = 15 - 20	High Chemical Resistant Hybrid Novolac Epoxy	Sherwin Williams: B62A00425 - Cor-Cote® HCR FF Flake Filled Novolac Epoxy (HAZY GRAY)

PART 3 - EXECUTION

3.01 Surface Preparation

- A. Perform surface preparation as specified herein and in accordance with the latest revision of the following requirements or manufacturer's requirements, whichever is more stringent:
 1. Concrete: In accordance with SSPC-SP13/NACE 6 for surface preparation of concrete by mechanical, chemical or thermal methods prior to the application of protective coating

3.02 Application

- A. Apply all material in strict accordance with manufacturer's instructions. Apply first coat immediately after surface preparation. Keep all paints at a consistency and applied in accordance with the printed directions of the manufacturer. The painting shall be done by hand, spray, or roller as approved by the Owner's Representative in conformance to individual paint manufacturer's recommendations. The Owner's Representative and paint supplier will review all surfaces to be painted on the job prior to application of any coatings. Once the Contractor begins undercoating or priming, this will be the Contractor's guarantee that the surface is acceptable to paint. All painted surfaces are to be free from drips, ridges, and brush marks. The following stipulations also apply:
 1. Thinning permitted only when recommended by the manufacturer and only with thinner recommended for use with the particular product.
 2. The use of additives to improve working characteristics or to lengthen or shorten set time is prohibited.
 3. Items difficult or impossible to paint after installation are to be painted before installation and touched up after installation.

4. Apply each coat to a uniform, even coating; lay material on in one direction and finish at right angles. Allow material to thoroughly dry between coats. Scuff, sand and remove all runs, sags, overspray, surface roughness, and other defects between each coat. Dust and wipe surface clean before applying next coat.
5. Cutting in is to be sharp and straight, free from overlaps or fuzzy edges. Redo any imperfect work.
6. Apply not less than the number of coats or dry film thicknesses specified. Apply additional coats if required for uniform coverage, full hiding, and to achieve film continuity. Finished work to be uniform in color, full coverage, smooth, and free of sags and brush marks.
7. Do not apply coatings when temperature is below 60°F, unless the product is rated for application at lower temperatures. Also, the air temperature of the surface to be painted must be at least 5°F over the dew point temperature. Perform coating operations only under favorable environmental conditions. Take all steps necessary to protect and completely cure the work. Correct defective work to the full satisfaction of the Owner's Representative.
8. Apply the last finish coat on all work after all major construction is complete and the work areas have been cleaned up and are dust free.
9. Apply all coatings within the manufacturer's recommended recoat window.

3.03 Field Quality Control

A. Pinhole and Continuity Testing:

1. After the application of the prime and finish coats of Paint Systems 3 and 10, perform continuity and pinhole checking by means of a low voltage electrical resistance meter per NACE-RP0188 and check thickness per SSPC-PA2 with a magnetic thickness gauge to determine that pinhole free condition and specified film thickness of the paint system has been achieved over all of the painted surfaces. Repair all deficiencies in film integrity and thickness in accordance with the manufacturer's instructions.
2. The Owner's Representative or an independent testing consultant may perform its own continuity and pinhole checking and thickness checks in addition to the Contractor's required tests. The appropriate equipment and necessary support, if requested, is to be provided by the Contractor. Repair any additional deficiencies in film integrity and thickness per the manufacturer's instructions and to the satisfaction of the Owner's Representative.
3. The Contractor's attention is directed to the fact that past use of this instrument has demonstrated that the painter must apply at least two and usually three or more stripe coats along all edges and angles and crevices formed by joining members in addition to the coats specified in order to achieve a pinhole free surface.

- B. Adhesion Testing: Where there is a question of paint or coating adhesion to surfaces, demonstrate to the Owner's Representative's satisfaction that the coating adhesion to the area in question is equal to or greater than that which the paint manufacturer literature states may be achieved by his product. An "Elcometer Adhesion Tester" is to be used by the Contractor to accomplish this demonstration.
- C. Continuity, Pinhole and Adhesion Testing Support: Provide scaffolding, ladders, lighting and labor as required to facilitate the Owner's Representative's check. Repair any areas damaged during and by the testing operation.
- D. Measure and record temperature, dew point and humidity daily (at the start of the day prior to painting, and if conditions deteriorate). Maintain the records in a place available to the Owner's Representative. Submit the records prior to Final Completion.

3.04 Cleaning and Completion

- A. At the completion of this portion of the Work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all buildings and structures in a clean condition, ready for use.
- B. Refinish all damaged or imperfect painting to the satisfaction of the Owner's representative prior to final acceptance of the facility.
- C. Finish work is to present an even, pleasing, and uniform color and appearance. Surfaces exhibiting coatings with shadows, streaks, overlap marks, sags, drips, roughness, or non-uniform sheen will be considered as improperly applied and will not be considered acceptable.

3.05 Spare Paint

Furnish one-gallon (minimum) container of the type and color of the top coat product used. Label container. Product shall have a minimum of 30 months of shelf life at project completion.

END OF SECTION 09920

SECTION 11010
EQUIPMENT GENERAL PROVISIONS

PART 1 - GENERAL

1.01 Summary

- A. The provisions of this section shall apply to all sections of Division 11 unless specifically revised therein.
- B. Any system requiring software to configure shall have the software and required cabling for set-up provided as part of the overall cost. All PLC programs for all equipment shall be provided with software, licensing, programming cables and interfaces, annotated hard copies of the programs, electronic copies of the PLC programs with documentation files included. Current programs and electrical prints with updated as-built information shall be provided no later than 30 days prior to Commissioning.

1.02 Submittals

- A. The following list of submittal information shall be required for all equipment and systems to be used for this project. Submit information in accordance with the requirement of Section 01300 - Submittals.
 - 1. Descriptive literature, bulletins, and catalog cuts of the equipment.
 - 2. Materials of construction
 - 3. Complete installation instructions, with points of electrical and plumbing connection requirements clearly shown.
 - 4. Motor Data
 - 5. Performance curves
 - 6. Complete Performance Data at the Design Point
 - 7. List of recommended spare parts required for long term operation of 5 years.
 - 8. Sequence of operation or functional narrative
 - 9. Instrumentation and Wiring Diagram
 - 10. PLC logic and theory of operation for all process controls and Human Machine Interfaces (HMIs)
 - 11. Operator interface screens shall be presented for Owner approval prior to completion of process.

12. List of all process control equipment organized by process referencing unique process ID numbers, the manufacturer and part number of this item, contact information for spare or replacement parts. The Owner's Representative's approval of this list is required for acceptance of the Project.

B. Spare Parts

1. A list of required spare parts is provided in the individual equipment section.
2. Spare equipment shall be provided in its original packaging and contain copies of installation and operation manuals.
3. All spare parts shall be provided to, and logged in by, the Owner's Representative.

1.03 Warranty

- A. The Contractor shall warrant to the Owner both the equipment construction, the functioning of the equipment system, and the equipment performance, as specified herein. The Contractor shall warrant the equipment for a minimum of twelve (12) months following successful acceptance testing.
- B. Individual equipment sections may contain additional warranty requirements and extended warranty periods. Contractor shall be responsible for procuring the required warranties for the individual equipment from the suppliers and vendors.
- C. The Contractor shall guarantee the equipment and control system to be free of defects in design, materials, and workmanship. As part of the guarantee, the Contractor shall indemnify and hold harmless the Owner and Owner's Representative and their officers, agents, and employees against and from all claims and liability arising from all damage and injury due to defects in the equipment and control system.
- D. The Contractor shall make any and all repairs, replacements, modifications, and adjustments necessary to eliminate any and all defects in design, materials, and workmanship which are disclosed within the equipment warranty period. All repairs, replacements, modifications, and adjustments shall be started within one-week (168 hours) of notification by telephone from the Owner and shall be completed within ten (10) days of notification by the Owner. Should the Contractor fail to begin the work within one hundred and sixty eight (168) hours, or to complete the work within the ten (10) day period, the Owner may proceed to undertake or complete the work. In such event, the Contractor and his surety shall be liable for all costs incurred by the Owner.

1.04 Quality Assurance and Quality Control

- A. All electrical equipment and materials specified herein shall be listed by and shall bear the label of Underwriters Laboratories (UL), Factory Mutual (FM) or other nationally recognized testing laboratory acceptable to the State of Washington Department of Labor and Industries electrical inspector. All control panels shall be manufactured by a UL 508A panel shop and shall be UL listed as an assembly.
- B. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.

1.05 Delivery, Storage and Handling

- A. All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.
- B. 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.
- C. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.
- D. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling and storage.
- E. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.
- F. Store motors, electrical equipment, and other equipment with moving parts in weathertight warehouses at maintained temperature of 60 degrees F minimum.
- G. Protect painted surfaces against impact, abrasion, discoloration and other damage. Repaint to original factory specifications all painted surfaces which are damaged prior to acceptance of equipment.
- H. Protect electrical equipment, controls, and insulation against moisture or water damage.
- I. Package all spare parts or spare part assemblies in separate, sturdy, waterproof containers clearly marked with the name of the part or assembly, and the name of the unit of which it is a component.

1.06 Adaptation of Equipment

- A. Furnish equipment readily adaptable for installation and operation in the structure shown on the Drawings. Equipment furnished shall be compatible with all other equipment furnished.

- B. Contractor shall assume full responsibility for alteration of the planned structure to accommodate other types of equipment. Assume full responsibility for all modifications of mechanical and electrical controls, equipment, wiring, piping, as required to accomplish function contemplated by the contract documents.
- C. Equipment which requires alteration of the structure, piping, and/or electrical work will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations.
- D. Provide all such alterations free of extra cost to the Owner.

PART 2 - PRODUCTS

2.01 Equipment

- A. Provide equipment in accordance with applicable sections of Division 11.
- B. Furnish each piece of equipment complete with its base, drives, shafting, couplings, controls, guards, and other appurtenances which are specified or required for proper and safe operation.
- C. All electrical equipment provided as an integral portion of an individual piece of process equipment shall include a means of disconnect suitable for lockout and service as required by all local and national codes.
- D. All railings, stairs, guards, and platforms required to access equipment for operation and maintenance shall meet or exceed the most recent federal OSHA and state requirements.
- E. Fabricate, assemble, erect, place and test all specified materials and equipment in full conformity with all Contract Document and manufacturer's recommendations.
- F. Furnish any special tools or equipment required for proper maintenance, testing, or adjusting.

2.02 Equipment Foundations, Bases and Pads

- A. All floor or floor stand-mounted equipment specified in Division 11 shall be set on concrete housekeeping pads as shown in the Contract Drawings. The height of the pads shall be as recommended by the equipment manufacturer, as required to connect to piping, or as shown on the Drawings. The height shall be sufficient to accommodate required anchorage devices.
- B. The pads shall extend 1 inch minimum and 3 inches maximum beyond the machine base in all directions unless otherwise indicated on the Drawings or by the equipment manufacturer. The top edges of the pads shall be chamfered.
- C. Concrete work shall be in accordance with Division 3.
- D. Anchor bolts shall be in accordance with Section 05500 - Metal Fabrications.

2.03 Drives and Guards

- A. BELT DRIVES: Unless specified otherwise, each motor which is not directly connected to the driven equipment shall have grooved pulleys and V-belts designed for 125% of full rated horsepower of the motor. Driven equipment that starts fully loaded shall have belts designed for 150% of the full rated horsepower. The drive system shall be designed to prevent belts from jumping, squealing, or slipping at high speed. Motors and driven equipment shall be secured to a common base in a manner which allows adjustment of belt tension and alignment. The drive system shall have the following features:
1. Motor pulleys shall be steel and of the manually adjusted, variable pitch type, arranged to keep belts parallel throughout the entire adjustable range. At design speed, pulleys shall be set midway in the adjustment range. Multiple belt drives requiring 3 or more belts shall not be of the variable speed type. Such drives shall be furnished with solid sleeves. Make allowance for one change of pulley size after installation to compensate for field conditions.
 2. Pulleys and bushes shall be dynamically and statically balanced. Pulleys shall be separately mounted on the bushes by means of three pull-up grub or cap tightening screws. Bushes shall be key seated to the driver shaft.
 3. Each belt driven unit shall be furnished with a complete set of spare belts. Spare belts shall be properly identified as to design, horsepower, speed, length, pulley size and use and shall be packaged and stored as specified for spare parts storage and marking. Where 2 or more belts are required, matched sets of belts shall be provided.
 4. V-belt drives shall conform to NEMA Standard NGI-3.15.
- B. DIRECT DRIVES
1. General: Unless specified otherwise, shaft couplings for directly connected electric motor-driven equipment ½-horsepower or larger shall be Type I or Type II as specified herein. Type I couplings shall be utilized for all reversing drives, positive displacement pumps, or high torque loads such as conveyor. Type II couplings shall be provided on all other drives.
 - a. Where requirements of the equipment dictate specialized features, the manufacturer may substitute the coupling normally supplied for the service. All couplings shall be nonlubricated type, designed for not less than 50,000 hours operating life.
 - b. Couplings shall be as recommended by the manufacturer for the specific application, considering horsepower, speed of rotation, and type of service. The use of couplings as specified herein shall not relieve the Contractor of responsibility for precision alignment of all direct-driven units.

2. Type I Couplings: Positive displacement pumps and reversing equipment or equipment where sudden torque reversal may be expected shall be connected to drivers by flexible couplings which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations. The flexible member shall consist of a built-up elastic member comprised of synthetic rubber, duck and wire reinforcement with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws, and the flanges shall be attached to the stub fit. There shall be no metal-to-metal contact between the driver and driven unit.
3. Type II Couplings: Type II couplings shall be employed on normal torque, non-reversing applications. The Type II couplings shall be of the pin and preloaded neoprene cylinder type, designed to accommodate shock loadings, vibration, and shaft misalignment or offset. Stub shafts shall be connected through collar or round flanges, firmly keyed to their shafts, to neoprene cylinders held to individual flanges by through pins. Couplings with cylinders pinned to both couplings will not be acceptable.

C. GUARDS

1. Guards shall be fabricated from 12-gage steel and expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized or painted after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts.
2. Fully enclosed belt drive guards shall have trimmed openings at both shafts for tachometer readings, with motor shaft opening slotted to permit adjustment for belt take-up. Fabricate guard to sufficient length to permit installation of 2-inch larger driven pulleys without alteration to the guard.
3. Secure guards to the driven equipment or to the foundations with heavy angle supports and only 3 anchor bolts. Do not secure braces or supports to motors. Do not bridge sound and vibration isolators with braces or supports.

2.04 Bearings

- A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller antifriction type of standard manufacture. Bearings shall be conservatively designed to withstand stresses of the service specified.
- B. Except when otherwise noted, bearings shall have a minimum L-10 life of 100,000 hours as defined by the American Bearing Manufacturers Association (ABMA).
- C. Grease lubricated bearings, except those specified to be factory lubricated for life, shall be fitted with easily accessible grease supply, flush, drain, and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be the standard hydraulic type.

- D. Oil lubricated bearings shall be equipped with either a pressure lubrication system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 40 degrees C and shall be equipped with a filler pipe and external level gage.
- E. During transportation, bearings shall be suitably blocked or otherwise protected to avoid work hardening or “Brinelling” damage from vibration. Bearings shall be separately packed if necessary to comply with this requirement.

2.05 Mechanical Seals

- A. Mechanical seals may be internal or external type, balanced or unbalanced type, and single or double seals, except as herein specified.
- B. An internal type seal may be used where clean sealing liquid is provided, either from the pumped liquid or an external source. When the pumped liquid is corrosive, abrasive, toxic or flammable, an internal double seal shall be provided with adequate sealing fluid pressure to prevent entry of the pumped liquid into the seal chamber, or an external seal may be provided. The sealing liquid shall be within the temperature limits and at the flushing rate recommended by the equipment manufacturer.
- C. The seal may be balanced or unbalanced as recommended by the equipment manufacturer. To maintain the necessary minimum or maximum pressure across the seal faces, spring pressure shall be uniformly distributed to the sealing faces by a coil spring or multiple springs. The rotating seal element shall be clamped to the shaft and provided with O-ring or gasket material.
- D. Seal faces shall be tungsten carbide to tungsten carbide, except on the double seal where the seal in contact with the pumped liquid shall be carbon. The O-ring gasket material shall be as recommended by the manufacturer for the liquid being pumped. Other parts shall be stainless steel.

2.06 Pressure Taps, Test Plugs and Gauges

- A. Pressure taps shall be provided on the suction and discharge sides of all pumps, blowers and compressors. Pressure and vacuum test plugs and gauges shall be provided where specified. Test plugs and gauges shall be as specified in Division 15.

2.07 Nameplates

- A. Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved on phenolic plates and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Color of the plates and engraving shall be as selected by the Owner.

2.08 Lubricants

- A. Equipment shall be furnished with proper lubricants in sufficient quantities to allow for the startup and testing period. The type of lubricant shall be as recommended by the equipment manufacturer. All lubricants shall be listed in a complete form either within or separated from the equipment maintenance manual, including a current MSDS. Each lubricant shall be referenced to an equipment number that associated with the equipment supplied, e.g., P-1051, SN-1201, etc.
- B. With the equipment manufacturer's approval, the Contractor shall minimize the number of different types and brands of lubricants by consolidating the lubricants into the least number of different types required to adequately service the equipment. Not less than 90 days before the date indicated for starting, testing, and adjusting equipment, the Contractor shall provide the Owner with five (5) copies of a list indicating the required lubricants, after consolidation, for each item of equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming continuous operation.

2.09 Noise Requirements and Controls

- A. Unless otherwise specified, the maximum permissible noise level for a complete piece of equipment shall not exceed 85 dbA at 3 feet. A complete piece of equipment includes the driver and driven equipment plus any intermediate couplings, gears and auxiliaries.

PART 3 - EXECUTION

3.01 Equipment Installation

- A. Equipment shall be installed in accordance with the equipment manufacturer's written installation instructions and the requirements of these Specifications. The Contractor shall provide and pay for the services of a manufacturer's service engineer to review the installation and make final adjustments to the equipment unless the specifications specifically state that such services are not required.
- B. Attention shall be given to design loadings of floors to assure that design loadings are not exceeded during installation of equipment. The Contractor shall be responsible for devising and maintaining installation procedures and techniques which will not overstress structural components.
- C. The Contractor shall cover openings in equipment prior to, during and following installation to prevent dirt, rubbish or water from entering.
- D. Equipment shall not be subject to electrical or mechanical shock. Damaged, dented or marred equipment shall be replaced or repaired in a manner satisfactory to the Owner, at the option of the Owner, at no additional cost to the Owner.

- E. Miscellaneous materials shall be furnished and installed as required to provide a complete, operable equipment installation. Such miscellaneous materials shall include, but not be limited to, the following:
1. Stainless steel and brass shim stock.
 2. Thread lubricants, pipe dope, gasket compounds, and sealers.
 3. Nonhazardous solvents and cleaning compounds.
 4. Welding rod and other expendable construction materials.
 5. Paint for touchup of shop coatings.
 6. Cribbing, jacks, slings, rigging, blocking, scaffolding, lifting eyes, and other erection materials.
 7. Grout, grout forms and blocking.
 8. Bolts, studs, nuts, and gaskets for makeup of connections to the equipment, securing the equipment to its supports, and to replace existing gaskets and hardware damaged or misplaced during storage, inspection, cleaning, filling or placing into service.
- F. Welding shall be performed as required to ensure complete and proper installation of the equipment. The following requirements shall apply:
1. The shielded metallic-arc welding process shall be used.
 2. Welders and welder operators shall be certified as qualified by the ANSI, ASME, or AWS codes as applicable.
 3. Welding procedures shall be in accordance with the following:
 - a. ANSI – Code for Power Piping B31.1
 - b. ASME – Boiler and Pressure Vessel Code
 - c. AWS – Structural Welding Code D1.1
 4. Welding to equipment shall be in accordance with the equipment manufacturer's recommended procedures.
- G. Grouting of equipment shall be in accordance with the provisions specified in Division 3 and as may be shown on the Drawings.
- H. Cleaning and touchup of equipment shall be performed as follows:
1. Temporary protective coatings and foreign materials shall be completely removed prior to assembly and installation.
 2. Shop-applied compounds shall be completely removed.
 3. Compressed air shall be used to completely remove foreign materials from equipment components and interconnecting piping.
 4. Weld splatter, burrs on cut surfaces, and sharp protrusions shall be removed to the satisfaction of the Owner's Representative.

5. Loose paint shall be removed by sandpaper, wire brush, or paint scraper to the satisfaction of the Owner's Representative.
6. Factory-applied prime coats shall be touched up in the field after installation is complete using touchup paint furnished by the equipment manufacturer.
7. Paint shall be applied by brush or spray and in accordance with the paint manufacturer's recommendations. Paint shall not be applied at temperatures below 50 degrees F.

3.02 Equipment Maintenance Prior to Initial Operation

- A. Mechanical equipment and appurtenances shall be properly oiled and lubricated prior to being operated. The equipment installation shall include furnishing and installing oil, grease, and protective fluids required for initial operation. The Contractor shall record the date, type, and quantity of lubricant and/or oil initially installed. Such records shall be submitted to the Owner prior to initial operation of the equipment.

3.03 Painting

- A. Equipment shall be painted in accordance with Section 09920 - Protective Coatings, except as specified herein.
- B. Equipment with approved factory finish shall not be painted, but shall be touched-up as necessary.
- C. Electrical equipment, as listed below, with standard factory-applied enamel coating systems shall not be painted:
 1. Panel boards
 2. Electrical panels
 3. Switchboards
 4. Switchgear
 5. Safety switches
 6. Motor starter equipment
 7. Motor control centers
 8. Raceways and cable trays
 9. Transformers
 10. Power circuit breakers

3.04 Spare Parts Storage and Marking

- A. Spare parts shall be wrapped in weatherproof material and packed in painted wooden boxes with hinged cover and hasp lock. Each box shall be clearly labeled on the front and top as to its contents. No box shall weigh more than 150 pounds when full.

3.05 Startup and Testing

- A. Pre-operational checkout, operational testing and startup shall be performed in accordance with Section 01660 - Facility Startup and Testing, and as may be specified for each equipment item.

3.06 Continuing Adjustments

- A. The Contractor shall provide such continuing adjustments as are necessary to insure proper operation of all equipment after acceptance of the Work and for a period of one year after Substantial Completion.

3.07 Training

- A. The Contractor shall provide and pay for the services of qualified representatives of the equipment manufacturers to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Instruction time shall be as specified in the equipment specifications. Instruction time shall be in addition to time associated with equipment installation verification, startup and testing.

END OF SECTION 11010

SECTION 11240
PAA BUILDING AND FEED EQUIPMENT

PART 1 - GENERAL

1.01 Section Includes

- A. This section specifies the Peracetic Acid (PAA) Building, feed equipment, and auxiliary components, herein referred to as the PAA system. Chemical and water carrier piping and valves shall be as specified in Division 15. The PAA system shall be supplied by a single manufacturer in a pre-packaged, pre-plumbed, and pre-wired building as specified herein.
- B. PAA feed equipment includes:
 - 1. Metering pumps (P-7411 and P-7412)
 - 2. PAA flow meter (FIT-7413)
 - 3. Carrier water flow switch (FSL-7414)
 - 4. PAA pump containment and PAA tote containment level switches (LSH-7415 and LSH-7416)
 - 5. PAA degassing valves, back pressure valve, pressure relief valves and isolation ball valves.
 - 6. PAA strainer, calibration column, pulsation dampener and pressure gauge with diaphragm seal.
 - 7. Carrier water rotameter, globe valve, check valve, strainer and pressure gauge with diaphragm seal.
 - 8. Isolation valves and space for installation of an Owner-furnished residual analyzer (AIT-7417) and second parallel future residual analyzer.
 - 9. Connecting piping, tubing, unions and flexible connectors.
- C. PAA Building includes:
 - 1. Structure frame with walls, floor, roof, vents, insulation, flashing and sealant.
 - 2. Window, skylight, door and hardware.
 - 3. Junction box, disconnect switch, transformer, distribution panelboard with circuit breakers of the size and number necessary to feed all new electrically powered equipment associated with this project, except the carrier water pump, and associated conduit and wire for equipment located inside the building.
 - 4. Lights, switches, receptacles and smoke detector.
 - 5. Fan, heater, air conditioner, vents with hood, and associated controls.

6. Plumbing with potable water and drain connections for an emergency shower/eyewash and in-line electrically powered hot water heater to supply tepid water to the emergency shower/eyewash.

D. Related Sections:

1. Section 01660 - Facility Startup and Testing
2. Section 11010 - Equipment General Provisions
3. Section 15060 - Process Pipe
4. Section 15100 - Valves
5. Section 17500 - Control Narratives

1.02 Quality Assurance

- A. All electrical equipment and materials specified herein shall be listed by and shall bear the label of Underwriters Laboratories (UL) or shall undergo an evaluation for field labeling if not already UL listed and listing is required by the Washington State Department of Labor and Industries electrical inspector. The manufacturer shall pay for the field evaluation and labeling.
- B. The manufacturer shall have a minimum of 10 years experience in the design, manufacture and supervision of installation of equipment of the type specified herein.
- C. The manufacturer shall have unit responsibility for all equipment specified in this section to provide a complete and operational system as specified herein.
- D. The equipment specified herein shall be factory assembled to the extent practical to verify that all mating parts fit properly and the system functions properly. All equipment components shall be inspected in the shop prior to shipping. Test electrical systems by conducting point to point testing of panel wiring and applying intended supply voltage to the panels. Label wires and devices using heat shrink labels and ensure wiring is properly installed and clean. Any deficiencies shall be noted, corrected and re-inspected before final authorization is given for shipment of the equipment. Receive favorable review of inspection report prior to shipping.
- E. The manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur.

1.03 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following information as a single package prior to fabrication:
 - 1. Descriptive literature, bulletins, and/or catalog cuts of the equipment and appurtenances.
 - 2. A list of all deviations from the Drawings and Specifications.
 - 3. Warranty information.
 - 4. Shop drawings showing:
 - a. Building plan, elevation, and section views
 - b. All connection points and equipment layout
 - 5. Materials of construction.
 - 6. Wiring diagrams.
 - 7. Complete installation instructions, with points of electrical and plumbing connection requirements clearly shown.
 - 8. Electric motor data, including manufacturer, size, operating voltage, number of phases, locked rotor current in amps, full load current in amps, and motor speed in rpm.
 - 9. Standard color chart for color selections by the Owner.
 - 10. Building load and seismic anchorage calculations stamped by a professional engineer registered in Washington State.
 - 11. The submittal shall include tabbed sections defining scope, equipment and component catalog cuts, material list, and dimensional installation drawings.
- B. Because the footprint of the PAA Building is under 120 square feet, a building permit application is not required for this structure.
- C. Submit certified shop inspection and testing reports prior to delivery.
- D. Submit manufacturer's installation, lubrication, operation and maintenance (O&M) manuals, bulletins, and spare parts lists in accordance with Section 01730 - Operation and Maintenance Data, prior to system startup.
- E. Submit affidavits from the manufacturers stating that the system has been properly installed, adjusted, and tested and is ready for full-time operation.

1.04 Delivery, Storage and Handling

- A. Immediately upon delivery to the job site, place materials in an area protected from weather and store per the manufacturer's instructions. Use non-marring slings for loading, unloading and handling of equipment to prevent rope or cable damage to surfaces and protective wrappings.

PART 2 - PRODUCT

2.01 Acceptable manufacturers

- A. Prominent
- B. Or approved equal.

2.02 General Requirements

- A. PAA feed equipment shall be skid-mounted, housed within the PAA Building, completely self-contained and designed to safely and accurately meter neat PAA solution. Unless specified elsewhere, skids shall include metering pumps, carrier water injection, valves, and accessories for a complete and fully functional PAA system as specified herein and depicted on Drawing I-2, except that a few items to be provided that will be installed outside the PAA Building shall be shipped loose for installation by the Contractor. Additionally, the residual analyzer will be furnished by the Owner for installation by the Contractor and the Contractor will fabricate the remote input/output (I/O) panel.
- B. Control wiring for the metering pumps and all other new equipment shall be connected to a remote I/O panel provided by the Contractor and mounted inside the PAA Building. An operator interface terminal (OIT) on the panel will provide access to SCADA for control of equipment. Conduit for control wiring shall be routed to the designated location for the remote I/O panel. The Contractor will make final connections to the remote I/O panel and install wiring.
- C. All equipment within the PAA building shall be pre-wired and terminated at the distribution panelboard by the manufacturer and tested in the factory prior to delivery to the jobsite.
- D. The metering skid shall be floor-mounted with spill containment, completely assembled and tested in the factory.
- E. Materials shall be suitable for the liquid being handled or pumped. Unless specified otherwise, provide piping, tubing, valves and appurtenances in accordance with Division 15.
- F. Metering pumps and other equipment having multiple similar items shall be from the same product line of a single manufacturer.

2.03 PAA Building

- A. General:
 - 1. The PAA Building shall be a pre-fabricated fiberglass building that is shipped to the site pre-assembled to the extent practical. Building size shall be as indicated in the Drawings. Fabrication shall be by American Composites Manufacturing Association (ACMA) Certified Composite Technicians.

2. The PAA Building shall have a minimum 8'-0" by 10'-0" footprint with minimum 7'-6" high interior clearance from floor to ceiling throughout.
 3. The PAA Building shall have a minimum 1-hour fire resistance rating.
 4. The PAA Building shall comply with codes as identified herein and as are applicable to the design and construction of the building.
 5. The PAA building shall be fabricated by ShelterWorks or approved equal.
- B. Special Guarantee: The PAA building fiberglass structure shall be warranted for 25 years from defects such as delamination, corrosion, UV degradation, leaks, cracks, failed hardware, and other structurally related defects.
- C. Regulatory Requirements:
1. Design and construction of the PAA Building shall comply with the Washington State Building Code, which is comprised of the following code editions listed below with City of Snohomish and Washington State Amendments:
 - a. 2015 International Building Code (IBC)
 - b. 2015 International Mechanical Code (IMC)
 - c. 2015 International Fire Code (IFC)
 - d. 2015 Uniform Plumbing Code (UPC)
 - e. 2015 Washington State Energy Code (Energy Code)
 2. Electrical work within the PAA Building shall comply with the 2017 National Electric Code with Washington State Amendments.
- D. The PAA Building shall be designed based on Chapter 16 of the IBC and also the following:
- a. Dead Load: As Calculated
 - b. Roof Live Load: 25 psf uniform, 400 lbs point load
 - c. Floor Live Load: 125 psf uniform, 400 lbs point load
 - d. Wind Load: 1.15 importance factor, 115 mph wind speed (3 second gust), exposure "D"
 - e. Snow Load: 15 psf uniform (ground), 1.1 importance factor, 0.9 exposure factor, 1.2 thermal factor
 - f. Seismic Load: 1.5 importance factor, site class "D", seismic category "D", occupancy category IV with the following site specific coefficients:
 - 1) Mapped Spectral Acceleration S_S : 1.286
 - 2) Mapped Spectral Acceleration S_1 : 0.487
 - 3) Spectral Response Coefficient S_{DS} : 0.857
 - 4) Spectral Response Coefficient S_{D1} : 0.491

E. Building Structure:

1. The structural frame shall be rigid and consist of structural shapes designed to meet the loading criteria listed above.
2. Building walls shall be mounted to a rigid base frame that includes chemical containment and plumbing drains. Wall connections to the base and roof connections to the walls shall be sealed to provide a weatherproof interface.
3. All hardware shall be stainless steel in accordance with ASTM F593 and F594.
4. The walls, roof, doors, skylights and windows shall be insulated to comply with the requirements of a semi-heated space in accordance with the Energy Code.
5. Walls shall be comprised of an exterior and interior fiberglass skin bonded together with fiberglass I-beams spaced no more than 12 inches apart. The void space between the exterior and interior skins shall be filled with a foam core for insulation and the skins shall be finished with a gel coat for color and UV resistance. Walls having equipment attached to them shall include OSB plywood underneath the interior skin fiberglass skin to provide reinforcement and added strength for equipment mounting.
6. Provide hipped roof. Roofing material shall be certified “Class C” in accordance with ASTM E108.
7. All finishes and exterior materials shall be weatherproof and resistant to degradation from UV light.
8. Prior to shipment, clean the structure to remove dust, debris, grease and other foreign matter. Provide material to the Contractor for field touch up and repair of coatings and materials.
9. Colors shall be selected by the Owner based on the manufacturer’s standard colors.
10. As indicated for submittals above, favorably reviewed PAA Building structural calculations and layout drawings shall be submitted to the City of Snohomish as a deferred submittal for a building permit application. The manufacturer shall be responsible for addressing and incorporating comments from the City of Snohomish into the building design prior to fabrication.

F. Building Appurtenances:

1. Door: Provide an insulated fiberglass door with seamless integrated door jamb and rain drip edge. Door shall be at least 3’-0” wide and 6’-8” tall with minimum 15-inch by 15-inch window. Window shall be made of double-paned tempered glass. Door hardware and hinges shall be stainless steel and door shall be equipped with a hydraulic door closer.

2. Knock-Out Panels and Bulkheads: Provide knock-out panels and or bulkheads for penetrations of piping and conduits for process, plumbing, electrical and communications/control connections. Bulkheads shall consist of a wall area with no foam core to allow penetrations through the fiberglass without exposing the core.
3. Containment Floor: The floor shall consist of a liquid tight containment basin with elevated fiberglass grating. Contained liquid shall be drained through a bottom pipe connection. Resin and materials for the containment floor shall be compatible with PAA. The metering pump skid containment shall be separated from the containment floor.
4. Skylight: Provide a translucent section of roof panel to serve as a skylight for illumination with natural light.
5. Workbench: Provide a wall-mounted workbench in the building interior. Workbench shall be minimum 40" long and 18" deep.
6. Smoke Detector: Provide a smoke detector for the interior building space with relay alarm output.
7. Signage: Provide hazard identification signs applicable to peracetic acid.

G. Building Electrical

1. General: All electrical components shall be Allen-Bradley or Square D.
2. Electrical Power Supply: Power supply to the PAA Building shall be 480-volt, 3-phase. Provide an external fused service-entrance-rated disconnect switch, 100 Amp minimum, for the power supply to the PAA Building. Provide fuses sized per the NEC. Provide a 480-120/240 Volt transformer, sized for all loads plus 10% spare capacity. Electrical items inside the building shall be rated NEMA 1 and items located on the building exterior shall be rated NEMA 3R.
3. Electrical Distribution: Provide a NEMA 1 panelboard mounted on the wall inside the building with circuit breakers sized to provide 120/240-volt single-phase power to the following:
 - a. Two (2) metering pumps
 - b. One (1) flow meter
 - c. One (1) flow switch
 - d. Two (2) level switches
 - e. One (1) residual analyzer
 - f. PAA Building lighting and receptacles
 - g. Tote storage canopy lighting
 - h. Tote storage canopy receptacles
 - i. Existing CCT receptacles
 - j. PAA Building heating
 - k. PAA Building ventilation and air conditioning

- l. PAA Building in-line hot water heater
 - m. PAA Building smoke alarm
 - n. Pipe heat tracing (three 20A GFCI circuits)
 - o. Minimum of 6 spare 20A circuits.
 - 4. Lighting: Provide LED lighting for the interior space connected to a light switch and an exterior LED light with a photocell above the doorway.
 - 5. Receptacles: Provide at least two interior 120-volt receptacles inside the PAA Building.
 - 6. Conduit and Wiring: Conduit and wiring for equipment, lights, switches, fan, heater and other powered items in the building shall be factory installed and tested prior to shipment. Similarly, conduit for control wiring shall be factory installed from the equipment inside the building to the designated location for the remote I/O panel. The Contractor will make final connections of control conduits to the remote I/O panel and install control wiring. Space shall be allocated for additional power conduit entries into the panelboard and for additional power and control conduit penetrations through the building.
 - 7. Locations: The emergency shower/eyewash, electrical equipment and space allocated for the remote I/O panel shall be arranged to avoid water splashing on the electrical equipment and remote I/O panel.
- H. Building Plumbing:
- 1. General: Piping, valves and appurtenances for pressurized plumbing shall be designed for system pressure up to 150 psi.
 - 2. Emergency Shower/Eyewash: Provide a corrosion resistant emergency shower/eyewash inside the PAA Building. Additionally, provide an outlet from the building to feed a second emergency shower/eyewash in the PAA tote storage area to be provided by the Contractor.
 - 3. In-Line Electric Water Heater: Provide an in-line electric water heater sized to provide tepid water to the emergency shower/eyewash in accordance with ANSI Z358.1, which may incorporate the use of a mixing valve. The water heater shall also comply with the requirements of the Energy Code.
 - 4. Building Drain: As specified above, provide a building drain from the containment floor to drain water from the emergency shower/eyewash.
- I. Building Heating, Ventilation and Air Conditioning:
- 1. Heater: Provide a corrosion resistant heater sized to keep the building interior temperature at or above 40 degrees Fahrenheit when outdoor temperatures are 0 degrees Fahrenheit.

2. Ventilation: Provide corrosion resistant fan, vents and rain hoods for ventilation of the building. The vents shall gravity louvers and insect screens. The fan shall be sized to provide at least 1 cfm of ventilation capacity per square foot of building area.
3. Air Conditioning: Provide a weatherproof air conditioner sized to maintain temperatures in the building not exceeding 85 degrees Fahrenheit when outdoor temperatures are up to 105 degrees Fahrenheit.
4. Controls: Provide switches for manual control of the heater, fan and air conditioner and thermostats for automatic control of the heater and air conditioner to maintain interior temperatures between 40- and 85-degrees Fahrenheit.

2.04 PAA Metering Pumps

A. Metering Pump Performance Requirements:

1. There shall be two metering pumps, one duty and one standby. The metering pumps shall be solenoid driven pumps sized based on the following:
 - a. Feed Chemical: Peracetic Acid
 - b. Solution Concentration: 15 to 22%
 - c. Maximum Feed Rate: 3.17 gph
 - d. Stroke Rate Adjustment Range: 1 to 12,000 strokes per hour
 - e. Average Feed Rate: 0.3 gph
 - f. Maximum backpressure: 58 psi
 - g. Minimum Suction Lift: 6.5 feet
 - h. Pump Model: gamma/ X Model 0414, with auto degassing

B. Materials:

1. Type 316 stainless steel or PVDF pump head and suction/discharge valve.
2. Ceramic balls and PVDF or ceramic ball seat.
3. PTFE seals.

C. Controls: The metering pumps shall be capable of both manual and automatic modes of operation utilizing local speed control in manual mode or a remote 4-20 mA signal input in automatic mode. Manual or automatic mode shall be selected locally at the metering pump.

1. Analog input to pump for flow control.
2. Analog output from pump for flow feedback.
3. Discrete input to pump for remote start/stop ("Pause").

4. Discrete outputs from pump for ready status, pump fault and diaphragm fail (requiring diaphragm rupture indicator).

2.05 Piping, Tubing and Connectors

- A. Piping shall be Type 316 stainless steel, minimum Schedule 40.
- B. Tubing shall be Type 316 stainless steel or Teflon (PTFE).
- C. Utilize bulkhead unions, compression fittings, and male connectors for making connections between tubing sections and to valves and accessories.
- D. Refer to Division 15 for additional requirements.

2.06 Valves and Accessories

- A. General: PAA system shall include at a minimum the valves and accessories specified below. Unless noted otherwise, all valves and accessories shall have a pressure rating of 150 psi or greater.
- B. Ball Valves: Ball valves shall be 2-piece with minimum 80% port opening and locking handle, sized and installed as indicated in the Drawings. Body, pack gland, ball and stem shall be Type 316 stainless steel. Seat, gaskets, packing and thrust washer shall be PTFE, and all other hardware shall be stainless steel. Provide a PVC handle sleeve. The ball valves shall be Nibco T-580-S6-R-66-LL or equal.
- C. Calibration Column: Provide one (1) 250 ml calibration column shall be provided and installed in the PAA supply piping as close to the metering pumps as practical. Material of construction shall be glass with PVDF and/or Type 316 stainless steel, seals shall be Viton, and connections shall be ½-inch NPT. The top of the calibration column shall be vented through the roof for overflow protection. Calibration Column shall be Accudraw Glass Calibration Cylinder or equal.
- D. Back Pressure Valve: Provide one (1) backpressure valve to regulate PAA discharge pressure. The back pressure valve shall have a Type 316 stainless steel top and PVDF or Type 316 stainless steel body with PTFE laminated and Viton backed diaphragm. Valve shall have two port connections sized at ½-inch FNPT with rated flow of 4 gpm at 50 psig and handle to adjust pressure setting. Back Pressure Valves shall be Top Valve or equal.
- E. Pressure Relief Valves: Provide two (2) pressure relief valves for protection against excessive discharge pressure. The pressure relief valves shall have a Type 316 stainless steel top and PVDF or Type 316 stainless steel body with PTFE laminated and Viton backed diaphragm. Valve shall have 3 port connections sized at ½-inch FNPT with rated flow of 4 gpm at 50 psig and handle to adjust pressure setting. Pressure Relief Valves shall be Top Valve or approved equivalent.

- F. Pulsation Dampener: Provide one (1) 4-cubic inch capacity pulsation dampener for installation on the common discharge line just downstream of the two PAA metering pumps, as shown on the Drawings. Pulsation dampener body shall be PVDF or Type 316L stainless steel, and bellows material shall be Teflon. Connection shall be a ½-inch NPT. The pulsation dampener shall be Accu-Pulse Model APIF Flat Top by Primary Fluid Systems Inc. or equal.
- G. Diaphragm Protected Pressure Gauges: Provide two (2) pressure gauges for indication of system pressure and include a diaphragm seal and impulse dampener for each. All components shall be provided by one single manufacturer.
1. Pressure gauges shall be liquid filled with Type 316 stainless steel case and wetted parts and 2 ½-inch dial size. Connection shall be ¼-inch NPT on bottom of gauge. Pressure range shall be from 0 to 100 psi with figure intervals of 10 and minor division of 1. Pressure gauges shall be Terice Model D83LFSS or equal.
 2. Diaphragm seals shall be clean-out design with flushing connection, standard threaded ½" NPT process connection with ¼" NPT instrument connection. Diaphragm materials shall be Type 316 stainless steel or Teflon and housing material shall be Type 316 stainless steel. Diaphragm seals shall be Terice Threaded NPT Diaphragm Seals or equal.
 3. Impulse dampener shall be ¼" NPT with Type 316 stainless steel body and insert material. Impulse dampeners shall be Terice 870 Series or equal.
- H. Y-Strainers: Provide two (2) Y-strainers, one on the carrier water injection line and one on the PAA suction line. Y-strainer shall have ½-inch NPT connections and 20 mesh screen. Body, screen, bonnet and plug shall be Type 316 stainless steel. Provide PTFE gasket and Viton O-ring. Y-strainer shall be FNW Figure 14B-YSS or equal.
- I. Degassing Valves: Provide two (2) degassing valves, one installed on the common discharge line and one on the common suction line of the PAA system. Install the degassing valves at the highest points along the common discharge and suction piping. Connect the vent lines to the vent from the calibration column. Degassing valve shall be constructed of Type 316 stainless steel or PVDF and have a ½-inch process connection. Degassing valve shall have maximum temperature and pressure ratings of 180 degrees F and 150 psi, respectively. Degassing Valve shall be Accu-Vent Automatic Degassing Valve by Primary Fluid Systems Inc. or equal.
- J. Globe Valve: Provide one (1) rising stem globe valve on the carrier water injection line to control carrier water flow. Valve body, cap, pin, disc, and plug shall be Type 316 stainless steel. Seal and plug gasket shall be PTFE. Connections shall be NPT. Provide handwheel actuator. Globe valve shall be FNW Figure 17B-200 or equal.

- K. Check Valve: Provide one (1) check valve with one-piece disc on the carrier water injection line to prevent backflow of PAA solution into the carrier water line. Valve body, disc, stem and bonnet shall be Type 316 stainless steel. Seal and packing shall be PTFE. Connections shall be NPT. Globe valve shall be FNW Figure 16B-200 or equal.
- L. Rotameter: Provide one (1) rotameter for measuring carrier water flowrate. The rotameter shall have a glass measuring tube, Type 316 stainless steel float, Viton seals, PVDF or Type 316 stainless steel fittings, PVDF float stops, and Type 316 stainless steel housing and union. The rotameter shall have an operating pressure of at least 100 psig and measurement range of at least 5 gpm to 40 gpm. Process connections shall be minimum 1½-inch NPT. Rotameter shall be Kobold Model KDV or equal.

2.07 Instruments

- A. High Level Switches: Provide two (2) ultrasonic level switches that operate on the principle of using the variable attenuation of a sonic signal created by a change in the percent solids to identify presence of a liquid at a set depth. A control unit/amplifier shall sense the change in signal strength across a sensor gap and provide an on-off control signal. The control output shall be a DPDT switch rated for at least 8 amps at 120 VAC. Power supply shall be 120 VAC. The level sensor shall be fabricated of Type 316 stainless steel. The control unit/amplifier shall be housed in a NEMA 4X enclosure with ¾-inch hubs for connection of the control and power wiring. Sensor length shall be as shown on the Drawings. One level switch shall be installed inside the pre-fabricated PAA Building to detect liquid in the PAA pump skid containment and the other shall be installed by the Contractor in the PAA tote containment. Ultrasonic level switches shall be Echotel Model 910 by Magnetrol or equal.
- B. Low Carrier Water Flow Switch: Provide one (1) flow switch utilizing thermal dispersion technology consisting of two resistance temperature detection (RTD) elements. The switch shall detect the temperature difference between the two electrodes which changes with the media flow rate (higher flow decreases the difference). A relay shall change state when the flow rate (temperature difference) setting is reached. The unit shall include temperature compensation so that change in liquid temperature does not change the flow rate at which the switch activates. Materials for probe and enclosure shall be Type 316 stainless steel. Provide probe with spherical tip and set point range of 0.01 to 5.0 feet per second velocity. Process connection size and type shall be as shown on the Drawings. The control output shall be a DPDT switch rated for at least 8 amps at 120 VAC. Power supply shall be 120 VAC. The flow switch shall be installed inside the pre-fabricated PAA Building to detect carrier water flow. Flow switch shall be Thermatel Model TD2 by Magnetrol or equal.
- C. PAA Flow Meter: Provide one (1) magnetic flow meter for measuring flow of neat PAA solution. The flow meter shall be installed inside the pre-fabricated PAA Building downstream of the two metering pumps and before injection of carrier water. The flow meter shall include two electrodes to measure voltage in the flow tube for calculation of volumetric flow based on Faraday's Law and a third

electrode to detect an empty pipe. The flow meter shall consist of a flow sensor and transmitter. The flow sensor shall include a PFA lined stainless steel flow tube, magnetic coils and Type 316L stainless steel electrodes, Type 316L or PVDF flange connections, Viton seals, Type 316L stainless steel ground rings, and a stainless steel housing. The flow sensor shall have a measuring range of 0.01 to 33 feet per second velocity and an internal diameter of 1/12-inch. The transmitter shall have a stainless steel housing and glass window and be the compact version mounted to the flow sensor. The transmitter shall be powered from 120 VAC and provide an analog 4-20 mA output proportional to flow, a discrete pulse output for totalizing flow, and a discrete output for transmitter fault. The transmitter shall have an adjustable low-flow cutoff and retain setup parameters in the event of a power failure. Flow meter shall be ProMag 50H by Endress + Hauser or equal.

2.08 Controls

- A. The PAA system and associated equipment shall support the control narratives specified in Section 17500 - Control Narratives. The manufacturer shall review the I/O required in Section 17500 to ensure that proposed products will support the necessary I/O for control of the system.
- B. Control wiring for new equipment specified herein will be wired to a remote I/O panel to be fabricated and installed by the Contractor. The remote I/O panel will include a local OIT for access to the SCADA system and will be connected to the existing programmable logic controller (PLC) in existing Main Control Panel 2A (MCP-2A) via an Ethernet connection.
- C. The Contractor is responsible for programming modifications to the existing SCADA system and PLC in MCP-2A to meet the requirements of Section 17500.

2.09 Spare Parts

- A. Provide recommended spare parts for the PAA system. At a minimum, spare parts shall include the following:
 - 1. One (1) maintenance kit for each metering pump. The kits shall include a diaphragm, check valve seats, O-rings, and seals.
 - 2. One (1) spare diaphragm each for the pulsation dampeners, pressure relief valves, and backpressure valve.

PART 3 - EXECUTION

3.01 Installation

- A. In general, follow Section 11010 - Equipment General Provisions, except where superseded by installation procedures in accordance with the PAA system manufacturer's written instructions and/or the instructions of a qualified manufacturer's representative on site.

- B. The Contractor shall provide flanges, couplings, unions, etc. as required for connection to equipment provided by the manufacturer.

3.02 Field Services

A. General:

1. The following steps must be executed in order and as specified in Section 01660 - Facility Startup and Testing.
2. The manufacturer's representative performing field services shall be a competent field service engineer who is a direct employee of the manufacture, not an employee of a contracted third-party.
3. The manufacturer is responsible for paying for travel and expenses associated with the field services specified herein.
4. At least one (1) trip and a total of five (5) eight-hour days of field service shall be provided. At least one (1) day shall be devoted exclusively to training, which shall include both classroom and field training.

B. Installation Verification:

1. The manufacturer's representative shall review the installation and provide a signed affidavit stating that the PAA system has been properly installed, adjusted, and tested and is ready for full-time operation. A representative of the Owner shall be present during this review.
2. If adjustments or corrections are required, these shall be made by the Contractor under direction from the manufacturer's representative at no additional cost to the Owner.
3. The manufacturer's representative shall conduct equipment checks that include, but are not limited to, the following:
 - a. Verify equipment mounting and tolerances.
 - b. Check instrument installation.
 - c. Calibrate and test functionality of instruments.
 - d. Test proper operation of the metering pumps, instruments, valves and accessories.
 - e. Test manual and automated operation of the metering pumps.
 - f. Test proper operation of instrumentation, alarms and operating indicators.
 - g. Check contractor-installed electrical connections and control wiring.
 - h. Test function of lighting, heater, ventilation fan, plumbing and other building accessories.
 - i. Clean, flush and test piping systems prior to functional testing. Testing of piping systems shall be in accordance with Section 15060 - Process Piping.

C. Functional Testing:

1. Following installation verification, the manufacturer's representative shall conduct functional testing as specified herein and in Section 01660. A representative of the Owner shall be present during functional testing.
2. Functional testing shall coincide with the operator training session. The Owner shall be given at least two weeks' notice prior to the manufacturer's representative initiating functional testing.
3. Functional testing shall include, but not be limited to, the following:
 - a. Demonstrate delivery of PAA to the injection locations.
 - b. Demonstrate different modes of operation, including automated PAA dose control.
 - c. Test that alarms trigger the proper warnings and control actions.
 - d. Demonstrate communications with the existing PLC and SCADA system.
 - e. Demonstrate proper operation of heating and ventilation equipment and controls.
 - f. Demonstrate proper operation of plumbing equipment and fixtures.
4. Pending successful functional testing, the PAA system may continue to operate on a full-time basis, and the Contractor may proceed with the next phase of the project. If functional testing is not successful, the PAA system shall be shut down and issues will be diagnosed and corrected, after which functional testing shall be repeated until deemed successful.
5. If additional service and/or trips are required due to the installation not being complete upon arrival of the manufacturer's representative, any additional service days and/or trips required will be at the Contractor's expense.

D. Performance Testing:

1. Prior to acceptance, performance testing of the PAA system must be completed. The manufacturer's representative need not be present for the start of performance testing.
2. Performance testing shall be conducted for a continuous 30-day period, during which time the Owner will collect and test final effluent grab samples for fecal coliform and PAA residual on their regular compliance schedule. The Owner will log:
 - a. Date and time samples are collected.
 - b. Effluent flow rate and filter feed flow rate.
 - c. Effluent total suspended solids (TSS) and 5-day carbonaceous biochemical oxygen demand measured from 24-hour composite samples collected on the regular compliance schedule.

3. If test results do not meet the NPDES permit requirements for effluent fecal coliform or PAA residual or expectations of performance based on prior full-scale testing of a temporary PAA system, the Owner and Engineer shall determine if there may be deficiencies in the equipment, installation and/or programming. If available information suggests such deficiencies may exist, the Contractor shall assist the Owner and Engineer in evaluating and assessing suspected deficient items and making the necessary corrections if deficiencies are found, at not additional cost to the Owner. If the PAA system manufacturer's equipment is found to be deficient, the manufacturer shall repair or replace the deficient equipment at no additional cost to the Owner. Following corrections of deficiencies, performance testing shall be restarted for a new 30-day period until successfully completed.
4. The Owner will continue to monitor performance of the PAA system following completion of performance testing and will notify the manufacturer if there are any concerns that might require action by the manufacturer under the warranty.

E. Training:

1. Training for the PAA system shall cover all related components including PAA injection and carrier water injection. Training for the complete PAA system shall be organized and provided by the PAA system manufacturer. The PAA system manufacturer is responsible for coordinating with other manufacturers of equipment provided as part of the PAA system to prepare training materials and provide the necessary training.
2. The training session shall be 8 hours and be conducted during installation verification and functional testing. The manufacturer's representative providing the training shall be knowledgeable in both the operation and maintenance of all equipment, instruments, programming, and controls associated with the PAA system. At a minimum, training shall include safety procedures, operating instructions (i.e., startup, shutdown, normal operations, emergency procedures, etc.) and preventative maintenance procedures.

END OF SECTION 11240

**SECTION 11330
SUBMERISBLE CARRIER WATER PUMP**

PART 1 - GENERAL

1.01 Summary

- A. This section specifies the submersible carrier water pump (SP-7420).
- B. Related Sections:
 - 1. Section 01660 - Facility Startup and Testing
 - 2. Section 11010 - Equipment General Provisions
 - 3. Section 15060 - Process Piping
 - 4. Section 15100 - Valves
 - 5. Section 17500 - Control Narratives

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following information as a single package prior to fabrication:
 - 1. Descriptive literature, bulletins, and catalog cut sheets of the equipment.
 - 2. Complete certified performance curves showing capacity versus head, NPSH required, pump efficiency, and brake horsepower.
 - 3. Materials of construction.
 - 4. Detailed drawings of complete pump assembly showing all pertinent dimensions.
 - 5. Electric motor data, including manufacturer, size, operating voltage, number of phases, locked rotor current in amps, full load current in amps, and motor speed in rpm.
 - 6. Wiring diagram.
 - 7. Complete installation instructions, with points of electrical and plumbing connection requirements clearly shown.
 - 8. Warranty information.

1.03 Quality Assurance

- A. All electrical equipment and materials specified herein shall be listed by and shall bear the label of Underwriters Laboratories (UL).
- B. Pumps shall be warranted to be free from defects in workmanship, design and materials for a period of 18 months from shipment and 12 months after acceptance.

1.04 Delivery, Storage and Handling

- A. Immediately upon delivery to the job site, place equipment in an area protected from weather and store per the manufacturer's instructions. Use non-marring slings for loading, unloading and handling of equipment to prevent rope or cable damage to surfaces and protective wrappings.

PART 2 - PRODUCTS

2.01 Pump

- A. BJM RX Series Model No. RX08SS
- B. Or equal.

2.02 General

- A. Pump and motor shall be furnished and assembled as an integral pumping unit by the manufacturer. Pump shall be equipped with a submersible cable of sufficient length to extend to the terminal box and suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards.
- B. The pumping unit and all components shall be designed for operation under the conditions specified herein and, in the suction, and discharge piping configuration shown.
- C. Each pump assembly and all pump assembly components shall be designed for and capable of continuous constant speed operation at any and all points on the pump curve.
- D. Pumps shall be designed and suitable for pumping sewage and capable of passing 1/4-inch diameter non-compressible spherical solids.
- E. Working parts shall be readily accessible for inspection and repairs, easily duplicated and replaced.

2.03 Performance Requirements

- A. The pump shall be capable of delivering 30 GPM flow at 39 feet TDH. The pump shutoff head shall be at least 49.5 FT.
- B. The pumps shall have motor operating at maximum 3,450 rpm and maximum 1-horsepower. The pumps will operate on 460-volt, 3 phase, 60 Hz power supply.
- C. Pumps shall operate without cavitation or vibration within the indicated flow range, with a submergence of two (2) feet above the impeller centerline.

2.04 Pump Construction

- A. General: All pump parts in contact with liquid shall be designed and constructed of Type 316 stainless steel with fluroelastomer (FKM) seals and gaskets.
- B. Impeller: Pump shall be supplied with a dynamically balanced impeller made of cast Type 316 stainless steel.
- C. Volute/Suction Plate: The volute casing design shall be concentric with multiple cutwaters, to reduce radial loads. The suction cover shall be cast integrally with the volute. The volute/suction cover shall be constructed from cast Type 316 stainless steel.
- D. Discharge: The pump design shall have a top discharge, with a Type 316 stainless steel 2-inch NPT connection.
- E. Mechanical Seals: The pump shall be supplied with double mechanical seals made of carbon/silicon carbide.
- F. Shaft: The pump shaft shall be Type 316 stainless steel.
- G. Handle: Pump shall be fitted with a Type 316 stainless steel handle.

2.05 Motor

- A. The motor shall be a NEMA design B induction air filled motor specifically designed for submersible usage and rate for continuous duty of pumped liquid up to 104 degrees F.
- B. The stator windings and leads shall be insulated with moisture resistant Class F insulation.
- C. The motor horsepower shall be non-overloading over the full range of the performance curve, from shut-off to full-flow. The combined service factor (frequency, voltage and liquid specific gravity) of the motor shall be 1.10 or greater.
- D. The motor shall be protected from failure from overheating and from low voltage or high amperage by a separate thermal overload switch installed in the pump.
- E. The motor shall be inverter duty and capable of VFD operation.
- F. The motor housing shall be constructed of Type 316 stainless steel.
- G. The motor cover shall be constructed of Type 316 Stainless steel and have a fitting to permit air pressure testing of the motor cover and power cord entry seal.

PART 3 - EXECUTION

3.01 Installation

- A. Install pumping equipment, complete, in accordance with the Drawings, manufacturer's recommendations, and approved submittals.
- B. Make final adjustment after piping is completed and before startup
- C. Pumps shall be set plumb with no stresses on the pump discharge and cables. All equipment shall be supported and securely anchored, ensuring all connections are tight.

3.02 Field Services

- A. Refer to Section 01660 for facility startup and testing requirements.

END OF SECTION 11330

SECTION 13122
PRE-ENGINEERED METAL CANOPY

PART 1 - GENERAL

1.01 Summary

- A. Section includes a complete pre-engineered canopy for sheltering the peracetic acid (PAA) tote storage area and includes without limitation the design and installation of the following:
 - 1. Rigid frame, prefabricated, prefinished metal canopy, including primary and secondary structural framing, and connection bolts.
 - 2. Bracing panels as required to provide lateral rigidity in roof.
 - 3. 2-hour rated fire wall on the side facing the PAA Building for required separation per the International Fire Code (IFC).
 - 4. Factory finished roof panels, gutters, rain water leaders, flashing, fasteners, closures, and sealants.
 - 5. Concrete foundations for the canopy support columns.
- B. Related Sections:
 - 1. Division 3 – Concrete.

1.02 References

- A. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings.
- B. American Iron and Steel Institute:
 - 1. Specification for the Design of Cold-Formed Steel Structural Members
- C. American Society for Testing and Materials International (ASTM):
 - 1. A36 Carbon Structural Steel.
 - 2. A307 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 3. A325 Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
 - 4. A446 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
 - 5. C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

- D. North American Insulation Manufacturers Association (NAIMA): "Understanding Insulation for Metal Buildings."

1.03 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following information as a single package prior to fabrication:
1. Descriptive literature, bulletins, and/or catalog cuts of the equipment and appurtenances.
 2. A list of all deviations from the Drawings and Specifications.
 3. Warranty information.
 4. Shop drawings showing Building plan, elevation, and section views.
 5. Materials of construction.
 6. Complete installation instructions.
 7. Standard color chart for color selections by the Owner.
 8. Building load and seismic anchorage calculations stamped by a professional engineer registered in Washington State.
 9. The submittal shall include tabbed sections defining scope, equipment and component catalog cuts, material list, and dimensional installation drawings.
- B. Favorably reviewed canopy structural calculations and layout drawings shall be submitted to the City of Snohomish as a deferred submittal for a building permit application. The manufacturer shall be responsible for addressing and incorporating comments from the City of Snohomish into the design prior to fabrication.

1.04 Quality Assurance

- A. Qualifications:
1. AISC Certified for design and fabrication, Member of Metal Building Manufacturer's Association (MBMA), or both.
 2. The manufacturer shall have a minimum of 10 years experience in the design, manufacture and supervision of installation of the type of product specified herein.
 3. The manufacturer shall have unit responsibility for all items specified in this section to provide a complete product as specified herein.
- B. Regulatory Requirements. Design and construction shall conform to the following:
1. Design and construction of the canopy shall comply with the 2015 International Building Code (IBC) with City of Snohomish and Washington State Amendments.

2. "Specification for Structural Steel Buildings " published by the American Institute of Steel Construction, Inc.
3. "Specification for the Design of Cold-Formed Steel Structural Members" published by the American Iron and Steel Institute.
4. Metal Building Manufacturers Association: "Metal Building Systems Code of Standard Practice."

1.05 Design Load Criteria

- A. The canopy shall be designed based on Chapter 16 of the IBC and also the following:
 1. Dead Load: As Calculated
 2. Roof Live Load: 25 psf uniform, 400 lbs point
 3. Wind Load: 1.15 importance factor, 115 mph wind speed (3 second gust), exposure "D"
 4. Snow Load: 15 psf uniform (ground), 1.1 importance factor, 0.9 exposure factor, 1.2 thermal factor
 5. Seismic Load: 1.5 importance factor, site class "D", seismic category "D", occupancy category IV with the following site specific coefficients:
 - a. Mapped Spectral Acceleration S_S : 1.286
 - b. Mapped Spectral Acceleration S_1 : 0.487
 - c. Spectral Response Coefficient S_{DS} : 0.857
 - d. Spectral Response Coefficient S_{D1} : 0.491
 6. Deflection of roof members not exceeding:
 - a. General: Span/180 for total specified loading.
 - b. Roof: Span/360 for total specified loading.

1.06 Delivery, Storage and Handling

- A. Deliver, store, handle and erect prefabricated components, sheets, panels, and other manufactured items in a manner that will not cause scratching, damage or deformation of exposed or concealed items or surfaces. Stack site stored materials and components on platforms or pallets and cover with tarpaulins or other suitable weathertight covering. Inspect all panels upon arrival at jobsite. Remove moisture, if any, and restack and protect materials and components until used.

1.07 Special Guarantee

- A. Submit a guarantee signed by both the manufacturer and the Contractor stating that the factory-applied panel finish will resist blistering, peeling, cracking, flaking and chipping and that finish color will not change or chalk for a period of 20 years.

PART 2 - PRODUCTS

2.01 Building Systems

- A. Manufacturers:
 - 1. All Steel Northwest
 - 2. American Buildings Company
 - 3. Star Building Systems
 - 4. Steelex Building Systems

2.02 General

- A. Provide a Contractor Designed rigid frame clear span cover with a roof, straight columns, and straight or tapered roof beams. Adding vertical diagonal bracing is not permitted.
- B. Frame end walls with clear span rigid frames to facilitate future expansion.
- C. Design all mill hot rolled sections and welded up plate sections in accordance with the latest edition of the AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
- D. Design all cold rolled sections in accordance with the latest edition of the AISI Specifications for the Design of Cold-Formed Steel Structural Members.

2.03 Structural Framing and Foundation

- A. Frame: Built-up or W Shapes: ASTM A36, ASTM A572 or ASTM A992.
- B. Primary Structural Items: Columns, beams, plates, angles, and bracing: ASTM A36, ASTM A572 or ASTM A992.
- C. Secondary Structural Framing: Purlins shall meet ASTM A446 Grade B, 16-gauge minimum.
- D. Welded Shop Connections: D1-1. Use only welders and welding operators that are certified as qualified welders for this type of work in accordance with the AWS Code.
- E. Bolted Connections, Anchor Bolts: ASTM A307, Grade A, galvanized. High strength bolting: ASTM A325, heavy hex, Type 1, galvanized.
- F. Concrete: In accordance with Division 3.

- G. Provide wind, or seismic double diagonal ("X") steel bracing in roof as necessary. Provide double roof purlins, interconnected by diaphragms between the rigid frames at all points of attachment of diagonal roof bracing. Fixed base corner columns or other suitably designed rigid frame bracing shall be used in lieu of sidewall diagonal bracing.
- H. Design and size foundation and bases for the canopy frame columns to take shear, uplift and bearing loads. Column anchorage shall be designed to resist the column reactions resulting from the specified loads applied in the specified loading combinations.
- I. Non-shrink Grout: ASTM C1107, Grade B. Provide grout for column and other structural members required to bear on the concrete slab. Furnish a pre-mixed, non-metallic dimensionally stable material.
- J. Finish: Clean all structural steel to remove all rust, dirt and grease and give at least one shop prime coat of penetrating rust-inhibiting alkyd primer suitable for finish coating as specified in Paragraph 3.06 below. Provide extra coating products for field touch-up.

2.04 Panels

- A. Roof and Wall Panels:
 - 1. Material: Form from 24-gauge carbon steel sheet, coated on both sides with aluminum by the hot dip method.
 - 2. Panel Design: Interlocking ribbed panels with 2-inch-high minimum locked standing seams with concealed clips.
- B. Panel Finishes: Provide building wall and roof panels and liner panels that have a fluoropolymer coating applied on both sides of metal sheets. Duranar 200 as developed by PPG Industries, or equal. Provide extra coating products for field touch-up.
- C. Panel Colors: Selected from manufacturer's standard line of colors.

2.05 Accessories

- A. Eave Gutters, Rainleaders, Fascias, Trim, Closures: Roll formed from 24-gauge aluminized steel Galvanized coating shall be 1.25 ounces minimum per square foot of surface.
- B. Finish: All accessories shall have a coating system as specified above for panels.
- C. Touch-up Material: Provide extra enamel for field touch-up to match factory finish.

2.06 Sealants

- A. Seal sidelaps, endlaps and flashings with gray pressure sensitive tape which consists of a blend of butyl and EPDM rubbers that are non-asphaltic, non-shrinking, non-drying and non-toxic, and that will adhere to metals, plastics and painted surfaces from -10°F to +140°F.
- B. Sealants: Sikaflex 1A or equal. Apply sealants required to achieve watertightness.

2.07 Fasteners

- A. Fasteners: Self-tapping sheet metal screws conforming to ANSI Standard B18.6 and having Type "A" threads. Use screws and washers made from carbon steel and plated with 0.0003-inch-thick cadmium. Where required for weathertightness, equip screws with metal and neoprene washers.
- B. Treat all exposed fasteners and washers with zinc phosphate and apply one prime coat and apply finish coats of baked silicone polyester. Apply a finish coat that matches the color of the wall and/or roof panels.

PART 3 - EXECUTION

3.01 Structural Framing and Foundation

- A. Install concrete foundation in accordance with Division 3 of these specifications. Coordinate footing size and locations with other trades.
- B. Bolt all field connections with ASTM A307 or ASTM A325 bolts.

3.02 Roof and Wall Panels

- A. Provide roof panels that are continuous from ridge to eave with no end splices.
- B. Secure roof panels with concealed clips attached to roof purlins with self-drilling fasteners.
- C. Seal all standing seams of roof panels with a continuous strip of sealant tape before field crimping.
- D. Secure wall panels to all bearing points with self-drilling fasteners at a maximum spacing of 12 inches on centers.

3.03 Flashing, Closures and Trim

- A. Install flashing and/or trim at the rake, comers and framed openings, where shown and where necessary to provide weathertightness and a finished appearance.
- B. Install preformed neoprene panel rib closures at the ridge, eave, base and where shown and where required for weathertightness.

3.04 Accessories

- A. Provide eave, gutters and rainleaders and provide effective roof drainage:
 - 1. Extend the gutter apron under the roof panels and seal with neoprene closures. Securely fasten and seal joints between adjacent sections and seal end closures and downspouts.
 - 2. Secure rainleaders to sidewall panels with 20-gauge straps spaced 6 feet on centers. Provide two self-tapping fasteners and washers at each anchor strap.

3.05 Adjustments and Touch-Up

- A. Factory Primed Items: Touch up all surfaces on which the factory applied primer has been marred or damaged with spare primer product provided by the manufacturer.
- B. Factory Finished Items: Exercise care in handling factory finished panels, sheets and accessories. Touch up scratches and small blemishes with spare coatings products provided by the manufacturer. Replace items that have been dented, creased, bent or rusted with new identical items.

3.06 Field Painting

- A. Apply protective coatings to frames and other accessories which had only received a factory applied primer and are not factory finished. Coating color shall be selected from manufacturer's standard line of colors to match finish applied to panels.
- B. Coating System: Heavy-duty, high-gloss, industrial alkyd enamel, 6 mils minimum dry film thickness each coat.
 - 1. First coat:
 - a. On galvanized metal: Chemical pretreatment followed by Alkyd Zinc Dust, Zinc Oxide primer.
 - b. On ferrous metal: Touch-up factory applied rust-inhibiting alkyd primer.
 - 2. Second and third coats: Heavy-duty alkyd industrial enamel.

END OF SECTION 13122

**SECTION 15010
MECHANICAL GENERAL PROVISIONS**

PART 1 - GENERAL

1.01 Summary

- A. The provisions of this section shall apply to all sections of Division 15.

1.02 Submittals

- A. In accordance with the requirements of Section 01300 - Submittals, submit the following Project Data:
1. Descriptive literature, bulletins, and catalog cuts of the equipment and appurtenances.
 2. Shop drawings showing all connection points and equipment layout.
 3. Materials of construction.
 4. Complete wiring diagrams.
 5. Complete installation instructions, with points of electrical and plumbing connection requirements clearly shown.

1.03 Standards

- A. 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.
- B. If a specified 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.
- C. 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 operations; 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.
- D. Meet requirements of 2015 Uniform Plumbing Code, 2015 International Mechanical Code, local and state amendments, and other applicable local and state codes.
- E. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.04 Product Delivery, Storage, and Handling

- A. Exercise care in transporting and handling to avoid damage to material.
- B. Store materials on the site in a proper manner to prevent damage or theft.
- C. Keep materials clean, dry, and free from deleterious conditions.
- D. Do not store materials directly on the ground.
- E. Repair or replace damaged material or equipment to the satisfaction of Owner.
- F. Protect electrical equipment, controls, and insulation against moisture and water damage.
- G. The Contractor shall be responsible for the equipment included in this Contract until it has received final inspection, testing, and acceptance in accordance with the requirements of these Specifications.

PART 2 - PRODUCTS

2.01 General Requirements

- A. In accordance with applicable sections of Division 15.
- B. All equipment and material shall be designed for the service intended; shall be 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.
- C. Appearance and safety as well as utility shall be given consideration in the design of details.
- D. Materials of construction shall be cathodically compatible.
- E. Design, fabricate, and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices.
- F. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable.
- G. The Contractor shall design and provide all supports for equipment and appurtenances, valves and piping, per the latest edition of International Building Code and International Mechanical Code.

2.02 Anchor Bolts

- A. Anchor bolts shall be adequately sized for equipment loads and, in no case, less than the size recommended by the equipment manufacturer.

- B. Anchor bolt materials shall be per Section 05500 - Metal Fabrications and as indicated on the Drawings.

2.03 Special Maintenance Materials

For equipment requiring frequent replacement of maintenance materials, such as filters, lubricants, etc.; provide a 1-year supply to the Owner, together with grease guns or other application devices and instructions.

2.04 Painting Manufactured Equipment

- A. Protect all steel and iron surfaces by suitable coatings applied in shop, in accordance with Section 09920 - Protective Coatings.
- B. Protect for the life of equipment, surfaces which will be inaccessible after assembly.
- C. Finish smooth, thoroughly clean, and fill exposed surfaces as necessary to provide smooth, uniform base for coating.
- D. Coat surfaces to be painted after installation with 1 or more coats of primer to protect equipment until finish coats are applied.
- E. Shop finish electric motors, speed reducers, starters, and other self-contained or enclosed components with oil-resistant enamel, unless specified elsewhere.
- F. Apply rust preventative compound to all machined, polished, and non-ferrous surfaces that are not be painted.
- G. Furnish at least one (1) gallon of each type, part and color of the finish coat materials for field touchup.

PART 3 - EXECUTION

3.01 General Installation Requirement

- A. Pipe and equipment systems shall be in accordance with the applicable sections of Division 15.
- B. Cooperate with all trades in furnishing material and information for correct location, in proper sequence, of all sleeves, bolts, inserts, foundations, wiring, etc.
- C. Piping connections to equipment shall be made with unions, flanges or grooved type connections to permit dismantling. Flanges, unions or grooved type connections shall also be installed in the piping systems to allow disassembly consistent with good installation practice and as required for the removal of connected equipment from place of installation.

- D. Belt drives, flexible couplings, and other exposed rotating or reciprocating parts shall be covered with approved safety covers. Covers shall be permanent type and easily removable.
- E. Motor and bearings shall be covered with watertight and dustproof covers during construction period.

3.02 Coordination of Work

- A. Plan all work so that it proceeds with a minimum of interference with other trades.
- B. Openings in a structure(s) required for the installation of the work under this division of these Specifications shall be coordinated with the work of all other trades.
- C. Contractor shall pay for all extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.03 Interference

- A. Contractor shall arrange the run of the piping in such a manner that it does not interfere with grilles, switches, receptacle, light outlets, light fixtures, or other equipment.
- B. Pipe shall normally be run parallel to walls, ceiling, or floor.

3.04 Equipment Installation

- A. General: Necessary supports shall be provided for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and fans.
- B. Suspended Equipment: Provide hangers and vibration isolators from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown.
- C. Floor-Mounted Equipment:
 - 1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
 - 2. Install all equipment at locations and to dimensions shown on the Drawings. Set equipment accurately with principal centerlines, and level using manufacturer's leveling screws, blocks, shims, or wedges. There shall be no distortion of equipment or baseplates.
 - 3. Install shims that are to remain in place on both sides of anchors.
 - 4. Do not attach piping to equipment until after anchor bolts are tightened.

3.05 Insulating Coupling / Isolation Gaskets

- A. Furnish and install at all interconnections between piping systems of dissimilar materials and at all connections of piping systems to equipment where piping and equipment are of dissimilar materials.
- B. Couplings shall be specifically designed for the purpose of electrically isolating pipelines from other piping systems or equipment.

3.06 Welded Installation

- A. Shop fabricated to maximum extent possible.
- B. Use welders certified in accordance with the latest requirements of the American Welding Society "Standard Qualifications Procedures."
- C. Repair protective coating and linings to a condition equivalent to the factory-applied coating or lining.
- D. Install coupling at ends of pipe to be welded to provide access for replacing protective lining.

3.07 Access to Equipment

- A. All motors, valves, control devices, pipe and equipment supports, specialties, etc., shall be so located as to provide for easy access for operation, repair, and maintenance.
- B. Concealed access doors shall be provided where necessary.

3.08 Lubrication

- A. Provide lubrication for the operation of all equipment until acceptance.
- B. Provide a chart listing the proper type of oil or grease recommended and frequency of lubrication for each piece of equipment.
- C. Contractor shall run all equipment with lubricated bearings long enough for equipment to come up to temperature, or for ½ an hour, whichever is more. After equipment is run, Contractor shall drain and flush all bearings and refill with a new oil change.
- D. Oil and lubrication fittings shall be located within reach from the operating surface. In order to meet these requirements with equipment as furnished, minor deviation from the Drawings may be made as favorably reviewed by the Owner's Representative.

END OF SECTION 15010

**SECTION 15051
CODING AND IDENTIFICATION**

PART 1 - GENERAL

1.01 Summary

- A. This Section specifies the color coding and identification of mechanical and electrical systems as shown on the Drawings and as specified.

1.02 Related Work

- A. The work of the following Sections is related to the work of this section. Other Sections, not referenced below, may also be related to this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.
 - 1. Section 01300 - Submittals
 - 2. Section 09920 - Protective Coatings
 - 3. Section 11010 - Equipment General Provisions
 - 4. Section 15060 - Process Piping
 - 5. Section 15100 - Valves
 - 6. Section 16010 - Electrical General

1.03 General Requirements

- A. Work under this Section includes but is not limited to the following:
 - 1. Color coding all new and relocated exposed piping, valves, fittings, conduit, and accessories.
 - 2. Identification of all exposed piping, panels, equipment cabinets, and mechanical equipment.
 - 3. Locating devices for concealed controls and equipment and buried piping and utilities.

1.04 Submittals

- A. The Contractor shall submit product data and samples of legend markers, valve tags, and plastic plates indicating all colors prior to painting in accordance with Section 01300.

PART 2 - PRODUCTS

2.01 Identification Systems

- A. General: All exposed piping, and appurtenances shall conform to an identification system. Items shall be considered exposed unless buried or concealed in the construction. Insulated pipe shall be identified as required for the carrier pipe.
- B. Standards: All piping and equipment shall be coated in accordance with Section 09920. Identification markers for piping shall have background colors as specified herein. All identification shall be in accordance with the following standards unless otherwise specified or directed by the Owner's Representative. The Contractor shall obtain the Owner's Representative's approval of all color-coding and identification prior to application:
 - 1. ANSI A 13.1 for identification sizes and background coloring.
- C. Identification:
 - 1. Legend markers: Provide clip-on type markers with legends and/or symbols with borders as approved by the Owner's Representative. Arrows indicating direction of flow shall point away from legend. If flow may be both ways, use double-headed arrows.
 - 2. Plastic cloth for coding pipe shall conform to Fed. Spec. MIL-E-5272A and shall be fabricated from all temperature plastic cloth. Individual dispenser card shall be provided with release coating. Markers shall be W. H. Brady Company B-500, and B-946 for outside use, Seton, or equal. Markers for piping 3 inches in diameter and larger shall be Brady Styles 1, 2, or 3 and for piping less than 3 inches in diameter, Brady Styles 4, 6, or 8, or similar styles from Seton, or equal.
 - 3. Valve Tags: Valve tags shall be numbered, 1-1/2-inch diameter brass discs attached to the valve with a heavy brass link. Letters and numbers shall be 3/8-inch high, blocked type, filled with black enamel. Numbers and legends shall comply with an identification schedule provided by the Owner's Representative during construction.
 - 4. Equipment Plates: Equipment plates shall be black plastic with engraved white letters and trim. The letters shall be 1/2-inch high, blocked type. The plates shall be mounted on or adjacent to the equipment in a conspicuous place as approved by the Owner, with stainless steel screws.

PART 3 - EXECUTION

3.01 Piping Systems

- A. Identify piping by legend markers and arrows to show pipe contents and direction of flow. Legend markers and arrows shall be provided at the following locations:
 - 1. Behind every access door or panel.

2. At each valve.
 3. At each T joint.
 4. At each point of entry or exit where pipe passes through walls, floors or ceilings, or leaves a pipe trench.
 5. At intervals not exceeding 16 feet apart on long runs.
- B. On overhead piping, provide legends on the lower portion of the pipe where view from the floor is unobstructed.

3.02 Valve Tags and Directory

- A. All interior valves shall be provided with identification tags.
- B. Provide a directory of valves giving tag symbol, location, use, type, size, pressure rating, and manufacturer's name prepared with permanent ink. Five copies shall be delivered to the Owner's Representative for transmittal to the Owner. Generally, valves shall be marked with the name included in the Drawings. Approval of Owner's Representative is required for numbering system.

3.03 Equipment

- A. All equipment, including apparatus cabinets, switchgear, panels, dampers, fans, pumps, blowers, etc., shall have identification consisting of plastic plates as approved by the Owner's Representative showing equipment number, name, and function of each piece of equipment, and a designation corresponding to control diagrams and directions. Voltages shall be indicated where applicable.
- B. Plates shall be on outside of boxes, cases, motor control centers, control panels, etc.; except panel cabinets, which shall be identified on the inside of the doors unless otherwise indicated.

3.04 Colors for Piping Systems

- A. As specified in Section 09920, color of equipment and pipe shall be as shown on a schedule to be provided by the Owner. The District will prepare the color schedule after the protective coatings are favorably reviewed. Notify the Owner's Representative 30 days before the color schedule is needed.
- B. Background colors and legends for piping, legend markers, equipment, and miscellaneous items shall be as indicated in the color schedule to be provided by the District. All colors on all items shall comply with the Pipe Identification color coding as given in Section G2-2.8.3 of the *Criteria for Sewage Works Design* (the DOE "Orange Book").
- C. Paint color shall be for interior and exterior piping. Bands, where indicated, shall be 6 inches wide spaced at 5-foot intervals.

- D. The Work includes the following piping systems:

<u>Abbreviation</u>	<u>Description</u>
D	Drain
FE	Final Effluent
PAA	Peracetic Acid
SA	Sampler
V	Vent
W	Water

- E. Other piping not listed as directed by Owner.

END OF SECTION 15051

**SECTION 15060
PROCESS PIPING**

PART 1 - GENERAL

1.01 Summary

- A. This section specifies pipe materials and installation methods for the process piping.

1.02 Related Work

- A. The work of the following Sections are related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.

- 1. Section 01300 - Submittals
- 2. Section 15010 - Mechanical General Provisions
- 3. Section 15051 - Coding and Identification
- 4. Section 15070 - Piping Appurtenances
- 5. Section 15100 - Valves

- B. All pipe materials and methods shall conform to applicable requirements of documents of latest edition listed hereafter. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

- 1. American National Standards Institute (ANSI):
 - a. A13.1 Piping and Piping Systems
 - b. B16.1 Cast Iron Pipe Flanges and Flanged Fittings
 - c. B16.5 Pipe Flanges and Flanged Fittings, Class 150 (Flat Face Flange)
- 2. American Society of Testing and Materials International (ASTM):
 - a. A47 Malleable Iron Castings
 - b. A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
 - c. A240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
 - d. A536 Ductile Iron Castings
 - e. D1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

- f. D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - g. D2467 Socket-type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
 - h. D2564 Solvent Cements for Polyvinyl Chlorine (PVC) Plastic Pipe and Fittings
 - i. D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - j. D3295 Standard Specification for PTFE Tubing, Miniature Beading and Spiral Cut Tubing
 - k. D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
 - l. F714 Standard Specification for Polyethylene Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - m. F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
3. American Water Works Association (AWWA):
- a. C104 Standard for Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
 - b. C110 Standard for Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
 - c. C111 Standard for Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
 - d. C150 Standard for Thickness Design of Ductile Pipe
 - e. C151 Standard for Ductile Iron Pipe, Centrifugally cast, in Metal Molds or Sand Lined Molds for Water and Other Liquids
 - f. C153 Standard for Ductile Iron Compact Fittings, 3-inch through 16-inch for Water and Other Liquids
 - g. C208 Standard Dimensions for Steel Water Pipe
 - h. C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 - i. C606 Standard for Grooved and Shouldered-type Joints
 - j. C907 Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4-inch through 8-inch
4. 2015 UPC 2015 Uniform Plumbing Code

1.03 Submittals

- A. In accordance with the requirements of Section 01300, submit the following Project Data:
1. Manufacturer's technical data for all piping, and documentation of conformance with appropriate standards and these specifications.
 2. Detailed drawings of all exterior (yard piping, to within 3 feet of buildings and structures) piping prepared in conformance with the following:
 - a. Drawings shall accurately locate existing structures and piping to remain.
 - b. Drawings shall accurately show the location of all new structures and pipe, including the location of all valves, couplings, fittings, manholes, catch basins, vaults, cleanouts, tanks, thrust blocks, and restrained joint pipe.
 - c. Plan drawings shall be at a scale not less than 1-inch equals 10 feet.
 - d. Drawings shall be dimensioned to show relationship between structures and piping and appurtenances. Specific locations of new piping, method of connection, and methods of pipe penetration shall be shown on the drawings.
 - e. Shop fabrication spool drawings shall show alloys (where applicable), diameters, pipe wall thickness, fittings, branches, flanges and other joint preparation details, dimensions, and other appurtenances to be supplied
 - f. Drawings shall show all required thrust restraints.
 3. Detailed drawings of all interior and exposed piping requirements, prepared in conformance with the following:
 - a. Plan drawings shall be prepared for all areas involving piping and equipment at a scale not less than 3/8-inch equals 1 foot. Upper and lower plan drawings shall be prepared for the Headworks Structure. Sections shall be cut as required to clearly show piping in each of the plan drawings.
 - b. Drawings shall be dimensioned to verify the locations of existing pipe, conduit, valves, supports, and other appurtenances.
 - c. Drawings shall be dimensioned to show the location of all new piping, pipe joints, pipe supports, pipe penetrations, valve end connections, and all other piping appurtenances.
 - d. Drawings shall clearly show the methods of pipe joint connections, pipe support, pipe penetrations, valve end connections, and all other piping appurtenances.

- e. Shop fabrication spool drawings shall show alloys (where applicable), diameters, pipe wall thickness, fittings, branches, flanges and other joint preparation details, dimensions, and other appurtenances to be supplied.
- f. Indicate locations, spacing, and materials used to support pipes as required by the specifications, Drawings, and piping manufacturer.
- g. Drawings shall show structural and mechanical components of the piping systems separately if required for clarity.

1.04 Quality Control

- A. The Contractor shall utilize quality control procedures acceptable to the Owner's Representative for the following:
 - 1. Inspection of pipe before installation.
 - 2. Pipe unloading, storage, installation, and jointing.
- B. Tests performed in accordance with Paragraph 3.09 shall include, but not be limited to, the following:
 - 1. Hydrostatic Pressure Test
 - 2. Air Pressure Test
 - 3. Flushing and Disinfection
- C. Contractor shall prepare and submit for the Owner's Representative's approval a testing plan and schedule detailing:
 - 1. Testing equipment and procedure for each type of testing media (i.e. air and water)
 - 2. System, or portion of system, to be tested and at what phase of construction testing will be done.
 - 3. Testing procedure, pressure and time duration required for each test.
 - 4. Cleaning, flushing and disinfection required for each system and at what phase of construction.

PART 2 - PRODUCTS

2.01 General

- A. Materials required for all piping and connections shall be as specified herein. All pipe sizes shall be as shown on the Drawings.
- B. All pipe sizes as shown on the Drawings and as specified herein are in reference to "nominal" pipe diameter, unless otherwise indicated.

- C. The piping systems shown on the Drawings indicate the approximate horizontal and vertical configuration required. The Contractor shall determine the exact layout of piping, fittings, and joints necessary to fit actual field conditions.
- D. Restrained joints shall be of a type specified for each pipe material as specified below. Any other piping systems shall be submitted to the Owner's Representative for consideration as a Substitution Request.
- E. Non-restrained joints shall be either push-on or mechanical joint as specified below.
- F. Joint restraint or thrust blocks shall be placed at all fittings on buried pressure pipes. Submit drawings showing the location and number of joints restrained, or size of thrust block required, and calculation supporting the design.
- G. Pipe shall be installed with unions, couplings, and flanged coupling adapters as required to allow placement of the pipe and removal of valves and equipment.
- H. Each pipe system, including fittings, shall be provided by a single manufacturer.
- I. Gasket-type and material used shall be appropriate for each pipe system and service intended, and shall be as specified in Paragraph 2.07, Pipe Schedule.
- J. Isolation gaskets shall be used when joining fittings of two different materials. Gaskets shall ensure that the two materials are not in contact at any point during normal operation of the system. Isolation gaskets shall be the type and of the material recommended by the manufacturer of each piping system.
- K. Linings and external coatings on fittings shall conform to the pipe system they are associated with. Requirements of the pipe in a piping system shall also pertain to the fittings.
- L. External coatings shall be as specified in Section 09920.
- M. Hardware: Bolts, nuts, washers, and miscellaneous hardware shall be Type 316 stainless steel unless noted otherwise on the Drawings or in these Specifications. All hardware shall be assembled with anti-seize compound as recommended by the manufacturer.
- N. Provide neoprene elastomer wraps on all mechanical fittings and restraints for buried piping installations.
- O. Provide restraint joints or thrust blocks on all pressurized piping system as indicated herein and on the drawings.

2.02 High Density Polyethylene (HDPE) Pipe

A. Materials

1. HDPE pipe and fittings shall be extruded from an extra-high molecular weight, high-density PE compound conforming to ASTM D3350 for a PE4710 material. This material shall have a compressive yield strength of 1,600 LBS/SQ IN when tested and analyzed by ASTM D695, and a tensile yield strength of 3,200 LBS/SQ IN when tested and analyzed by ASTM D638.
2. The PE compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2 percent.
3. The manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe and fittings for this project.
4. HDPE products shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specifications from the same raw material supplier.

B. Pipe

1. The same manufacturer shall supply polyethylene pipe and fittings. Pipe and fittings from different manufacturers shall not be interchanged.
2. Pipe and fittings shall be of the nominal diameter shown on the Drawings. All pipe sizes, either solid or perforated, shall conform to ASTM F714.
3. The HDPE pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. Any pipe with nicks, scrapes, or gouges deeper than 5 percent of the nominal wall thickness shall be rejected. The pipe shall be uniform in color, opacity, density, and other physical properties.
4. HDPE pipe shall be SDR 17.
5. All HDPE pipe shall be ductile iron pipe size (DIPS) unless otherwise noted.

C. Fittings

1. HDPE fittings shall be from the same manufacturer as the pipe, molded or fabricated from HDPE pipe and shall have the same SDR as pipe connecting to the fitting. HDPE fittings shall be molded, for sizes 6-inch and smaller, if manufactured as a standard item. All other HDPE fittings shall be fabricated from HDPE pipe by means of thermal butt-fusion unless otherwise noted.

2. All molded HDPE fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications. All fabricated HDPE fittings shall have the same or higher pressure rating as the adjoining pipe when installed in accordance with the manufacturer's recommendations.
3. Provide stainless steel backing rings at all flanged connections of HDPE pipe and fittings.

2.03 Copper Pipe

A. Pipe

1. Copper tubing shall be seamless copper, conforming to ASTM B88 and shall be Type L, drawn, where used in exposed service and Type K, annealed for buried service.

B. Couplings and Fittings

1. Coupling and fittings for copper tubing 1-inch and smaller nominal diameter shall be compression type, brass or bronze, capable of holding the full bursting strength of the tubing; shall meet the requirements of ANSI B16.26; and shall be Imperial, Parker, Swagelok, or equal.
2. Couplings and fittings for copper tubing larger than 1 inch nominal diameter shall be wrought copper or bronze, solder joint pressure fittings and shall conform to ANSI B16.22.

C. Solder

1. Solder to be used in copper piping shall be 50% lead and 50% tin and shall conform to alloy Sn 50 of ASTM B32.

2.04 PVC Pipe

A. Pipe

1. PVC pipe shall be Schedule 80, normal impact, and shall conform to ASTM D1784, Class 12454-B.

B. Fittings

1. Fittings shall be Schedule 80 PVC socket type, normal impact and shall conform to ASTM D2467.

2.05 PTFE Tubing

- #### **A. Tubing**
- Tubing shall be standard wall and conform to ASTM D 3295 Specification for PTFE tubing.

- B. The hose shall be standard 1/16" wall with I.D. as called out of the drawings
- C. Hose working pressure at 73 deg. F shall be 240 psi and a tensile strength of 2,500 to 3,000 psi.
- D. Fitting shall be Type 316 stainless steel barb fittings, or approved equivalent

2.06 Stainless Steel Pipe

- A Pipe and Fittings
 - 1. Shall be Type 316 Schedule 40 manufactured from ASTM A240 annealed and pickled sheets and plates in accordance with ASTM A312 or A778, Vertical diffuser piping shall be Type 316 Schedule 80 manufactured from ASTM A240 annealed and pickled sheets and plates in accordance with ASTM A312 or A778.
 - 2. The fabricated Type 216 stainless steel pipe and fittings shall be furnished by a single fabricator. The pipe and fittings shall be shop fabricated and field installed in accordance with approved shop drawings.

2.07 Pipe Supports

- A. All components of the pipe supports, including but not being limited to all base plates, stanchions, clamps, saddles, brackets, couplers, hinges, supports, U-bolts, and rods shall be Type 316 stainless steel. All hardware, anchors and fasteners for all pipe supports shall also be Type 316 stainless steel.
- B. Pipe supports shall consist of channels, posts, post bases, clamps, brackets, fittings, and accessories. Pipe supports shall be Unistrut P1000 series, 1 5/8-inch or approved equal.
- C. Length shall be as required to accommodate the pipe clamp or clamps, and anchor bolts. Length shall be 12" minimum.
- D. Anchor bolts shall be type as required for the mounting surface. A minimum of two bolts shall be used for each channel.

2.08 Pipe Schedule

PIPE LEGEND	PIPING SYSTEM	EXPOSURE	PIPE MATERIAL	LINING	JOINTS	GASKET MATERIAL	TEST MEDIUM, PRESSURE/DURATION
D	DRAIN	ALL	PVC (SCH 80)	BARE	SOLVENT WELD		WATER, 15 PSI/120 MIN
FE	FINAL EFFLUENT	INTERIOR OR EXPOSED	SST (SCH 40)	BARE	THREADED	PTFE OR PVDF	WATER, 120 PSI/120 MIN
PAA	PERACETIC ACID	BURIED OR EXPOSED	SST (SCH 40)	BARE	THREADED	PTFE OR PVDF	WATER, 120 PSI/120 MIN
PAA	PERACETIC ACID	SUBMERGED (DIFFUSER)	SST (SCH 80)	BARE	THREADED	PTFE OR PVDF	
PAA	PERACETIC ACID	EXPOSED OR CONTAINED	PTFE TUBING (1/16" WALL)	BARE	SST BARB FITTING		WATER, 120 PSI/120 MIN
SA	SAMPLE	EXPOSED	PVC (SCH 80)	BARE	SOLVENT WELD		WATER, 30 PSI/120 MIN
V	VENT	INTERIOR OR EXPOSED	SST (SCH 40)	BARE	THREADED	PTFE OR PVDF	WATER, 60 PSI/120 MIN
W	WATER	BURIED OR ENCASED	HDPE (SDR 11 IPS) OR COPPER (TYPE K)	BARE	FUSION WELDED / THREADED		WATER, 150 PSI/30 MIN
W	WATER	EXPOSED	COPPER (TYPE L)	BARE	SOLDER / THREADED		WATER, 150 PSI/30 MIN

2.09 Pipe Identification

- A. Plastic markers for coding pipe shall conform to ANSI A13.1 and shall be as manufactured by W.H. Brady Company, Seton Name Plate Corporation, or equal. Markers shall be the mechanically attached types that are easily removable; they shall not be the adhesive attached type. Markers shall consist of pressure-sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Pipe identification shall be as specified in Section 15051 - Coding and Identification.

PART 3 - EXECUTION

3.01 General

- A. LOCATION: The Contractor shall be responsible for checking and verification of all existing piping and appurtenances whether or not they are shown on the Drawings. The Contractor shall excavate and locate all existing pipes, appurtenances, and points of connection. The Contractor shall check and verify or modify horizontal and vertical locations of each and every exposed piping run. The Contractor shall be responsible for the protection of all existing piping, appurtenances, and structures during construction and shall take care not to damage them or impair the operation in any way.

B. PIPE SUPPORTS

1. The Contractor is responsible for supporting all pipe. Pipe supports shall be installed strictly in accordance with applicable standards and codes and recommendations of the piping support system manufacturer and piping manufacturer.
2. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.
3. Minimum pipe support spacing shall be as follows:

<u>Nominal Pipe Size, inch</u>	<u>Maximum Span, feet</u>
3/8	5
1/2	5
1	6
1 1/2	8
2	8

4. Provide insulation protection shields at all pipe supports for insulated piping, as specified in Section 15070, Piping Appurtenances.
5. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing that directly contact the pipe shall be copper-plated or rubber- or vinyl-coated. Additionally, those portions of pipe supports that contact other dissimilar metals shall also be rubber- or vinyl-coated.

- C. JOINT RESTRAINT: Bends and tees in all pressure piping systems shall be restrained for the test pressure, unless specified otherwise.
- D. LINE AND GRADE DEVIATIONS
1. Buried, Bedded, and Encased Pipe: Variance from required line and grade shall not be greater than 1/16 of the nominal pipe diameter and shall not exceed 1 inch. In so far as possible, all gravity flow pipe shall be laid at constant line and slope.
 2. Exposed Pipe: Variance from required line and grade shall not be greater than 1 inch. All pipe shall be laid in straight runs with fittings as required for bends. Gravity flow pipe shall be laid at constant slope.
- E. BURIED PIPE LAYING
1. Preparation of bedding and backfill shall be as specified in Division 2 and shown in the Drawings. Pipe shall be laid with uniform bearing under the full length of the barrel of the pipe.
 2. The interior of the pipeline shall be cleaned as the work progresses.
- F. PIPE PENETRATIONS
1. Pipe penetrations into structures shall be as shown on the Drawings. Seep rings shall be provided for all pipe penetrations from exposed to buried or submerged conditions, unless shown otherwise on the Drawings.
 2. Where any piping 2 inches in diameter and larger passes from a concrete structure into earth, two flexible joints or sleeve-type mechanical couplings shall be provided at the face of the structure. The first joint or coupling shall be located at a distance from the face of the structure of not greater than 1½ times the nominal pipe diameter or 12 inches, whichever is greater. The second joint or coupling shall be located at a distance from the first of not greater than the distance from the first to the face of the structure. Push-on or mechanical pipe joints are considered a flexible joint. Flexible joints may be specifically shown or called out on the Drawings only for some pipe; but this shall not relieve the Contractor from the requirement to provide joints on all piping as specified above.
- G. ELECTRICAL ISOLATION: All connections between dissimilar metal pipe, such as copper or bronze to steel or stainless steel, coated to uncoated metallic piping, or piping with different types of coatings, shall be electrically isolated with an electrically insulating fitting. Fittings shall be unions, couplings, or flange sets for the service intended unless specified otherwise. Electrical isolation between valve and stainless steel piping for air service is not required. The Owner's Representative may conduct tests to verify electrical isolation.

H. COUPLINGS AND JOINTS

1. Sleeve-type mechanical pipe couplings shall be provided in strict accordance with these specifications and the manufacturer's instructions. Grooved-end flexible couplings shall be installed in strict accordance with these specifications, AWWA C606, and the manufacturer's instructions. Grooved-end couplings shall not be employed on buried, encased, or embedded applications unless otherwise indicated on the Drawings and elsewhere in the specifications.
 2. Where cutting of existing pipe is required for new fitting installation, the Contractor shall replace the entire length of pipe to the nearest joint.
 3. Couplings shall be installed on exposed piping at walls, valves, and equipment to allow disassembly of the piping. Unions shall be employed on piping 2 inches and smaller. Flanged or grooved-end coupling joints shall be employed on piping 3 inches and larger. Where piping passes through walls, couplings shall be provided within 2 feet of wall. A coupling shall be provided within 2 feet of each threaded-end valve unless the valve can otherwise be easily removed from the piping.
- I. EXPANSION JOINTS: Expansion joints or couplings, where indicated, shall be located and spaced as recommended by the manufacturer to accommodate pipe movement due to temperature changes for the pipe joint system utilized. Expansion joints or couplings shall be suitable for the pressures specified in the Pipe Schedule and an ambient temperature range of 0 to 100 degrees Fahrenheit. Expansion joints shall not be installed during times of temperature extreme or in a fully compressed or expanded condition.

3.02 Stainless Steel Pipe

- A. After the manufacture of individual stainless steel fittings and pipe assemblies, they shall be pickled by immersion in a tank containing an ambient nitric hydrofluoric acid solution made up from Oakite Deoxidizer SS, or equal. The duration of immersion shall be 15 to 20 minutes and may be supplemented by manually scrubbing or brushing with non metallic pads or stainless steel wire brushes. The acid treatment shall be followed by immersion in a rinse water tank, followed if necessary by a spray rinse. The stainless steel products shall then be allowed to air dry to achieve passivation.
- B. Welding of pipe spools shall be performed using welders and procedures qualified in accordance with ASME Section IX. Piping with wall thicknesses up to and including 11 gauge (0.125") shall be welded with the TIG (GTAW) process. Heavier walls shall be beveled according to procedure, root pass welded with the TIG (GTAW), and have subsequent weld passes performed using the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process.
- C. After shop fabrication into pipe spools, exterior welds shall be manually scrubbed or brushed with non metallic pads or stainless steel wire brushes to remove weld discoloration, rinsed with clean water and allowed to air dry.

- D. Whenever possible, minimize need for any field welding by making field connections between welded segments using flanges.
- E. After installation, painting of the stainless steel pipe is not required. However, the contractor shall be responsible for supplying and installing the stainless steel piping with a consistently clean surface.
- F. After installation, the piping system shall be tested by the Contractor according to this specification and Pipe Schedule.

3.03 PVC Pipe

- A. GENERAL: PVC pipe smaller than 3 inches in diameter shall be solvent welded unless otherwise specified or shown on the Drawings. PVC gravity sewer pipe shall be gasketed.
- B. TESTING: Testing of all plastic piping shall be as specified in this section and the Pipe Schedule.
- C. FOUNDATION DRAINS: Foundation drains shall be required as shown on the drawings. Pipe shall be perforated, except that pipe noted as "tight-line" on the drawings, which shall be non-perforated.

3.04 HDPE Pipe

- A. Install HDPE pipe in accordance with the manufacturer's instructions. Do not make final connections under extreme cold or hot weather that will generate issues with thermal expansion/contraction after the pipe is buried and returns to a neutral temperature.
- B. After installation, the piping system shall be tested by the Contractor according to this specification and the Pipe Schedule.

3.05 Copper Pipe

- A. FABRICATION
 - 1. Solder Joints. All pipe and fittings shall be jointed with solder, shall be free from all burrs, and wire-brushed or steel-wool-cleaned. Solder shall then be applied and flame passed toward the center of the fittings until the solder disappears. All excess solder shall be removed while it is still plastic. Absolutely no acid flux or acid wipe shall be used in making solder joints.

2. Dielectric Protection. Wherever a metallic pipe or appurtenance is connected to another metallic pipe or appurtenance, a dielectric union or coupling shall be installed. Wherever copper pipe is supported from hangers, it shall be suitably insulated from the hangers. Care shall be taken that copper tubing or fittings are not permitted to come into contact with steel piping, reinforcing steel, or other steel at any location. Electrical checks shall be made between copper piping and steel elements to assure that discontinuity is maintained. Wherever electrical contact is demonstrated by such tests, the Contractor shall locate the point or points of contact and correct this condition.
- B. **DISINFECTION AND TESTING:** Disinfection of all copper piping shall be as specified in Paragraph 3.11. Testing of all copper piping shall be in accordance with this section and the Pipe Schedule. Disinfection is not required for piping downstream of the Air Gap Pump Station on 2W water system.

3.06 Piping Identification

- A. **PIPE CODING:** After application of the specified coating and insulating systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases, and valve vaults shall be identified with plastic markers as specified Section 15051. Legend markers and directional arrows shall be located in each side of walls, floors, and ceilings at one side of each piece of equipment, at piping intersections, and at 15-foot centers.

3.07 Testing

- A. Contractor shall perform all tests specified. Provide all test equipment including test pumps, gauges, volumetric measuring equipment, and other equipment required. Pressure gauges used shall be graduated in increments not greater than 5 psi and shall have a range of approximately twice test pressure. Use only gauges and instruments recently calibrated.
- B. Where testing is specified, completed installation shall comply with designated requirements. Provide replacement materials as may be required to accomplish this compliance.
- C. **PIPING**
 1. **General**
 - a. Remove from systems, during testing, all equipment which would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system. Where new pipe connects to existing piping, the joint between the two pipes shall be tested. Correct leaks by remaking joints with new material; makeshift remedies will not be permitted. Test time will be accrued only while full test pressure is applied to system.

- b. The Contractor shall be responsible for providing all temporary fittings, plugs, and thrust blocking for all testing at the specified pressure.
 - c. Perform all testing before backfilling, concealing, insulating, or painting.
- 2. Allowable Leakage
 - a. Leakage shall be zero at the specified test pressure throughout the specified duration for all systems.
- 3. Drain Systems
 - a. Drain systems (Drain, Storm Drain and Foundation Drain) other than pumped drain systems, shall be tested in accordance with Section 318 of the 2015 Uniform Plumbing Code, except that no leakage shall be allowed for drain and vent systems.
- 4. Correction
 - a. Each section of pipeline which fails the pressure test and connection pipe and fittings that are observed to leak shall be removed and either properly reinstalled, or replaced with new materials. Reinstalled and replaced pipeline sections shall be pressure tested after completion of backfilling.

D. VALVES

- 1. Test valve bonnets for tightness. Test operate valves from closed-to-open-closed position while valve is under piping pressure.
- 2. Test automatic valves by actuating from fully open to fully closed position.

E. HANGERS AND SUPPORTS: With systems in normal operation, test hangers, supports, and rods to ensure they are plumb and support proper share of load. Additionally support, as required, systems and equipment that sway, crawl, and vibrate.

F. OTHER MATERIALS AND EQUIPMENT: Test other materials and equipment as specified, as recommended by equipment manufacturer, or directed to assure they are complete, operable, and ready for use.

3.08 Cleaning

- A. Clean equipment and materials. Remove foreign materials including dirt, grease, and other matter.
- B. Clean by flushing, interior of water piping after pressure testing. Upon completion of flushing, completely drain systems at all low points; remove, clean, and replace all strainer baskets and refill systems.

3.09 Disinfection

- A. Provide means to inject a 50 ppm chlorine solution within 2 to 3 feet of the connection to the existing service and flush the system completely with this solution. Inject solution at a continuous and even rate until the free chlorine residual concentration at each outlet shows 50 ppm. Close all outlets and let the solution remain in the pipes for 24 hours. After 24 hours test the free residual and demonstrate that it is no less than 10 ppm. After this disinfection procedure has been adequately completed to the satisfaction of the Owner's Representative, flush the piping and confirm that the residual at all outlets is less than 0.5 ppm.
- B. Chlorine residual testing shall follow AWWA C651, Appendix A, DPD Drop Dilution Method. All testing shall be performed by the Contractor.
- C. After completion of disinfection, the Owner shall test samples for bacteriological analyses. The total plate count must be less than 100 bacterial per cubic centimeter, otherwise the disinfection procedure must be repeated.
- D. Dechlorinate and dispose of chlorinated water in accordance with applicable regulations.

END OF SECTION 15060

SECTION 15070 PIPING APPURTENANCES

PART 1 - GENERAL

1.01 Summary

- A. This section specifies pipe appurtenances that include, but are not limited to, mechanical fittings, flexible fittings, couplings, unions, saddles and other special equipment/materials.

1.02 Related Work

- A. The work of the following Sections is related to the work of this section. Other Sections, not referenced below, may also be related to this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.
 - 1. Section 01300 - Submittals
 - 2. Section 11010 - Equipment General Provisions
 - 3. Section 15010 - Mechanical General Provisions
 - 4. Section 15060 - Process Piping
 - 5. Section 15100 - Valves

1.03 Submittals

- A. In accordance with the requirements of Section 01300, submit the following Project Data:
 - 1. Catalog information
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 Modular Mechanical Expanding Seal

- A. The modular mechanical expanding seal shall include a complete assembly consisting of a sleeve (as indicated on the Drawings) and sufficient quantity of modular seals required to provide a hydrostatic seal for pipe penetrations.
- B. The seal shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and shall have the following properties as designated by ASTM as follows:

1. Service Temperature: -40 to +250°F
 2. Elastomer: EPDM, ASTM D2000 M3 BA510
 3. Color: Black
- C. The seal pressure plates shall be molded of glass reinforced Nylon Polymer.
- D. All fastener shall be 316 stainless steel per ASTM F593-95, with an 85,000-psi average tensile strength.
- E. Sleeves shall be molded, high-impact resistant HDPE. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.
- F. Seal assemblies shall be Link-Seal as manufactured by GPT Industries, or equal. Sleeves shall be Century-Line as manufactured by GPT Industries, or equal.

2.02 Service Saddle

- A. Service saddles shall be of the ductile iron saddle with stainless steel double strap design.
1. Romac 202N-H
 2. Or approved equal
- B. Tap size and thread type shall be coordinated with corp stop, see Section 15100.
- C. Pressure rating shall be greater than test pressure of piping system.
- D. Materials:
1. Body: Nylon coated ductile iron.
 2. Straps: Type 316 stainless steel.
 3. Hardware: Type 316 stainless steel.
 4. Gasket: Buna-N.
- E. Manufacturing and testing shall comply with the latest revision of AWWA C800 standards and are certified to NSF 61.

2.03 Pipe Insulation

- A. Pipe insulation shall be applied to all process piping that is exposed. For pipes that are double contained provide pipe insulation on the outside containment piping.

- B. Insulation material shall be pre-molded fiberglass with a maximum “K” value of 0.25 at 70 degrees Fahrenheit and have a factory-applied jacket. Pipe insulation shall be Johns Manville “Micro-Lock” with scrim foil jacket, or equal. Section joints shall be sealed with self-sealing laps and butt strips.
- C. Provide Type 316 stainless steel roll or cut and roll jacketing, elbows, and accessories for all exposed insulation in accordance with ASTM C1767. Jacket shall be minimum 0.020 inches thick with a stucco embossed finish. Use pressed elbow covers as available. Jacketing for tees, valves, flanges, caps, etc. shall be factory or field-fabricated to fit closely around insulation. Use stainless steel banding. Sealants shall be used to seal around protrusions, insulation terminations, and jacketing slip joints. Jacketing shall be as manufactured by ITW Insulation Systems or equal.
- D. Provide stainless steel insulation protection shield (top and bottom) at all pipe supports to protect insulation from being crushed. Type B3154 by Cooper Industries or equal.
- E. Insulation shall be continuous where insulated pipe passes through structures.

2.04 Electric Heat Tracing

- A. Heat tape shall be self-regulating industrial grade heating cable to be applied to all exposed PAA, sample, effluent and water piping.
- B. The heating cable shall consist of two 16 AWG or larger copper bus wires embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. A ground fault protection device shall protect each circuit. The cable shall have a copper braid wire around the core with a cross sectional area equal to, or greater than, the conductor cross-sectional area. The braid shall be protected with a fluoropolymer outer jacket. Heating cable shall be Pentair Raychem 5BTv, or equal.
- C. The heating cable shall have a capacity of approximately 5 watts per foot at 40 degrees Fahrenheit using 120-volt, single-phase power.
- D. The heating cable shall be UL approved; suitable for a Class 1, Division 2 hazardous environment; and operate without the use of thermostats.
- E. The heat tracing system shall be supplied complete with power connection kits, splice kits, tees, end seals, installation tape, pipe straps and labels. Heating cable shall be attached to the pipe by means of fiberglass or aluminum tape. Installation and testing of the heat tracing system shall be in strict accordance with the manufacturer’s instructions.
- F. Pipe insulation specified in Paragraph 2.06 above shall be applied after the heat tracing system has been successfully installed and tested.

2.05 Cleanout Boxes

- A. Cleanout boxes shall have cast iron body and cover. Cover shall be stamped "Sewer." Cleanout shall consist of two (2) 45 degree bends from system's horizontal wye connection and be provided with a compression style plug.

PART 3 - EXECUTION

3.01 Installation

- A. Piping appurtenances shall be installed in accordance with the manufacturer's recommendation and at the location shown on the plans.

END OF SECTION 15070

SECTION 15100 VALVES

PART 1 - GENERAL

1.01 Summary

- A. This Section specifies valves for process piping.

1.02 Related Work

- A. The work of the following Sections is related to the work of this section. Other Sections, not referenced below, may also be related to this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.

1. Section 01300 - Submittals
2. Section 09920 - Protective Coatings
3. Section 15010 - Mechanical General Provisions
4. Section 15060 - Process Piping
5. Section 15070 - Piping Appurtenances

1.03 Quality Assurance

- A. Referenced Standards: 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 a listed document, the requirements of this section shall prevail.

- B. References:

1. American National Standards Institute (ANSI):
 - a. B16.1 Cast Iron Pipe Flanges and Flanged Fittings
2. American Petroleum Institute Specifications (API) 609.
3. American Society of Testing and Materials International (ASTM):
 - a. A126 Gray Iron Castings for Valves, Flanges and Pipe Fittings
 - b. A436 Austenitic Gray Iron Castings
 - c. A536 Ductile Iron Castings
 - d. B584 Standard Specification for Copper Alloy Sand Castings for General Applications

- e. D2000 Standard Classification System for Rubber Products in Automotive Applications
- 4. American Water Works Association (AWWA):
 - a. C500 Standard for Gate Valves 3- through 48-inch for Water and Sewage Systems
 - b. C504 Standard for Rubber Seated Butterfly Valves
 - c. C508 Standard for Swing-check Valves for Ordinary Water Works Service
 - d. C517 Resilient-Seated Cast-Iron Eccentric Plug Valves
 - e. C550 Protective Epoxy Interior Coatings for Valves and Hydrants

1.04 Submittals

- A. In accordance with the requirements of Section 01300, submit complete literature of manufacturer, described in full the characteristics of each item and its pertinent dimensions.

PART 2 - PRODUCTS

2.01 General

- A. All valves shall be manufacturer's standard design unless otherwise specified and shall be furnished with operating wheel, wrench nut, or lever as indicated. Unless otherwise indicated, the direction of rotation of the wheel, wrench nut, or lever to open the valve shall be counter-clockwise and shall have cast thereon the word OPEN. Unless otherwise required by the connecting piping, all 2-inch or smaller valves shall have threaded ends. A union, grooved-end connection, or other special connector allowing easy removal shall be provided within 2 feet of each threaded end valve unless the valve can be otherwise easily removed and such technique of removal is approved by the Owner's Representative.
- B. All valves of the same type shall be from a single manufacturer.
- C. Cast-iron valve boxes extending to the finished or established ground or paved surfaces shall be provided for all buried valves. They shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put hinged covers. Boxes shall be of the screw or sliding type having 5¼-inch shaft diameter or greater. All parts of the valve boxes, bases, and covers shall be coated by dipping in hot bituminous varnish, except that part set in concrete shall be galvanized. Covers for all boxes shall have cast thereon an appropriate name designating the service for which the valve is used. All valve boxes shall be set in a concrete pad as shown on the drawings, except where valve box is set in concrete sidewalk. See also Section 15070.

- D. All buried valves shall have position indicators in the valve box and wrench nut operator. Wrench nuts shall be provided on all buried valves, on valves which are to be operated through floor boxes, and where shown. All wrench nuts shall comply with Section 20 of AWWA C500. Extend shafts to within 6 inches from grade, and support every 5 feet with the last support just below the operating nut. Buried valves have 2-inch AWWA nut operator.
- E. Manual operators shall be as required for each specific valve.

2.02 Ball Valves

- A. All ball valves shall be vented two-piece type 316 stainless steel construction with threaded ends, minimum 80% port opening.
- B. Rated working pressure shall be 200 psi or greater.
- C. Ball valves shall have locking operator handles.
- D. Valves for all other services shall be stainless steel body; stainless steel ball and stem; PTFE seats, gaskets, packing and thrustwasher; stainless steel lever; Nibco T-580-S6-R-66-LL, or equal.

2.03 Degassing Valves

- A. Install the degassing valves at the highest points along the common discharge and suction piping. Provide discharge vents as indicated in the Drawings
- B. Degassing valve shall be constructed of Type 316 stainless steel or PVDF and have a ½-inch process connection. Provide reducer tees, bushings, and/or nipples as required for connection with process piping.
- C. Degassing valve shall have maximum temperature and pressure ratings or 180 degrees F and 150 psi, respectively.
- D. Degassing Valve shall be Accu-Vent Automatic Degassing Valve by Primary Fluid Systems Inc. or equal.

2.04 Corp Stop

- A. Corporation valve shall be brass construction design with thread by compression for connection to service saddle and transitioning to HDPE piping respectively
- B. Manufacturing and testing shall comply with the latest revision of AWWA C800 standards and are certified to NSF 61.
- C. Inlet: 1 ½" I.P. thread
- D. Outlet: Conduction compression connection for 1 ½" CTS OD HDPE tubing
- E. Corp Stop shall be Mueller Ori-Corp H-15023N corporation valve or equal.

PART 3 - EXECUTION

3.01 Installation

- A. All valves shall be installed in accordance with the referenced standards and the manufacturer's recommendations.
- B. Valves shall be installed where shown on the drawings and in accordance with the manufacturer's recommendations. Valves, for liquid containing solids (wastewater and sludge lines) shall be installed as follows:
 - 1. For horizontal pipe, the valve plug shaft shall be in the horizontal plane with the plug rotating towards the top of the valve body.
 - 2. For vertical pipe, the valve should be installed with seat end on the top side regardless of the flow direction, with the plug rotating to the top of the valve.

3.02 Testing

- A. Valves shall be tested as part of the piping for leakage in accordance with Section 15060. Testing shall also be conducted to verify that the wiring is correct, and the valve will operate as specified. Electrical and control shall be as specified in Division 16.

END OF SECTION 15100

**SECTION 16010
ELECTRICAL GENERAL**

PART 1 - GENERAL

1.01 Scope

- A. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

1.02 Definitions

- A. The word "**provide**" shall be interpreted to mean furnish and install.
- B. "**Owner**" is the City of Snohomish, WA
- C. "**Contractor**" is the party who furnishes and installs all materials and equipment. This includes the Prime Contractor and all other Contractors and Sub Contractors.

1.03 General Description of Work

- A. The Contractor shall:
 - 1. Provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the plans and these specifications.
 - 2. Provide identification (nameplates and wire tags) of all electrical equipment and wiring.
 - 3. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components, accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified function properly.
 - 4. Provide detailed wiring diagrams showing all equipment and instrumentation connections and terminations.
 - 5. Check electrical equipment prior to installation so that defective equipment is not installed. Do not begin demolition or replacement until replacement parts are on site and have been properly checked.

6. Provide start-up, follow-up and training of the Owner's personnel for electrical systems. Make all corrective measures required during start-up. See specific requirements for training and start-up in other specification sections.
7. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up of operation of the equipment, and to correct any problems, which occur during start-up.
8. Pay for and obtain electrical permits necessary to complete the Work.

1.04 Equipment Coordination

- A. The Contractor is responsible to coordinate the equipment supplied from other manufacturers. This includes but is not limited to:
 1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.
 2. Verifying the equipment supplied will fit within the space allocated.
 3. Coordination of equipment and the electrical power and control requirements provided in all sections of the specifications and drawings.
 4. Providing all necessary control wiring and components for any special requirements from an equipment manufacturer.
- B. The Contractor shall verify as a minimum:
 1. Correct voltage, phase and frequency.
 2. Size and space requirements.
 3. Mounting requirements.
 4. Proper coordination with the controls.
- C. Any discrepancies between the electrical and other equipment shall be brought to the immediate attention of the Owner.

1.05 Coordination of Electric Service Shutdowns

- A. Obtain the Owner's approval at least seven (7) calendar days prior to shutdown of any utility, service or operation of the existing facility. Give required notice and make appropriate arrangements with utility owners and other affected parties prior to shutdown of any utility service.

1.06 Project Description

- A. In general, the project consists of the addition of a new engine generator set, automatic transfer switch, and associated wiring.
 1. Provide O&M, record drawings and training.

1.07 Temporary Operation and Construction Power

- A. Facility Operation Power:
 - 1. Provide temporary power service for critical facility operation during construction as indicated on the plans. Provide power and control systems, circuits and components, and connections for all motors and equipment that remain in operation during construction. The Contractor shall pay for all construction costs for temporary facility power.
 - 2. Any necessary modifications to the existing electrical system for temporary or construction power shall be coordinated and paid for by the Contractor.

1.08 Standards and Codes

- A. Permits, licenses, approvals and other arrangements for work shall be obtained and paid for by the Contractor and included in the bid price.
- B. Electrical work shall be executed in strict accordance with the latest edition of the National Electrical Code and local ordinances and regulations.
- C. All electrical equipment, materials, construction methods, tests and definitions shall be in strict conformity with the established standards of the following in their latest adopted revision:
 - 1. Underwriters' Laboratories, Inc. (UL)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Canadian Standards Association (CSA)
 - 4. Electrical Testing Laboratories (ETL)
 - 5. Factory Mutual (FM)
 - 6. All applicable Washington State Codes and local City Codes.
- D. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- E. All materials shall be new, free from defects, of current manufacture, of quality specified or shown. Each type of material shall be of the same manufacturer throughout the work.

1.09 Contract Documents

- A. The electrical layouts are generally diagrammatic. The location of equipment is approximate unless dimensioned. Exact locations and routing of conduits shall be governed by structural conditions and physical interference's and by locations of electrical terminations on equipment.

1.10 Reference Documents

- A. The Contractor shall refer to the drawings, project data and shop drawings for additional details, which affect the proper installation of the work. Diagrams and symbols showing electrical connections are diagrammatic only, and so do not necessarily show the exact physical arrangement of the equipment.

1.11 Site Familiarization

- A. Before submitting a bid, the Electrical Contractor shall become familiar with all features of the site, which may affect the execution of the work. The Contractor shall take all field measurements necessary for the work and shall assume full responsibility for their accuracy. Any damage to existing equipment shall be repaired or replaced by the Contractor at a cost negotiated with the Owner.

PART 2 - PRODUCTS

2.01 Nameplates

- A. Nameplates shall be provided on all electrical devices, (including but not limited to motor control equipment, MCC cubicles, control stations, junction boxes, panels, motors, instruments, solenoids, switches, indicating lights, meters, and all electrical equipment enclosures.)
- B. Nameplates shall also be provided on all electrical panel interior equipment, including but not limited to: relays, circuit breakers, power supplies, terminals, contactors, and other devices.)
- C. All nameplates shall include the equipment name and number (circuit number and function, if applicable).
- D. Nameplates of all powered equipment (including instruments, motors, control panels, HVAC, etc.) and all switches, disconnects, and receptacles shall have included on the nameplate the power source (circuit and panel number, MCP/control pnl and circuit #, or MCC and unit number, etc.) that the equipment is fed from.
- E. Nameplates shall be made of 1/16" thick machine engraved laminated phenolic having black letters not less than 3/16" high on white background or as shown on the drawings or other sections of the specifications. Nameplates on the interior of panels and on light switches and receptacles shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or equal.
- F. All nameplates shall include the equipment name and number (and function, and circuit number if applicable).
- G. Provide warning nameplates on all panels and equipment, which contain multiple power sources. Lettering shall be white on red background.

- H. Provide information or warning nameplates as required by the NEC or electrical inspector for identification of service disconnects, multiple service disconnects etc.
- I. Nameplates shall be secured to equipment with stainless steel screws/fasteners/straps. Epoxy glue may be used where fasteners are not practical if first approved by the Engineer.

2.02 Wire Markers

- A. Each power and control conductor shall be identified at each terminal to which it is connected. Conductors size No. 10 AWG or smaller shall have identification sleeves. Conductors shall be identified in accordance with the Owner's standard.
- B. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink. The figures shall be 1/8 inch high. Sleeves shall be white tubing, sized to fit the conductor insulation. The sleeves shall be shrunk to fit the conductor with hot air after installation.
- C. They shall be TMS Thermofit Marker System by Raychem Co., sleeve style wire marking system by W.H. Brady Co., or equal. Adhesive strips are not acceptable. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

2.03 Thermal (Temperature) Ratings of Equipment Terminations

- A. Wiring and circuit breakers on this project are designed for 75°C operation above 30 amperes; 60°C for 30 amperes and below.
- B. All products furnished on this project shall have electrical terminations rated for 60°C for ampacities of 30 amperes or less and rated for 75°C for ampacities above 30 amperes.

PART 3 - EXECUTION

3.01 Storage and Installation Environment

- A. All electrical equipment shall be stored in a dry environment free from dust, moisture, sprays or vapors, which may be detrimental to their new condition. After installation of equipment, care shall be taken to protect all equipment from all dust, moisture, paint and other spray, harmful vapors, etc. until final acceptance and certificates of occupancy have been obtained.

3.02 Site Inspections

- A. Prior to final acceptance the Owner or Owner's representative will perform one or more site observation trips to develop a "punch list" of items deemed incomplete

- B. Each punch list item shall be completed by the Contractor and checked off of the list. When all of the items on the list are completed or commented on, the list shall be signed by the Contractor and returned to the Owner for verification.

3.03 Final Acceptance

- A. When all work is complete, the Contractor shall call the Owner for the final acceptance testing inspections. The Contractor shall be present while these inspections are taking place and shall be available for opening cabinets and operating and adjusting the system as is necessary for the Owner or Owner's representative to verify all equipment is installed and operates to the requirements of the contract documents.
- B. Prior to the Contractor calling for this observation, the Contractor shall have completed all items of work, including wire markers, nameplates, final tests and final test reports. All equipment shall be checked for proper operation and all signals verified for correct calibration and wiring.
- C. Final acceptance will not be given until:
 - 1. All work is complete.
 - 2. All "site inspection" punch-lists are checked off and returned to the Owner.
 - 3. All site inspection punch-list items are complete and approved by the Owner.
 - 4. All test reports are received.
 - 5. All O&M manuals are received.
 - 6. All project record drawings are received.

3.04 Project Record Drawings

- A. A set of drawings shall be maintained at the job site (by the Contractor) showing any deviations in the electrical systems from the original design.
- B. This set of drawings shall be readily available for inspection by the Owner and the Owner's representative at all times.

3.05 Guarantee

- A. The Contractor shall guarantee his work and all components thereof, excluding fuses, incandescent and fluorescent lamps for a period of 1 year from date of acceptance of the project, as specified in Section 01710 - Closeout Procedures. The Contractor shall remedy any defects in workmanship and repair or replace any faulty equipment that shall appear within the guarantee period without additional cost to the Owner.

3.06 Cleanup

- A. The premises must be kept free of accumulated materials, rubbish and debris at all times. Surplus material, tools and equipment must not be stored at the job site. At the completion of the job, all equipment and fixtures shall be left clean and in proper condition for their intended use.
- B. All motor control equipment and control panels shall be cleaned inside and out at the completion of the project.

3.07 Tests

- A. Testing for installed feeder cables is required as specified in other sections. Test reports shall be submitted to the Engineer prior to final acceptance. All tests shall be performed in accordance with the applicable sections of NETA.
- B. Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

3.08 Maintained Operation Requirements

- A. This wastewater treatment plant is an existing and operating facility. The wastewater treatment plant must remain fully operational during construction. The following are the base requirements.
 - 1. Power must always be available and connected to critical loads as indicated on the drawings – utility power or existing standby generator or contractor furnished trailer mounted generator.
- B. The Contractor shall submit a detailed plan with timelines and dates for the transition of equipment showing how above will be accomplished.
- C. Existing electrical power and control equipment may be relocated and reconnected to the existing equipment for temporary operation during construction.
- D. All changes in plant operations shall be directly coordinated with the Owner. All power outages shall be coordinated with the Owner.

3.09 Operation and Maintenance Manuals

- A. The Contractor shall prepare and assemble detailed operation and maintenance manuals as specified in Section 01730 - Operation and Maintenance Data.

3.10 Training

- A. Training shall be provided per the requirements of Section 01660 - Facility Startup and Testing.

END OF SECTION 16010

SECTION 16110
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 Summary

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Boxes, enclosures, and cabinets.
 - 3. Handholes and boxes for exterior underground cabling.

1.02 Definitions

- A. GRC: Galvanized rigid steel conduit.

1.03 Submittals

- A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Source quality-control reports.

PART 2 - PRODUCTS

2.01 Metal Conduits, Tubing, and Fittings

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

- F. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 Nonmetallic Conduits, Tubing, and Fittings

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. LFNC: Comply with UL 1660.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: Comply with UL 514B.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 Boxes, Enclosures, and Cabinets

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

2.04 Conduit Supports

- A. Strut supports: Galvanized steel.

PART 3 - EXECUTION

3.01 Raceway Application

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

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1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Generators, Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed: GRC.
 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 3. Damp or Wet Locations: GRC.
 4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.02 Installation

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies.
- B. Complete raceway installation before starting conductor installation.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- E. Install conduit on strut supports on all concrete structures. Do not attach conduits directly to concrete.
- F. Support conduit within 12 inches (300 mm) of enclosures to which attached.

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- G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- O. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC.
- Q. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 Installation of Underground Conduit

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom with minimum 4" of sand.
2. Cover conduits with minimum 4" of sand. Install backfill per NFPA 70.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Provide warning tape 12" above all buried conduits.

3.04 Protection

- A. Protect coatings, finishes, and cabinets from damage and deterioration.**
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16110

SECTION 16460
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 Summary

- A. Section includes:
1. Material and installation requirements for:
 - a. Building wire, power cable, control cable, and instrumentation cable.
 - b. Wire connectors, terminations, splices, and insulating tape.
 - c. Pulling lubricant.

1.02 Quality Assurance

- A. Referenced Standards:
1. Canadian Standards Association (CSA):
 - a. Test Methods for Electrical Wires and Cables (FT-4 Vertical Cable Tray Test).
 2. Institute of Electrical and Electronics Engineers, Inc. / American National Standards Institute (IEEE/ANSI):
 - a. 1202 Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.
 3. National Electrical Manufacturers Association (NEMA):
 - a. ICS 4 Industrial Control and Systems: Terminal Blocks.
 4. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - a. WC 57/S-73-532 Standard for Control Cables.
 - b. WC 70/S-95-658 Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
 5. National Fire Protection Association (NFPA):
 - a. 70 National Electrical Code (NEC).
 6. Underwriters Laboratories, Inc. (UL):
 - a. 44 Standard for Safety Thermoset-Insulated Wires and Cables.
 - b. 83 Standard for Safety Thermoplastic-Insulated Wires and Cables.

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- c. 467 Standard for Safety Grounding and Bonding Equipment.
 - d. 486A Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
 - e. 486C Standard for Safety Splicing Wire Connections.
 - f. 510 Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - g. 1277 Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
 - h. 1581 Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
 - i. 2250 Standard for Safety Instrumentation Tray Cable.
- B. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.03 Definitions

- A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- B. Instrumentation Cable:
- 1. Multiple conductors, insulated, twisted or untwisted, with outer sheath.
 - 2. The following are specific types of instrumentation cables:
 - a. Analog signal cable:
 - 1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller conductors.
 - 2) Commonly used types are defined in the following:
 - a) TSP: Twisted shielded pair.
 - b) TST: Twisted shielded triad.
 - b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.
- C. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 8 AWG and larger.

- D. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.
- E. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.04 Submittals

- A. Shop Drawings:
 - 1. See Section 01300 - Submittals for requirements for the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in Part 2 of this section except:
 - 1) Wire connectors.
 - 2) Insulating tape.
 - 3) Cable lubricant.
 - b. See Section 16010 - General Electrical for additional requirements.
- B. Qualification Data: For testing agency.
- C. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

PART 2 - PRODUCTS

2.01 Acceptable Manufacturers

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Building wire, power and control cable:
 - a. American Insulated Wire Corporation.
 - b. General Cable.
 - c. Manhattan/CDT.
 - d. Southwire Company.
 - 2. Instrumentation cable:
 - a. Analog cable:
 - 1) Alpha Wire Corporation.
 - 2) American Insulated Wire Corporation.
 - 3) Belden CDT Inc.

- 4) General Cable.
- 5) Manhattan/CDT.
- 3. Wire connectors:
 - a. Burndy Corporation.
 - b. Buchanan.
 - c. Ideal.
 - d. Ilsco.
 - e. 3M Co.
 - f. Teledyne Penn Union.
 - g. Thomas and Betts.
 - h. Phoenix Contact.
- 4. Insulating and color coding tape:
 - a. 3M Co.
 - b. Plymouth Bishop Tapes.
 - c. Red Seal Electric Co.

2.02 Cables and Wire

- 1. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
- 2. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- B. Power Cable:
 - 1. Conductor shall be stranded copper with 600 V rated insulation.
 - 2. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
 - 3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation with an overall PVC jacket.
 - 4. Number of conductors as required, including a bare ground conductor.
 - 5. Individual conductor color coding:
 - a. ICEA Method 4.
 - b. See Part 3 of this section for additional requirements.
 - 6. Conform to NFPA 70 Type TC.
- C. Control Cable:
 - 1. Conductor shall be stranded copper with 600 V rated insulation.

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2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation with an overall PVC jacket.
 4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size:
 - a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
 5. Individual conductor color coding:
 - a. NEMA/ICEA Method 1, Table E-2.
 - b. See Part 3 of this section for additional requirements.
 6. Conform to NFPA 70 Type TC and IEEE/ANSI 1202, CSA FT-4 or NFPA 262.
- D. Electrical Equipment Control Wire:
1. Conductor shall be stranded copper with 600 V rated insulation or 300 V as indicated on the drawings.
 2. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
 3. Conform to UL 44 for Type SIS insulation.
 4. Conform to UL 83 for Type MTW insulation.
- E. Instrumentation Cable:
1. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
 2. Analog instrumentation signal conductors shall be a 16-gauge copper stranded twisted shielded pair, with aluminum shield and tinned copper conductors with an overall waterproof nylon insulation jacket, rated at 90oC and:
 - a. 300 V rated insulation with PVC outer jacket.
 - b. Twisted with 100 percent foil shield coverage with drain wire.
 - c. Six (6) twists per foot minimum.
 - d. Individual conductor color coding: ICEA Method 1, Table K-2.
 - e. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
 3. Digital cable:
 - a. As recommended by equipment (e.g., PLC) manufacturer.
 - b. Conform to NFPA 262 and NFPA 70 Type ITC.

F. Wire Connectors:

1. Twist/screw on type:
 - a. Insulated pressure or spring type solderless connector.
 - b. 600 V rated or as indicated on the drawings.
 - c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
 - d. Phase and neutral conductors: Conform to UL 486C.
2. Compression and mechanical screw type:
 - a. 600 V rated.
 - b. Ground conductors: Conform to UL 467.
 - c. Phase and neutral conductors: Conform to UL 486A.
3. Terminal block type:
 - a. High density, screw-post barrier-type with white center marker strip.
 - b. 600 V and ampere rating as required, for power circuits.
 - c. 600 V, 20 ampere rated for control circuits.
 - d. 300 V, 15 ampere rated for instrumentation circuits.
 - e. Conform to NEMA ICS 4 and UL 486A.

G. Insulating and Color Coding Tape:

1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
 - a. Insulating tape: Black.
 - b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

H. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.01 Conductor And Insulation Applications

- A. Service Entrance: Type XHHW, single conductors in raceway.

- B. Feeders: Type XHHW, single conductors in raceway.
- C. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.
- D. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.02 Installation

- A. Conceal cables (in raceway) in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Support cables according to Section 16010 – General Electrical. Identify and color-code conductors and cables according to Section 16020 – Identification for Electrical Systems.
- E. Permitted Usage of Insulation Types:
 - 1. Type XHHW-2:
 - a. Building wire and power and control cable in conduit below grade.
 - 2. Type SIS and MTW:
 - a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.
- F. Conductor Size Limitations:
 - 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
 - 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
 - 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

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G. Color Code All Wiring as Follows:

1. Building wire:

	480Y / 277 V
Phase 1	Brown
Phase 2	Orange
Phase 3	Yellow
Neutral	Grey
Ground	Green

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
 - b. Conductors larger than No. 6 AWG:
 - 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
 - a) Continuous colored outer finish along its entire length.
 - b) 3-IN of colored tape applied at the termination.
 - 2) Insulated grounding conductor shall be identified by one (1) of the following methods:
 - a) Continuous green outer finish along its entire length.
 - b) Stripping the insulation from the entire exposed length.
 - c) Using green tape to cover the entire exposed length.
 - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
2. Power cables ICEA Method 4 with:
- a. Phase and neutral conductors identified with 3-IN of colored tape, per the Table herein, applied at the terminations.
 - b. Ground conductor: Bare.
3. Control cables NEMA/ICEA Method 1, Table E-2:
- a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.

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- b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3-IN of colored tape, per the Table herein, applied at the terminations.
- H. Install all wiring in raceway unless otherwise indicated on the Drawings.
- I. All wire and cable shall be suitable for the temperature, conditions, and locations where installed.
- J. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
 - 1. Where specifically indicated on the Drawings.
 - 2. Where field conditions dictate and written permission is obtained from the Engineer.
 - 3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted:
 - a. The combinations shall comply with the following:
 - 1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
 - 2) AC control circuits shall be isolated from all DC circuits.
 - 4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted:
 - a. The combinations shall comply with the following:
 - 1) Analog signal circuits may be combined.
 - 2) Digital signal circuits may be combined but isolated from analog signal circuits.
 - 5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway:
 - a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:
 - 1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
 - 2) The neutral conductors may not be shared.
 - 3) Up sizing raceway size for the size and quantity of conductors.
- K. Ground the drain wire of shielded instrumentation cables at one (1) end only:
 - 1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

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- L. All circuits shall be continuous from the field device termination to the control cabinet; splices are not allowed.
- M. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method:
 - 1. Feeder and branch power circuits:
 - a. Device outlet boxes:
 - 1) Twist/screw on type connectors.
 - b. Junction and pull boxes and wireways:
 - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
 - 2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
 - c. Motor terminal boxes:
 - 1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
 - 2) Mechanical screw type connectors for use on No. 8 AWG and larger wire.
 - d. Manholes or handholes:
 - 1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
 - 2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
 - 2. Control circuits:
 - a. Junction and pull boxes: Terminal block type connector.
 - b. Handholes: Twist/screw on type connectors pre-filled with epoxy.
 - c. Control panels: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
 - 3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer:
 - a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
 - b. Junction and pull boxes: Terminal block type connector.
 - c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.

4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

N. Insulating Tape Usage:

1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

O. Color Coding Tape Usage: For color coding of conductors.

3.03 Connection

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.04 Field Quality Control

- A. Testing: Perform the following field quality-control testing:
 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Contractor to perform tests and inspections and prepare written test report to record the following:
 1. Model, serial number and latest calibration of each instrument used.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 5. Legibly sign, print name, and date each sheet.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16460

**SECTION 17010
INSTRUMENTATION AND CONTROLS GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 Section Includes

- A. Pre-selected Control System Integrator/Programmer:
 - 1. The City has pre-selected Process Solutions, Inc. to perform the PLC programming for this project. The Contractor shall sub-contract with Process Solutions and include their price in the Contractor's bid.
 - 2. Contact information:
Brian Crossman
Process Solutions, Inc.
brianc@processsolutions.com
360-403-7037, Ext. 153
Fax: 360-435-2866
- B. Work Included:
 - 1. Provide all tools, equipment, materials, and supplies and be responsible for all labor required to complete the installation, startup, and operational testing of a complete and operable Instrumentation and Control (I&C) System as indicated on the Drawings and as specified herein.
 - 2. Provide all the necessary equipment components and interconnections along with the services of manufacturers' engineering representatives necessary to ensure that the Owner receives a completely integrated and operational I&C system as herein specified.
 - 3. Provide all terminations for wiring at field mounted instruments, equipment enclosures, alarm, and status contacts.
 - 4. Provide all Instrumentation and Control wire required for a fully functioning Instrumentation and Controls System as shown on the Drawings except for wire specifically specified in Division 16.
- C. Work Specified in Other Divisions:
 - 1. Process piping, installation of inline instrumentation, and other mechanical work and equipment as specified in Divisions 11 or 15.
 - 2. Division 16 work, including all instrumentation and controls conduit, and only that wire specified in Division 16. Refer to Division 16 Specifications for specific requirements for wire, conduit, grounding, and other electrical equipment.
 - 3. General mechanical requirements as specified in Division 11.

1.02 Reference Standards

- A. American National Standard Institute (ANSI) Publications:
 - 1. Y14.15a Drafting Practice
 - 2. C62.1 Surge Arrestors
- B. International Society of Automation (ISA) Publications:
 - 1. S5.4 Instrument Loop Diagrams
 - 2. S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

1.03 Instrumentation and Control and SCADA Subcontractors Requirements and Scope of Work

- A. The PLC shall be configured and programmed to achieve the controls as described in Section 17500 - Control Narratives.
- B. The I&C subcontractor shall be responsible for the following:
 - 1. Programming logic for operation of the equipment as specified in Section 17500.
 - 2. Installation, calibration and integration of instruments.

1.04 I&C System Integration

- A. General: The I&C equipment as specified in this Division shall be considered an integrated system. The entire system installation including but not limited to: assembly, manufacture, calibration, verification, startup, operation testing, and training shall be performed by qualified personnel, possessing all the necessary skills and equipment, and who have had experience performing similar installations.
- B. System Responsibilities:
 - 1. Instrumentation and control system drawings are diagrammatic only. The control descriptions and individual specifications sections also describe requirements for signals displayed on the operator interface terminal and human-machine interface (HMI) system which are supplemental requirements. The Contractor is responsible to verify all components of the instrumentation system, including primary measuring, indicating, transmitting, receiving, recording, totalizing, controlling, and alarming devices, and all appurtenances are completely compatible and shall function as outlined and shall furnish and install such additional equipment, accessories, etc., as are necessary to meet these objectives at no cost to the Owner.

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2. Compatibility: See that all components of the instrumentation system, including equipment specified under other Divisions, are completely compatible and function properly as a system. Provide such additional equipment, accessories, interface relays, etc., as are necessary to meet these objectives at no cost to the Owner.
3. Coordination: For control components, devices, and systems specified in other Divisions or shown on the Drawings.
 - a. Provide technical advice to mechanical and electrical subcontractors as necessary regarding their installation of instruments.
 - b. Verify the correctness of installation of all instruments.
 - c. Verify that the proper type, size, and number of control wires with their conduits are provided.
 - d. Verify that proper electric power circuits provided for all components and systems.
 - e. Resolve all manufacturers' installation discrepancies between requirements and the detail requirements of the Drawings and Specifications.
 - f. Supervise final signal connections, both electric and pneumatic, to all process instrumentation and control equipment.
 - g. Adjust, startup, and test all process instrumentation and control equipment.
 - h. Provide specified documentation and training.
4. Performance: While the Drawings and Specifications provide sufficient information to establish the form and function of the systems and their relationships, the responsibility for system integration and performance rests solely with the Contractor. The Engineer provides technical instruction and guidance where needed.
5. Site and Instrument Inspection: Inspect site for conformance to Drawings, paying special attention to space allocation and dimensions shown or required on Drawings. Inspect completed work and verify that it is ready for installation of instruments and equipment. Inspect each instrument and piece of equipment for damage, defects, completeness, and correct operation before installing.

1.05 Submittals

- A. Refer to Division 1 for required method of preparation and transmittal, and conform to requirements herein.
- B. Shop Drawings: Submit shop drawings (diagrams) for review in complete bound sets indexed by Specification number, with tabs marked by subject. Submit manufacturer's catalog cuts for each item for which shop drawings are not required. Manufacturer's catalog cuts, specifications or data sheets shall be clearly marked to delineate the options or styles to be furnished. Show

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dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Drawings shall be complete with device tag numbers, wire numbers and terminal board numbers. Submit fabrication details, nameplate legends, and control panel internal wiring and piping schematic drawings. Submit panel graphic drawings where applicable. Include material lists and/or bills of material.

1. Elementary Diagrams: Submit an elementary diagram (also known as a schematic diagram) for control, protection, and monitoring circuits. Elementary diagrams are not required for lighting, communications and those systems clearly defined on the single line diagram. Show all interconnections between power sources, apparatus, and device elements of a particular system or equipment, and all interlocks with other systems in a manner which fully indicates circuit function and operation. Refer to the Drawings for functional and operational requirements.

C. Specification Forms:

1. Submit completed Specification Forms per ISA S20, including those instrumentation and control components directly related to process control, but specified in other Divisions of these Specifications.
2. Include on each form the assigned tag numbers, manufacturer's part numbers, and device data. More than one tag numbered item may be included on a sheet.

D. Record Drawings: Submit a revised set of shop drawings that incorporates all change orders and modifications made during performance of the work. In addition to updated loop diagrams, interconnect diagrams, and elementary diagrams, submit equipment and device wiring diagrams and other drawings as necessary to depict the "as-built" condition of equipment. Include all installed field and panel conduit and piping/tubing runs and routing, tray systems, supports, mounting details, interconnection diagrams with cable, wire, tube, and termination numbers. Coordinate all drawings with the conductor identification requirements in Division 16. Submit a copy of CAD produced drawings on CD ROM in AutoCAD DWG format.

E. Operation and Maintenance Manuals: Furnish Operation and Maintenance Manuals, including Instruction Manuals and Part Lists, for equipment provided under Division 17 as required by Division 1. Obtain data from manufacturers, and format and bind as specified. Obtain distribution method instructions from the Owner or his representative.

1. Schedule: Deliver at least four (4) copies of manuals in 3-ring binders (8 1/2- by 11-inch format) not later than the equipment shipment date.
2. Contents: Include in manuals not less than the following information, as applicable, for each instrument, equipment, subsystem and/or control loop:
 - a. General introduction and overall description, purpose, functions, simplified theory of operations, etc.

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- b. Specifications (including equipment specification data sheet as described above under Shop Drawings), sufficiently detailed for reordering exact duplicates of the original items.
 - c. Installation instructions, procedures, sequences, tolerances, and precautions.
 - d. Operational procedures.
 - e. Shutdown procedures.
 - f. Maintenance, calibration, and repair instructions.
 - g. Parts list and spare parts recommendations.
 - h. Calibration curves, rating tables, and any other data showing the relationship of the variable inputs and the calibrated output of all measuring devices and controlled equipment.
 - 3. Format:
 - a. Use drawings and pictorials to illustrate the text to the extent necessary to insure a clear, concise presentation. If manuals have been written to cover a family of similar instruments or equipment, strike out inapplicable information in a neat fashion or emphasize applicable portion by heavily weighted arrows, circles, or boxes, whichever provides the clearest and neatest presentation.
 - b. Group manuals by system control panels, including field instrumentation connected or associated with the panel. Where identical instruments are used in more than one control loop or subsystem, include only one instruction manual, per panel grouping; however, an index by tag number for all instruments shall identify its location in that manual.
 - c. Provide control loop and/or subsystem operational descriptions to identify the function of each instrument and its relation to the other instruments in the loop.
 - 4. Binding: Bind each manual in a cover, which indicates the panel or process area to which it applies, manufacturer's name, local address and telephone number, and year of purchase. Punch and bind manuals in standard three ring binders and include system name and subcontractor's name on binding.
- F. Accessory and Maintenance Materials: Submit data for the following items:
- 1. Special Tools and Accessories: Special tools, instruments, and accessories for maintaining instruments and equipment requiring periodic repair and adjustment as specified elsewhere herein. Also, furnish special lifting and handling devices for equipment requiring such devices.
 - 2. Maintenance Materials and Spare Parts: Submit a list of manufacturer recommended spare parts for each item specified. Refer to other sections of these Specifications.

- G. Test Reports: Submit the following test reports as described herein:
1. Instrument Calibration Data Sheets (para. 2.13)
 2. Factory Testing of Control Panels (para. 2.14)
 3. Instrument Verification Report (para. 3.07.B)
 4. Final Operational Testing (para. 3.07.C)
- H. Demonstration and Final Operation Test Plan and Results: Submit a document that outlines all procedures to be used in final operational testing of instrument and control systems. Include a description of each system, the scope of testing, test methods and materials, testing instruments and recorders, a list of functional parameters to be recorded on each item, and Shop Drawings showing temporary bypasses, jumpers, and devices.

1.06 Quality Assurance

Standard of Quality: The Contractor shall provide equipment of the types and sizes specified which has been demonstrated to operate successfully. Provide equipment which is new and of recent proven design.

1.07 Inspections

- A. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.
- B. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests, and operations.
- C. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

1.08 Drawings

- A. Drawings: The Drawings are diagrammatic; exact locations of instrumentation products shall be determined in the field by the Contractor and verified/approved by the Owner's representative. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this Specification shall take precedence in the event of conflict.
1. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, power and convenience outlets, and ground wells are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.

2. Review the Drawings and Specification Divisions of other trades and perform the instrumentation work that will be required for the installations.
3. Should there be a need to deviate from the Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
4. Resolution of varying interpretations of the Contract Documents shall conform to Division 0.
5. The Drawings provide details of installation and supersede the manufacturer's recommendation where a conflict exists.

1.09 Product Delivery, Storage, and Handling

- A. Box, crate, or otherwise enclose and protect instruments and equipment during shipment, handling, and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids and gases, or any element that could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain prior favorable review by the Engineer before making repairs to damaged products.

PART 2 - PRODUCTS

2.01 Materials and Standard Specifications

- A. Provide instruments, equipment, and materials suitable for service conditions and meeting standard specifications such as ANSI, ASTM, and ISA. Provide instruments and equipment of a uniform quality and manufacture throughout the plant. All instruments in the plant of the same type shall be made by the same manufacturer.

2.02 Nameplates

- A. For each piece of equipment, provide a manufacturer's nameplate showing manufacturer name, location, the pertinent ratings, and the model designation.
- B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where acceptable to the Owner's Representative, with epoxy cement. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.
- C. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

- D. Provide CAUTION or SAFETY nameplates to alert operators of special conditions that may result in faulty equipment operations. Devices containing batteries that must be replaced periodically must be clearly identified. Nameplates are not required if the device senses and displays a low battery warning.

2.03 Name Tags

- A. All instrumentation and equipment items or systems shall be identified by name tags. Field equipment shall be tagged with the assigned instrumentation tag number listed in the Drawings or Specifications.
- B. Name tags shall be stainless steel with engraved or stamped black characters of 3/16-inch minimum height. Tags shall be attached to equipment with a tag holder and stainless steel band with a worm screw clamping device. Use 20-gauge stainless steel wire where banding is impractical. For field panels or large equipment cases use stainless steel screws; however, such permanent attachment shall not be on an ordinarily replaceable part.

2.04 Field-Mounted Equipment

- A. All instrument and control equipment mounted outside of protective structures shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices. Protective devices used on 120 VAC inputs to field mounted equipment shall be secondary valve surge protectors conforming to the requirements of ANSI C62.1.

2.05 Equipment Operating Conditions

- A. All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum ranges:
 - 1. Electrical Power: Fused 24 VDC from area control panel except where specifically stated otherwise on the Drawings or in the Specifications, or when two-wire, loop-powered devices are specified.
 - 2. Field Instruments:
 - a. Outdoor Areas:
Ambient Temperature: +15°F to +110°F
Ambient Relative Humidity: 5% to 100%
Weather: Rain, sleet, snow and ice
 - b. Indoor Unheated Areas:
Ambient Temperature: +40°F to +120°F
Ambient Relative Humidity: 5% to 95%, non-condensing

- c. Indoor Environmentally Controlled Areas:
Ambient Temperature: +60°F to +104°F
Ambient Relative Humidity: 10% to 90%, non-condensing

2.06 Equipment Locations

- A. Provide equipment and materials suitable for the types of locations in which they are located as defined under Division 16. All equipment specified for field mounting shall be weatherproof and splash proof as a minimum. If electrical or electronic components are contained within the equipment, they shall be housed in Type 316 stainless steel NEMA 4X enclosures, except Type 316 stainless steel NEMA 7 enclosures in hazardous locations, unless noted otherwise on the Drawings.

2.07 Analog Signal Indicated Units

- A. For all instruments with local or remote indicators, provide indicators scaled in actual engineering units, i.e., gallons per minute, feet, psi, etc., rather than 0 to 100%, unless noted otherwise on the Drawings or in the Specifications.

2.08 Signal Transmission

- A. Analog:
 - 1. Signal transmission between electric or electronic instruments shall be 4-20 mA and shall operate at 24 VDC. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating. Where practical, provide signal isolators or isolated signal PLC input cards.
 - 2. Non-standard transmission systems, such as impulse duration, pulse rate, and voltage regulated, will not be permitted except where specifically noted in the Specifications or shown on the Drawings. Pulses for flow totalization shall be a minimum of 175 milliseconds in length.
- B. Discrete: All alarm and status signals shall be 24 VDC unless specified otherwise on the Drawings or in the Specifications. Proprietary data highway or serial bit transmissions such as RS232C shall be allowed to the extent shown on the Drawings.

2.09 Finishes

- A. Provide Type 316 stainless steel enclosures for panels and Type 316 stainless steel bodies, housings and components for instruments and equipment. If stainless steel is not an option, factory paint all instruments and equipment except where installed in pipelines.
- B. Paint as required in Section 09920 - Protective Coatings for structural supports, brackets, etc. Repair damaged factory paint to satisfaction of the Engineer. Feathering, priming, and painting shall produce a reasonable match to the surrounding paint work.

2.10 Fasteners

- A. Fasteners for securing equipment to walls, floors and the like shall be stainless steel. When fastening to existing walls, floors, and the like, provide epoxy anchors, not expansion anchors. Size anchors to meet load requirements. Minimum size anchor bolt is 3/8 inch.
 - 1. Fasteners used to attach nameplates or other devices to the exterior of enclosures shall be self-sealing, waterproof type. Provide gasket or waterproofing bolts as required to maintain enclosure rating.
- B. Provide seismic calculations/report (Signed and stamped by a Professional Engineer) for all mounted equipment over 400 lbs. Contractor shall utilize a Structural Professional Engineer in Washington State to provide the seismic calculations/report.

2.11 Instrument Calibration

- A. Each field instrument shall be calibrated at 0%, 25%, 50%, 75%, and 100% of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated. Such test instruments have accuracies traceable to the National Institute of Standards and Technology (NIST).
- B. Submit a written report to the Engineer on each instrument. This report shall include a laboratory calibration sheet or the manufacturer's standards calibration sheet on each instrument and calibration reading as finally adjusted within tolerances.
- C. The Contractor may, at his option, choose to perform calibration on an instrument by acquiring the services of an independent test lab, or by obtaining the required test instruments and performing the calibration.

2.12 Factory Testing of Control Panels

- A. All fabricated equipment shall be tested before it leaves the factory. At the factory verify wiring continuity and equipment operation by simulating input and output.
- B. Upon completion of factory testing, submit a report certifying the control panels/devices/equipment are operable and meet the Specifications.

PART 3 - EXECUTION

3.01 Mountings

- A. Mount and install equipment as indicated. Mount field instruments on pipe mounts, brackets or other similar means in accordance with suppliers' recommendation and as shown on the Drawings. Where mounted in control panels, mount according to requirements of that section.

- B. Equipment specified for field mounting shall be suitable for direct pipe mounting or surface mounting. Surface-mounted indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than 3 feet-6 inches nor higher than 6 feet above walkways, platforms, catwalks, and the like.
- C. Note that applicable specifications require detail drawings showing seismic sway bracing design and anchorage requirements for their equipment and provide associated seismic zone requirements.
- D. All devices shall be accessible to operators for servicing, operating, reading, etc. Provide permanent platforms to assure devices are continuously accessible.

3.02 Process Connections

- A. Provide instrument impulse tubing (see Part 2) to meet the intended process service and ambient environmental condition for corrosion resistance, etc. Install impulse tubing with a continuous slope according to service to promote self-draining or venting back to the process. Terminate connection to process lines or vessels in a service rated root valve, provided under other Divisions, which will permit closing off the impulse line or removal of the element without requiring shutdown of the process. Include blow down of drip legs and valves for terminations of impulse lines at the instruments.
- B. Process vessels, line penetrations, and root valves shall be furnished and installed under other Divisions of these Specifications. Instrument tubing and valve manifolds are installed as part of this Specification.

3.03 Field Wiring

- A. Ring out signal wiring prior to termination and perform surge withstand tests where required. Verify wire number and terminations are satisfactory as designated on the diagrams. Verify all terminations are tight and shields are uniformly grounded at one location.

3.04 Electromagnetic Interference (EMI)

- A. Construction shall proceed in a manner which minimizes the introduction of noise (RFI/EMI) into the I&C System.
- B. Cross signal conductors and conductors carrying AC power or control signals at right angles.
- C. Separate signal conductors from wires carrying AC power or switched AC control signals from DC signal or control conductors within control panels, terminal cabinets, telemetry equipment, multiplexer cabinets, and data loggers as much as possible. Provide the following minimum separations within such equipment unless indicated otherwise on the Drawings:

Power Wiring Capacity	Separation (Inches)
120 volts ac or 10 amps	12
240 volts ac or 50 amps	18
480 volts ac or 200 amps	24
4,160 volts ac or 800 amps	48

3.05 Signal Grounding

- A. Proper grounding of equipment and systems in this Division is critical to proper equipment operation. The Drawings and Division 16 specify safety grounding for all equipment in this Division.
- B. A single-point grounding system for instrument signals is required for all instrument panels. This instrument single point grounding system does not use building steel or conduit systems for its ground path.
 - 1. Ground all signal shields, signal grounds, and power supplies at an isolated signal bus within each instrument panel, rack, or enclosure. The shields at the far ends of these signal cables must be disconnected (floated) from any ground to prevent ground loops.
 - 2. Do not connect the rack or enclosure frames to the signal grounding buses.
 - 3. Connect each isolated signal ground bus within each panel using a stranded, insulated copper wire of size 6 AWG or larger directly to a system ground rod installed per the Drawings.
- C. If more than one instrument panel or rack is installed side-by-side, locate an isolated system grounding plate in one of the panels.
 - 1. Connect all the isolated signal buses in such instrument panel or rack radially to the system ground plate using a stranded, insulated copper wire of size 8 AWG or larger.
 - 2. Do not use conduit, cable raceways, or building steel to distribute the grounding connections; use dedicated wires as specified above. Install a single conduit containing a #2 AWG insulated ground wire from the insulated grounding plate directly to a system ground rod installed per the Drawings. See Division 16 for conduit requirements.

3.06 Preparation

- A. Ensure that installation areas are clean and that concrete or masonry operations are completed prior to installing instruments and equipment. Maintain the areas in a broom-clean condition during installation operations.
- B. Panels shall be protected during construction to prevent damage to front panel devices and dust accumulation in the intervals. Other protective measures (lamp, strip heaters, etc.) shall be included as weather conditions dictate.

3.07 Field Testing

- A. General: The purpose of the field testing is to verify instruments are calibrated and operationally performing their intended function. Provide the services of factory trained and experienced engineers to perform verification and operational testing as prescribed below. Since the initial calibration of instruments may not satisfy the final operation of system, perform recalibration or adjust setpoints as required to satisfy the performance requirements of the system. Notify the Engineer and Owner in writing a minimum of 48 hours prior to the proposed date for commencing final operational testing and acceptance.
- B. System Verification Testing: Verify that each instrument is operating and calibrated as specified herein by simulating inputs at the primary element in each system loop and verify performance at loop output devices (i.e. recorder, indicator, alarm, etc., except controllers). Simulate inputs at 0%, 25%, 50%, 75%, and 100% of span or with on-off inputs, as applicable. During system verification:
1. Make initial or provisional settings on levels, alarms, etc. listed in the control narrative (see Section 17500).
 2. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point.
 3. Cause malfunctions to sound alarms or switch to standby to check system operation.
 4. Check all loop instruments thoroughly for correct operation.
 5. Immediately correct all defects and malfunctions disclosed by tests.
 6. Submit a report certifying completion of verification of each instrument system. This report shall include a data sheet on each instrument tested that indicates instrument tolerances, instrument calibration verification, data, and initial settings made to devices.
- C. Final Operational Testing: Upon completion of instrument verification, test all systems under process conditions in the presence of the Owner or designated representative. System testing shall be accomplished in accordance with a favorably reviewed Test Plan. The test for each portion thereof shall be witnessed, documented, and signed off upon completion by the Owner or designated representative. The intent of this test is to demonstrate and certify the operational interrelationship of plant instrumentation and control systems. This testing shall include, but not be limited to:
1. Making final adjustments to levels, alarms, etc.
 2. Optimum tuning of controllers.
 3. Checking all alarms, failure interlocks, and operational interlocks.
 4. Verifying all computer input and outputs and displays are fully functional.

DIVISION 17 – INSTRUMENTATION
SECTION 17010
INSTRUMENTATION AND CONTROLS GENERAL REQUIREMENTS

5. Verifying automatic computer-generated reports are performing satisfactorily.
6. Immediately correcting all defects and malfunctions and retesting.
7. Submit the witnessed test results and a transmittal letter indicating that all required systems have been tested satisfactorily and the systems meet all the functional requirements of their applicable specifications.

3.08 Instruction of Owner's Personnel

- A. Provide the services of a factory trained and field experienced instrumentation engineer to conduct group training of the Owner's designated personnel in the operation of each instrument system. This training shall be for the time period of two working days and shall be performed during the operational testing period. Include instruction covering basic system theory, operating principles and adjustments, routine maintenance and repair, and "hands on" operation. The text for this training shall be the Operation and Maintenance Manuals furnished under these Specifications.

END OF SECTION 17010

**SECTION 17500
CONTROL NARRATIVES**

PART 1 - GENERAL

1.01 Section Includes

- A. This section provides control narratives to be utilized by the Contractor for adding and modifying programming within an existing programmable logic controller (PLC) and the existing supervisory control and data acquisition (SCADA) system for monitoring and control of new equipment installed under this project. The existing PLC is located in existing Main Control Panel 2A (MCP-2A) housed within the electrical room of the existing Chlorination Building. This also includes, but is not limited to, programming and setup of new field devices and instruments associated with this project.
- B. All inputs/outputs (I/O) for control of new equipment will be connected to a new remote I/O panel located within the new PAA Building. This new remote I/O panel will be connected to existing MCP-2A via Ethernet and will have a local operator interface terminal (OIT) for access to SCADA.

1.02 Quality Assurance

- A. Applicable Standards:
 - 1. NEMA ICS 1-1988 General Standards for Industrial Control and Systems
 - 2. NEMA ICS 1.1-184 Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
 - 3. NEMA ICS 3-1988 Industrial Systems
 - 4. NEMA/EIA 232-D-1986 Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange

1.03 Submittals

- A. Provide printouts of proposed SCADA screens and description of any proposed modifications to the control narratives described herein.
- B. All finished programs shall be fully documented in hardcopy printouts submitted as part of the O&M information and in electronic format on a flash drive. Supply 11" x 17" printed drawings for all equipment and electrical schematics. Supply electronic AutoCAD files for all equipment and electrical schematics.

PART 2 - CONTROL NARRATIVE

2.01 General

- A. The general operations philosophy for new equipment and programming shall allow the Operator to manually operate each piece of equipment without SCADA or a PLC using Hand-Off-Auto (HOA) switches, Local-Off-Remote (LOR) switches or local control interfaces. In addition, all control logic shall be included in the PLC to allow automated operations to continue without SCADA.
- B. The control narratives herein and the process and instrumentation diagrams (P&IDs) in the drawings comprise the functional design criteria for PLC and SCADA programming. The Contractor shall coordinate all installation verification and testing with the Engineer and Owner to completely verify all manual and automatic modes of operation.
- C. The control narratives included herein describe the PLC control logic and monitoring capabilities to be configured. Control narratives are grouped by process and function established in the P&IDs. The control and network communications logic, including any data redirects, shall be programmed by the Contractor.
- D. PLC controls, including control related set points, status, and alarms shall be viewable and modifiable from SCADA as established herein. Programming of PLCs shall follow existing security protocol, specifically in terms of password protections, changing of set points, and logging user activity.

2.02 Common Control and Monitoring

- A. General: The following control and monitoring are used throughout the control narratives. The Contractor shall reference the P&ID, specific control narratives and electrical drawings to verify applicability.
- B. Hand-Off-Auto (HOA) or Local-Off-Remote (LOR) Switches: Motorized equipment linked to the PLC for control will be equipped with a HOA or LOR switch or local control interface. These may be integral with the equipment provided by the manufacturer or installed separately, as indicated on the Drawings and noted herein. HOA/LOR switches will normally be in the AUTO/REMOTE position, which allows the equipment to be controlled by the PLC. When an HOA/LOR switch is in the HAND/LOCAL position, the corresponding piece of equipment will run continuously or enable local controls, regardless of other control logic, but the PLC will continue to monitor and display alarm conditions. When an HOA/LOR switch is in the OFF position, the corresponding piece of equipment will not run or operate, regardless of other control logic, but the PLC will continue to monitor and display alarm conditions.
- C. AUTO/REMOTE Status: Provide an equipment AUTO/REMOTE status when the associated HOA/LOR switch is in the AUTO/REMOTE position. The PLC will not attempt to start any equipment item unless that item's HOA/LOR switch is in the AUTO/REMOTE position and any permissive control logic is satisfied.

- D. SCADA Manual: As described in the control narratives, certain control functions may have selections for “AUTO” or “MANUAL” within SCADA. In “AUTO”, the PLC will exercise control based on the programming. In “MANUAL” the Operator will be able to remotely start/stop or open/close associated equipment from SCADA, as well as remotely adjust the output, speed or position of equipment with variable output/speed/position.
- E. Call to Run: If equipment is in AUTO/REMOTE and required to run, the PLC shall activate a normally open discrete output to call the equipment to start (or operate).
- F. RUN and OPENED/CLOSED Status: The PLC shall receive a RUN discrete input from equipment (e.g., pumps) that provides a run signal to the PLC. Similarly, the PLC shall receive an OPEN/CLOSED discrete input from equipment (e.g., electrically actuated gates/valves) that provides open/close signals to the PLC. RUN and OPENED/CLOSED status will be displayed in SCADA.
- G. Runtime and Start Count: Provide PLC programming to track runtime and number of starts for each piece of equipment (e.g., pumps) controlled by the PLC. The PLC programming may use runtime and start count registers integrated into motor controllers, such as motor overload relays or variable frequency drives where practical. There shall be total runtime and start count registers that never reset and separate temporary runtime and start count registers that automatically reset on user specified intervals (i.e., daily, weekly, monthly, annually). At the end of the specified interval, the temporary runtime register shall reset and the total for that interval shall be logged and transferred to a register that shows the previous interval's runtime or start count. The total runtime and start count registers for each equipment item shall have protected resets in SCADA in the event the equipment is replaced or rehabilitated. Runtime and start count will accumulate when equipment runs in either HAND/LOCAL or AUTO/REMOTE. An alert shall be displayed in SCADA when a motorized device exceeds a set point number of starts within a single day. Equipment run time and number of starts data shall be displayed in SCADA for graphic indication and monitoring. The runtime registers will display times in hours and tenths of hours.
- H. Fail to Run: If the PLC calls an equipment item to start/stop or a valve to open/close and the appropriate run or position feedback is not received within a certain time period when the associated HOA/LOR switch is in the AUTO/REMOTE position, then a FAIL alarm is set in the PLC and displayed in SCADA. This FAIL condition exists not only when an equipment item is first started, but also if it is already running and then stops while a call to run is being asserted. A FAIL alarm will also occur if there is an overload condition detected at the motor controller. Upon occurrence of a FAIL alarm, the PLC will remove the call to that equipment item and take the control action required (for example start the other pump). The FAIL alarm will remain until the alarm is reset; the equipment item's HOA/LOR switch is placed either in HAND/LOCAL (and the equipment item starts) or OFF; or until the equipment item is called again. If the failed equipment item is called and fails to start again, a new instance of the FAIL alarm will be set.

- I. Equipment Unavailable: Installations with multiple pieces of identical equipment that operate in a duty-standby, lead-lag or staggered sequence (e.g., metering pumps) in which one piece of equipment becomes unavailable (HOA/LOR switch in OFF or equipment has failed), that piece of equipment shall be tagged unavailable and control shall pass to the next piece of equipment in the sequence. Upon availability being re-established, the equipment shall be tagged available, but remain off until called to run. It shall then be placed back into the original selected sequence.
- J. Equipment Alternation: For two or more pieces of equipment of the same function that are programmed to operate in a duty-standby, lead-lag, or staggered sequence (e.g., metering pumps), the PLC shall alternate their operation using one of the selected modes listed below, based upon input from SCADA. If an automatic mode is selected, this will override settings for the manual mode. Similarly, if the manual mode is selected, this will override all automatic modes and associated settings.
 - 1. Manual: The “lead” or “duty” piece of equipment is assigned within SCADA and will continue to run unless it becomes unavailable or process conditions require the “lag” equipment to run. In the next cycle of operation, the same equipment continues the same assignment unless manually reassigned.
 - 2. Automatic (Run Time): The equipment alternates duty-standby or lead-lag based on manually set run time thresholds. If the equipment has not already been manually alternated (the run time will reset after any alternating of the equipment) and the set run time is reached, the PLC switches the current duty/lead equipment to standby/lag, the current standby/lag equipment to duty/lead, starts the new duty/lead equipment, and stops the new standby/lag equipment. If the standby/lag equipment has failed or is not in AUTO/REMOTE, the PLC will start the second standby/lag equipment (if applicable), otherwise the duty/lead equipment will not alternate. If the duty/lead equipment fails or is switched to OFF, the standby/lag equipment becomes duty/lead.
 - 3. Automatic (Time of Day): The equipment alternates duty-standby or lead-lag based on time of day. For continuously running equipment (e.g., metering pumps), the lead equipment alternates once a day based on when the time of day set point is reached. The PLC switches the current duty/lead equipment to standby/lag, the current standby/lag equipment to duty/lead, starts the new duty/lead equipment, and stops the new standby/lag equipment. If the standby/lag equipment has failed or is not in AUTO/REMOTE, the PLC will start the second standby/lag equipment (if applicable), otherwise the duty/lead equipment will not alternate. If the duty/lead equipment fails or is switched to OFF, the standby/lag equipment becomes duty/lead.

- K. Adjustable Delays: PLC control strategies concerning equipment shall contain adjustable delays (seconds) for start, start after stop (e.g., backspin for centrifugal pumps), minimum runtime, and stop. PLC control strategies concerning multiple pieces of the same equipment shall also provide for separate adjustable sequential start and stop delays (seconds) that parallel normal start and stop delays, and sequence/alternation selection.
1. When Duty/Lead/Lag/Standby equipment is called by PLC logic to start or stop, start or stop action will be queued. An adjustable timer will provide a delay between starts and stops.
 2. Once the sequence timer has timed out, the next start or stop command in the queue will execute and the timer will reset. Further starts or stops will be blocked until the timer times out again.
 3. The sequence will continue until the queue is empty.
 4. Conditions that call for immediate start or stop owing to a hazardous condition that could result in injury or damage equipment shall bypass the queue and execute immediately.
- L. Alarm Conditions: Alarm conditions can be discrete, derived, or deviation. A discrete alarm occurs when a discrete input alarm is detected by the PLC. A derived alarm occurs when one or more analog or discrete inputs indicate an alarm condition based on control logic. A deviation alarm occurs when a process variable deviates outside an adjustable range from a set point value, whether the set point is manual or calculated. All alarms shall contain adjustable time delay (seconds) or dead-band function that must be satisfied before alarming, unless otherwise noted. During a loss of normal utility power (as measured by the ATS), the PLC shall disable all control and control program affiliated alarms and instead register only an alarm for loss of power. Upon power being restored through the backup generator, all loss of power alarms shall be re-enabled following an adjustable time delay (seconds).
- M. Nuisance Alarms: It shall be possible from SCADA to “block” or “inhibit” selected (nuisance) alarms. Blocked alarms shall prevent SCADA from receiving the associated alarm. Inhibited alarms shall block SCADA from receiving the associated alarm and prevent the PLC control logic from performing specified failure control logic to the associated equipment. Selection of either shall start a timer that alerts SCADA of the timed-out condition when it meets and exceeds the adjustable set point (hours).
- N. Alarm Acknowledgement and Silencing: All alarms shall be capable of being acknowledged via SCADA, unless otherwise noted herein. For alarms that sound an audible horn or energize a light, the horn shall be allowed to be silenced and the light de-energized via the acknowledgement, even if the alarm itself requires resetting the equipment locally.

- O. Analog Signal Transmitter Fail: The PLC will monitor each analog input signal to verify it is within the correct 4 to 20 mA operating range. If the analog signal goes below 3.8 mA or above 20.2 mA for an adjustable time delay, an alarm is set by the PLC and displayed in SCADA. Equipment for which the start signals rely upon the failed signal shall stop (if non-critical), continue operating under the current setting, or operate in a backup mode not controlled by the failed signal, as indicated for each specific equipment item.

2.03 SCADA Programming Guidelines

- A. The Contractor shall integrate the new remote I/O panel into the existing network and conduct associated programming of the SCADA system to integrate the new equipment, instruments and controls using the guidelines established herein. The new remote I/O panel will have an operator interface terminal that will provide access to the SCADA system.
- B. Screens: Show the status of the equipment associated with a particular process area in graphic animation. Indicate new alarms, run time, start count, and analog values (e.g., flow, PAA residual) by alphanumeric characters. Show process lines graphically. Provide method to move to other screens. List all recent alarms and provide provisions to acknowledge, reset, and silence alarms. Provide a screen for input of all set points. Include a numeric keypad and all functional requirements. Provide password protection consistent with current programming.
- C. All Operator actions are to be provided with feedback (e.g., “AUTO/REMOTE” and “RUN” status indications) to the PLC and indication in SCADA.
- D. All analog signals (e.g., flow, PAA residual, etc.) shall be constantly processed to provide daily minimum and maximum values with time stamps indicating when the minimum and maximum values occurred and the three most recent daily average values. These values shall be placed into holding registers for “today’s” 24-hour period (adjustable end of 24-hour period set point, e.g. 2:00 am or 0200 hours). Upon reaching the end of the 24-hour period, the data shall be logged and transferred to the “previous” 24-hour holding registers. Today’s 24-hour period registers shall be reset to zero. The PLC shall hold the previous 24 hours of daily data to be retrieved by SCADA for reports in the event of an extended communication failure. SCADA shall have storage for at least 400 days of data for creating monthly reports and examining trends for all tags described as logged or recorded. Additionally, total and temporary runtime and start count registers (as discussed above) and flow totalization for all analog flow signals shall be displayed in SCADA. The flow totalization register shall have protected resets, same as the total runtime and total start count registers.
- E. All alarm and control set points shall be selectable from a related process graphic control display in SCADA with the appropriate security password as defined by the Owner. All analog set points shall be selectable in four-digit blocks with one digit in tenths. All timer set points shall be selectable from 0-9999.

2.04 PLC Programming Guidelines

- A. The Contractor shall add and modify programming of the existing PLC in MCP-2A to include control strategies for new equipment and instruments as specified herein and follow the guidelines established herein. All new I/O shall be connected to the new remote I/O panel, which shall be connected to the PLC in MCP-2A via an Ethernet connection.
- B. The following are general guidelines to be applied to the programming of the PLCs:
 - 1. Programming shall be organized and arranged to facilitate the addition of future equipment, instrumentation, and control functions as identified herein and on the Drawings.
 - 2. Include descriptive headers in the programming for each routine and sub-routine and provide descriptive addresses and tag names based on existing equipment/instrument tags and other identifying attributes.
 - 3. All control logic shall be contained in the PLC program. No automated control is to be programmed in SCADA or other external device. This will allow automated operations to continue if SCADA is not functioning, in which case the PLC shall operate based on last known set points.
 - 4. Program all logic such that there is a separate logic scheme for each individual function rather than relying upon indexed, indirect, or block control of different addresses performing the same function. It is acceptable to use derived function blocks for tasks where appropriate.
 - 5. The PLC program shall be structured to organize individual control blocks into relative potential size utilizing the entire PLC memory area to establish block register consistency and control standardization.
- C. Communicated data to each PLC shall be located in contiguous block registers and all digital data packed to optimize data transfer duration where practical.
 - 1. It is acceptable to use scheduled or explicit communication functions.
 - 2. It is acceptable to use customized data objects provided that the definition files and descriptions which would be necessary for modifying or recreating the PLC program are also provided to the Owner.
 - 3. The SCADA system will communicate directly to each PLC. Only that data needed for PLC operation shall be transmitted between PLCs
- D. To the extent practical, programming of new PLCs and programming added to existing PLCs shall be organized in the following primary control blocks:
 - 1. Communications: Communications programming, communication fail set points, and contiguous communication data blocks.
 - 2. Scaling/Data: All analog scaling and filtering and accumulated data such as flow totalization, equipment runtime and start count, analog minimum / maximum / average, and previous day holding registers.

3. Alarms: All analog and digital alarm and timer set points and alarm resets.
4. Auto Controls: Control scenarios to include sequence and operational set points, control selections and set points, backup controls, and override control.
5. Function Control: Individual auto / manual device selection, safety interlocks, auto control command conclusions, and digital output commands.
6. Heartbeat Monitoring: Provide the millisecond PLC clock time to be read by the SCADA system for each PLC. This will be used by the SCADA system to determine Running/Fault status, as well as a Heartbeat to verify communications.

2.05 Peracetic Acid (PAA) Metering

- A. General: The PAA system will include two metering pumps (duty and standby). One pump will be used to dose PAA and the other will be a backup. Dose can set manually in SCADA or controlled automatically based on flow-pacing.
- B. Related Equipment:
 1. PAA Metering Pump #1 (P-7411)
 2. PAA Metering Pump #2 (P-7412)
 3. PAA Flow Meter (FIT-7413)
 4. PAA Residual Analyzer (AIT-7417)
 5. North Chamber Outlet Gate (MVEFF01) (Existing)
 6. South Chamber Outlet Gate (MVEFF02) (Existing)
 7. Lagoon 4 Outlet Gate (MV4420) (Existing)
- C. PLC I/O: All I/O below will be wired to the new remote I/O panel.
 1. Discrete Input:
 - a. PAA Metering Pump #1 Ready (Active)
 - b. PAA Metering Pump #1 Fault
 - c. PAA Metering Pump #1 Diaphragm Fail
 - d. PAA Metering Pump #2 Ready (Active)
 - e. PAA Metering Pump #2 Fault
 - f. PAA Metering Pump #2 Diaphragm Fail
 - g. PAA Flow – Totalizer Pulse
 - h. North Chamber Outlet Gate Open
 - i. North Chamber Outlet Gate Closed

- j. South Chamber Outlet Gate Open
- k. South Chamber Outlet Gate Closed
- 2. Discrete Output:
 - a. PAA Metering Pump #1 Pause
 - b. PAA Metering Pump #2 Pause
 - c. North Chamber Outlet Gate Close
 - d. South Chamber Outlet Gate Close
 - e. Lagoon 4 Outlet Gate Close
- 3. Analog Input:
 - a. PAA Metering Pump #1 Flow Feedback
 - b. PAA Metering Pump #2 Flow Feedback
 - c. PAA Flow
 - d. PAA Residual
- 4. Analog Output:
 - a. PAA Metering Pump #1 Flow Control
 - b. PAA Metering Pump #2 Flow Control
- D. PLC Control Description: Each metering pump has local control elements and an LCD screen that allows the Operator to select different modes of operation. The normal modes of operation will either be the “Manual” operating mode or the “Analog” operating mode. The “Contact” and “Batch” operating modes also available with the metering pumps will not typically be utilized. When in the “Manual” operating mode, the Operator can adjust the pump settings manually using the local control elements on the pump. This includes manually starting and stopping the pump using the local start/stop button. When manually started, the pump will run continuously at the manually entered settings (or current settings if not changed from the last time the settings were adjusted). When manually stopped, the pump will remain stopped and not operate. When in the pump is in “Analog” operating mode, it can receive an analog flow signal from the PLC based on one of three automated modes selected by the Operator via SCADA. The Operator will need to select one of the three operating modes described below and the PLC will have to receive a “Ready” status from the pump to send the analog flow control signal. The Operator will also be able to select the duty pump, or automated cycling of the duty pump (based on run time or time of day).

The PAA flow and PAA residual will be continuously displayed in SCADA. The SCADA system will log the daily maximum, minimum and average PAA flow and PAA residual. Additionally, the PLC will totalize the PAA flow based on the discrete input flow pulse. The SCADA system will log the daily, weekly and monthly PAA flow totals.

Set Flow (SCADA Manual): The Operator will enter a desired flow rate from the duty metering pump (default range of 0.0 to 3.0 gph). The duty metering pump will increase or decrease output to match the desired flow, as measured by the PAA flow meter.

Flow Pacing: The Operator will enter a target PAA dose in mg/L in the SCADA system (adjustable allowed range, default of 0.0 to 2.0 mg/L). The Operator shall also enter the PAA neat solution concentration percentage (adjustable, default 15%) and the PAA neat solution specific gravity (adjustable, default 1.135), which need only be entered once unless the PAA formulation being used changes. The PLC will then determine the pumped flow necessary to deliver the desired dose based on the measured effluent flow rate using the equation shown below. The calculated target flow rate and actual measured flow rate of neat PAA, will be displayed in SCADA.

$$\text{PAA Flow (mL/min)} = \frac{\text{Flow (MGD)} \times 1 \text{ day}/1,440 \text{ min} \times 1,000,000 \text{ gal/MG} \times 3.785 \text{ L/gal} \times \text{Dose (mg/L)}}{\text{S.G. (g/mL)} \times 1,000 \text{ mg/g} \times \% \text{ Active}}$$

Contact Time (T): The PLC will calculate the current CCT depth, volume and contact time (T) using the following formulas:

$$\text{CCT Depth (ft)} = [(\text{Flow (MGD)} \times 694.44 \text{ gpm/MGD} / 1943) ^{(1 / 2.5)}] + 11.29 \text{ (ft)}$$

$$\text{CCT Volume (gal)} = 639 \text{ (ft}^2\text{)} \times \text{CCT Depth (ft)} \times 7.48 \text{ gal/ft}^3 \times \text{CCT Chambers (\#)}$$

$$\text{T (min)} = [\text{CCT Vol. (gal)} \times \text{Injection Factor}] / [\text{Flow (MGD)} \times 694.44 \text{ gpm/MGD}]$$

The number of CCT chambers in service will be determined by the position of the associated outlet gates. If the outlet gate is open, the chamber is considered by the PLC to be in service. If the outlet chamber is closed, the chamber is considered by the PLC to be out of service. The PLC will also apply an adjustable factor to the CCT volume when calculating the contact time (T) based on the injection location entered by the Operator. The factor for injection at the Mixing Manhole will be a default of 1.0. The other injection locations will have a lower factor that will be determined during startup based on actual positioning of the injection locations. The calculated contact time, CCT chambers in service, and injection location will be displayed in SCADA.

E. Alarms: The following alarm conditions will apply:

1. **Metering Pump Fail** – If the duty metering pump fails (as indicated by discrete inputs for general fault or diaphragm fail from the metering pump), an alarm will be set in the PLC and displayed in the SCADA system and the PLC will start the standby metering pump. If the standby metering pump also fails or is not in “Ready” status, an alarm for standby metering pump failure or standby metering pump unavailable (as applicable) will be set in the PLC and displayed in the SCADA system and the PLC will close the CCT and Lagoon 4 outlet gates. The Operator will need to manually reset the system and open the CCT and Lagoon 4 outlet gates.

2. No PAA Flow – If one or both metering pumps are in “Ready” status and an analog flow control signal is being sent to the pump with no flow feedback being received from the flow meter, a No Flow alarm will be set in the PLC and displayed in the SCADA system and the PLC will close the CCT and Lagoon 4 outlet gates. The Operator will need to manually reset the system and open the CCT and Lagoon 4 outlet gates.
3. PAA Flow Out-of-Range – An alarm will be set in the PLC and displayed in the SCADA system if the measured flow is out-of-range of the set or target flow by an adjustable dead band (default of +/- 0.1 gph) for an adjustable delay period when operating in Set Flow mode or Flow Pacing mode. The duty metering pump will continue operating at its current rate for an adjustable delay period (default 30 minutes). If after this delay period the alarm condition is not cleared, the PLC will close the CCT and Lagoon 4 outlet gates. The Operator will need to manually reset the system and open the CCT and Lagoon 4 outlet gates.
4. Transmitter Failure – The PLC will monitor the analog input signal from the flow meter and residual analyzer to verify that they are within the correct 4 to 20 mA operating range. If an analog signal goes below 3.8 mA or above 20.2 mA for an adjustable time delay, or if a fault signal (discrete input to the PLC from the transmitter) is received, an alarm is set by the PLC and displayed in the SCADA system, identifying the problematic transmitter. The duty metering pump will continue operating at its current rate for an adjustable delay period (default 30 minutes). If after this delay period the alarm condition is not cleared, the PLC will close the CCT and Lagoon 4 outlet gates. The Operator will need to manually reset the system and open the CCT and Lagoon 4 outlet gates.
5. High/Low PAA Residual – An alarm will be set in the PLC and displayed in the SCADA system if the PAA residual reaches or surpasses the High (adjustable, default of 0.8 mg/L) or Low (adjustable, default of 0.2 mg/L) PAA residual alarm set points for an adjustable time delay.
6. High-High/Low-Low PAA Residual – An alarm will be set in the PLC and displayed in the SCADA system if the PAA residual reaches or surpasses the High-High (adjustable, default of 0.9 mg/L) or Low-Low (adjustable, default of 0.0 mg/L) PAA residual alarm set points for an adjustable time delay and the PLC will close the CCT and Lagoon 4 outlet gates. The Operator will need to manually reset the system and open the CCT and Lagoon 4 outlet gates.
7. Gate Failure – If an actuator fault signal is received or a gate is not registering the position called for by the PLC after an adjustable delay, a gate fail alarm will be set in the PLC and displayed in the SCADA system. If this alarm condition occurs while attempting to stop effluent flow (closing both gates) due to a critical alarm condition (e.g., High-High PAA residual, no PAA flow, etc.), this alarm shall repeat at an adjustable interval until acknowledged.

2.06 Injection Location Control

- A. General: Four injection locations are provided for dosing PAA. The furthest upstream location is the Mixing Manhole, which provides the longest contact time. Turbulence from the manhole baffle and pipe connecting the manhole to the CCT generates sufficient mixing energy to dose neat PAA in the Mixing Manhole. The three downstream injection locations are located in the second, third, and last passes of each chamber in the CCT. Each of these three injection locations has one injection point in each chamber with identical branching piping for an even flow split. Because there is insufficient mixing energy produced by flow through the CCT, carrier water is used to dilute the PAA and a vertical diffuser assembly is used to introduce the diluted PAA for faster and more efficient mixing of the PAA with the effluent. Manual valves are used to control the active injection location. There is no automated control for injection location.
- B. Related Equipment: None.
- C. PLC I/O: There is no I/O associated with control of injection location.
1. Discrete Input: None.
 2. Discrete Output: None.
 3. Analog Input: None.
 4. Analog Output: None.
- D. PLC Control Description: None.
- E. Alarms: None.

2.07 Carrier Water Pumping

- A. General: Effluent is pumped from the downstream end of the CCT (after the two chambers combine into a single outlet channel) and used as carrier water to dilute the neat PAA and provide energy for diffusion and mixing at the three injection locations in the CCT.
- B. Related Equipment:
1. Carrier Water Pump (SP-7420).
 2. Carrier Water Flow Switch (FSL-7414).
- C. PLC I/O: All I/O below will be wired to directly to the PLC in MCP-2A.
1. Discrete Input:
 - a. Carrier Water Pump Running
 - b. Carrier Water Pump in Auto
 - c. Carrier Water Pump Fault

2. Discrete Output:
 - a. Carrier Water Pump Call-to-Run.
 3. Analog Input: None.
 4. Analog Output: None.
- D. PLC Control Description: The carrier water pump has a Hand-Off-Auto switch at the motor control center in the Chlorination Building. When in Auto, the carrier water pump will run when either metering pump is running, and any injection location is selected or being utilized by the PLC that is not the Mixing Manhole. If neither metering pump is running, both chamber outlet gates are closed, and/or the selected/utlized injection location is at the Mixing Manhole, the carrier water pump shall be stopped by the PLC. When in Hand, the carrier water pump will run continuously and cannot be stopped by the PLC. When in Off, the carrier water pump cannot be started by the PLC.
- E. Alarms: The following alarm conditions will apply:
1. Low Carrier Water Flow – If the PLC receives a low flow signal from the flow switch on the carrier water pump discharge, a low carrier water flow alarm will be set in the PLC and displayed in the SCADA system and the PLC will change the injection location to the Mixing Manhole.
 2. Carrier Water Pump Fail – If the PLC receives an overload signal from the carrier water pump starter, a carrier water pump fail alarm will be set in the PLC and displayed in the SCADA system and the PLC will change the injection location to the Mixing Manhole.

2.08 Leak Detection and Smoke Detection

- A. General: A level switch in the metering pump containment skid and a second level switch in the PAA tote containment area provide indication of accumulated PAA solution from a leak.
- B. Related Equipment:
1. Metering Pump Skid Containment Level Switch (LSH-7415).
 2. PAA Tote Containment Level Switch (LSH-7416).
 3. Smoke Detector (GS-7418).
- C. PLC I/O:
1. Discrete Input:
 - a. Metering Pump Skid Containment High Level
 - b. PAA Tote Containment High Level
 - c. Smoke Alarm
 2. Discrete Output: None.

3. Analog Input: None.
 4. Analog Output: None.
- D. PLC Control Description: The level switches and smoke detector provide alarm indications as noted below.
- E. Alarms: The following alarm conditions will apply:
1. PAA Metering Pump Leak – A metering pump leak alarm will be set in the PLC and displayed in the SCADA system if a high-level signal is received from the Metering Pump Skid Containment Level Switch.
 2. PAA Tote Leak – A PAA tote leak alarm will be set in the PLC and displayed in the SCADA system if a high level signal is received from the PAA Tote Containment Level Switch.
 3. Smoke Alarm – A smoke alarm will be set in the PLC and displayed in the SCADA system if a smoke alarm signal is received from the smoke detector in the PAA Building.

PART 3 - EXECUTION

Not Used.

END OF SECTION 17500

APPENDIX A

GEOTECHNICAL REPORT

APPENDIX B

PREVAILING WAGE RATES