

**CITY OF WINFIELD  
PUTNAM COUNTY, WEST VIRGINIA**

**CONTRACT NO. 1 – WASTEWATER TREATMENT PLANT IMPROVEMENTS**

**JANUARY 24, 2020**

**ADDENDUM NO. 2**

To whom it may concern:

**A. BOILER PLATE**

1. Bid Opening for Contract #1 **HAS BEEN MOVED TO** February 4, 2020 at 2:00 p.m. at the City of Winfield, 12448 Winfield Road, Winfield, WV.
2. Bid Opening for Contract #2 will **REMAIN** on January 28, 2020 at 2:00 p.m. at the City of Winfield, 12448 Winfield Road, Winfield, WV.

**B. SPECIFICATIONS**

1. **DELETE** Section C-410 – “Bid Form” in its entirety and **REPLACE** with the attached Section C-410 – “Bid Form”.
2. **DELETE** Section 12000 – Price and Payment Procedures in its entirety and **REPLACE** with the attached Section 12000 – Price and Payment Procedures.
3. **DELETE** Section 024120 – Decommissioning of Existing Wastewater Treatment Plant in its entirety and **REPLACE** with the attached Section 024120 – Decommissioning of Existing Wastewater Treatment Plant
4. **ADD** the attached Section 033100 – Cast-in-place Concrete for Pre-Cast Post-Tension.
5. **DELETE** Section 034100 – Precast Structural Concrete in its entirety and **REPLACE** with the attached Section 034100 – Precast Structural Concrete.
6. **DELETE** Section 263200 – Transfer Switches in its entirety and **REPLACE** with the attached Section 263200 – Transfer Switches.
7. **DELETE** Section 263213 – 350 kW Packaged Engine Generator in its entirety and **REPLACE** with the attached Section 263213 – Packaged Engine Generator.
8. **DELETE** Section 432540 – Proposed WWTP Lift Station in its entirety and **REPLACE** with the attached Section 432540 – Proposed WWTP Lift Station.
9. **DELETE** Section 463333 – Sequencing Batch Reactor System in its entirety and **REPLACE** with the attached Section 463333 – Sequencing Batch Reactor System.
10. **DELETE** Section 466656 – UV Disinfection System in its entirety and **REPLACE** with the attached Section 466656 – UV Disinfection System.
11. **DELETE** Section 467621 – Sludge Dewatering Equipment in its entirety and **REPLACE** with the attached Section 467621 – Sludge Dewatering Equipment

## C. DRAWINGS

1. **DELETE** Sheet 2B in its entirety and **REPLACE** with the attached Sheet 2B.
2. **ADD** Sheet 2J.
3. **ADD** Sheet 2K.
4. **DELETE** Sheet 5 in its entirety and **REPLACE** with the attached 5.
5. **DELETE** Sheet 9 in its entirety and **REPLACE** with the attached Sheet 9.
6. **DELETE** Sheet DET-11 in its entirety and **REPLACE** with the attached Sheet DET-11.
7. **DELETE** Sheet S4 in its entirety and **REPLACE** with the attached Sheet S4.
8. **DELETE** Sheet E8 in its entirety and **REPLACE** with the attached Sheet E8.

## D. QUESTIONS AND CLARIFICATIONS

The following are clarifications and responses to questions posed by Contractors and suppliers regarding the above referenced project.

1. **Clarification:** Addendum No. 1 Question 5 states “The Contract Time will be 420 months for Substantial Completion and 450 Days for Final Payment.” This statement should read “The Contract Time will be 420 Days for Substantial Completion and 450 Days for Final Payment.”

2. **Clarification:** Specification 024120 – Decommissioning of Existing Wastewater Treatment Plant has been revised to include the list of parts required to be replaced if the new sludge press is used during the decommissioning of the existing sewer lagoons.

3. **Question:** Are pre-cast concrete Sequencing Batch Reactor basins acceptable?

**Answer:** Yes, page 4 of the Bid Form has been updated so the Contractor can specify whether their bid includes pre-cast post-tension or cast-in-place concrete basins. Specification Section 034100 “Pre-cast Structural Concrete” has been added for Pre-cast Structural Concrete.

4. **Question:** Can a bid item be added to account for sludge tipping fees?

**Answer:** Bid Item 6 has been added to the Bid Form for Sludge Removal and Disposal. Section 12000 – Price and Payment Procedures has been revised to include Bid Item 6.

5. **Question:** Section 463333 – “Sequencing Batch Reactor System” Part 2.29.A indicates that the SBR control panel should be 120 volt single phase service. As the Variable Frequency Drive, Transformer, and Transformer Primary and Secondary Fuse require three-phase power, are they to be excluded from the SBR control panel?

**Answer:** The Variable Frequency Drive, Transformer, and Transformer Primary and Secondary Fuse are to be provided as part of Contract #1. Specification Section 463333 has been revised accordingly and attached to this addendum.

6. **Question:** Will Generac Industrial Power be an acceptable generator manufacturer?

**Answer:** Yes. Generac has been added to Specification Section 263213 Part 2.1A.

7. **Question:** Specification Section 263213 header states “350kW Packaged Engine Generators” E8 Riser shows 600 kW is what is needed. Please confirm this is the correct wattage.

**Answer:** The generator shall be 600 kW, as stated on Sheet E8 of the drawings.

8. **Question:** Sheet E8 shows a 3Pole 800 amp automatic transfer switch (ATS) on sheet note FF and 4 pole on the generator grounding drawing. Please confirm whether a 3 pole or 4 pole ATS should be provided.

**Answer:** 3 Pole. The generator grounding schematic has been updated on Sheet E8. A copy of the revised Sheet E8 has been attached to this Addendum..

9. **Question:** In Specification Section 263200 1.3-c calls for a bypass isolation switch with remote annunciator. Drawings do not reference a bypass isolation switch, is this required? Is a separate ATS annunciator required in lieu of the standard NFPA 110 generator annunciator, which includes “generator on load”?

**Answer:** A bypass isolation switch and a separate ATS annunciator are not required.

10. **Question:** Specification 263200 2.2G-1 class for a type 3R stainless enclosure, drawing E8 drawing calls a NEMA 1 enclosure. Please verify which enclosure needs to be provided: NEMA 1, NEMA 3R, or NEMA 4?

**Answer:** NEMA 1.

11. **Question:** Specification 263200 2.3.B calls for a double throw switch with no pause, 2.3E calls for a programmed neutral. Is a delay transfer required?

**Answer:** No.

12. **Question:** Does the ATS require a warranty matching the 5 years stated in the generator spec?

**Answer:** Yes.

13. **Question:** Is a stainless-steel channel required for the UV system?

**Answer:** No. Specification Section 466656 – UV Disinfection System Part 1.1A has been updated to remove reference of a stainless-steel channel.

14. **Question** Specification Section 466656 – UV Disinfection System Part 1.5A appears to be the submittal requirements for pumps.

**Answer:** Specification Section 466656 – UV Disinfection System Part 1.5A has been updated to specify submittal procedures for the UV system.

15. **Question:** What is the required UV dose of the system?

**Answer:** Specification Section 466656 – UV Disinfection System Part 2.1B.1 has been updated to require a minimum of 50 mJ/cm<sup>2</sup> with one bank out of service at the end of lamp life.

**16. Question:** For the clearing and grubbing operation, is burning of brush allowed on site?

**Answer:** Yes. Contractor shall adhere to all applicable local, state, and federal regulations.

**17. Question:** Is the 1" = 30 ft scale on Sheet 2B accurate?

**Answer:** The scale on Sheet 2B has been revised for 1" = 40 ft.

**18. Question:** Who is responsible for paying for the compaction and concrete testing on the project?

**Answer:** The Contractor is responsible for the compaction and concrete testing costs on this project.

**19. Question:** Sheet 2C shows a concrete pad for dumpster beside the headworks structure. What are dimensions and thickness of this pad?

**Answer:** The concrete pad for the dumpster beside the headworks structure shall be 10'x10' and 6" thick. See the Concrete Parking Lot Detail on Sheet DET-8.

**20. Question:** What is the thickness of the Office/Sludge building floor slab?

**Answer:** The office floor slab shall be 6 inches thick, the truck bays and sludge press section of the building shall be 8 inches thick.

**21. Question:** What is the thickness of the SBR/Digester/Post EQ Basin Walls? Sheet 5 shows these walls as 14" thick, sheet S8 shows them at 18" thick. Which is correct?

**Answer:** Sheets 5-5G includes the pre-cast post-tension option for the basins. Sheet S8 details dimensions for the cast-in-place concrete option.

**22. Question:** Is Section 033050 Crystalline Concrete Waterproofing required at any other cast-in-place concrete structure besides the SBRs?

**Answer:** Yes. The headworks channels, UV building channels, and non-potable sump shall also include crystalline concrete waterproofing..

**23. Question:** What is the building permit cost for this project? Is it 0.9% as per E.3 of addendum 1? Or is it 0.09% as per VI. c. of the Pre-bid agenda in Addendum #1. Please clarify

**Answer:** 0.9%.

**24. Question:** Is epoxy coating resteel required for the storage bin? If so, are there any other structures which require epoxy coating?

**Answer:** No Epoxy coated resteel is not required for the storage bin or any other structure.

**25. Question:** What material are the stairs shown on sheet 2A connecting the sidewalk to SBR 1?

**Answer:** Steel with aluminum handrail. An additional detail has been added to Sheet S4. Revised Sheet S4 is attached to the addendum.

**26. Question:** In regards to the dewatering of the sludge lagoons, it was mentioned at the prebid that we could use the new belt press system to remove the sludge from the lagoons. Who is responsible the electric, water polymer, lime, belt press operator, testing, etc required for this operation?

**Answer:** The Contractor is responsible for any operational costs of dewatering the sludge.

**27. Question:** Addendum 1 Question #8 says the site work balances. Can you provide approximate cut & fill volumes at the lagoon area?

**Answer:** For the entire site there is approximately 16,950 cubic yards of fill required. The general site work will produce approximately 8,400 cubic yards of cut and the excavations for road/parking areas, SBR tanks, foundations, and other underground structures will produce approximately 8,600 cubic yards. Final grade of the decommissioned sewer lagoon site can be adjusted to accommodate any excess material. Refer to Sheet 2J included with this Addendum No. 2.

**28. Question:** Can you provide the elevations or cross sections of the existing lagoons in order

**Answer:** Sheet 2J and Sheet 2K has been added to show the cross sections of the existing lagoons.

**29. Question:** Are the UV Chamber and non-potable sump to be coated?

**Answer:** Waterproofing admixture shall be used per Section 033050 – Crystalline Concrete Waterproofing.

**30. Question:** What is the high water table elevation to use for the structural and flotation calculations on the pre-cast post-tension basin structure? The 500 year flood elevation on sheet 5B of 581.00, or the HW EL of 575.80 on sheet 5C?

**Answer:** Use the 500 year flood elevation of 581.00 for structural and flotation calculations. Pressure relief valves have been added to the bottom of the SBR tanks. Revised Sheet 5 has been attached to this Addendum showing the location of the pressure relief valves.

**31. Question:** If the intent of the lime feed is to mix the lime with a dry cake pump, is there a required percent cake required for the lime feed system?

**Answer:** Up to 19%.

**32. Question:** Is 304 stainless steel an acceptable alternative to hot dipped galvanized steel for the belt press?

**Answer:** Yes.

**33. Question:** OR-Tec uses a flocculator tank variable speed paddle mixer which allows operators to instantly change mixing energy rather than the upstream fixed inline venturi type meter. It also means the operators do not have to move spool pieces in the event they want to change location. OR-Tec's system has two factory piped injection which can be selected with a valve. Will this be acceptable?

**Answer:** Yes.

**34. Question:** Is Class 50 Ductile Iron pipe acceptable to be used as the buried ductile iron yard pipe on this project?

**Answer:** Ductile Iron Pipe shall be Class 53, as stated in Section 400519 Part. 2.A.2

**35. Question:** Is Contract #1 sales tax exempt?

**Answer:** Yes.

**36. Question:** Specification 432540 – Proposed WWTP Lift Station names SEEPEX or Moyno. Will Flygt be an approvable equal?

**Answer:** Yes. Specification 432540 – Proposed WWTP Lift Station Paragraph 2.1.A.1 has been revised to name Flygt and Meyers to coincide with the Winfield Way lift station specification.

#### **E. GENERAL**

1. B&O Taxes are required for Prime Contractor and any Sub-Contractor. B&O Tax Rate is 1%, City Building Permit Cost is 0.9%.
2. A City Building Permit **IS** required for this project. Contract Licenses run from June 30 to June 30 at \$90. The initial year will be pro-rated.
3. American Iron and Steel (AIS) requirements **DO** apply to this project.
4. The Engineer's cost estimate for this project is \$7,100,000.00.
5. Bidders are hereby notified to acknowledge receipt of all addenda in space provided on the Bid Form.

If you have any questions or need any other information, please do not hesitate to contact me.

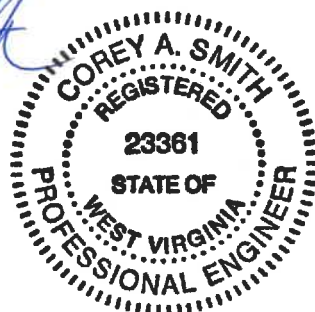
Sincerely,

THE THRASHER GROUP, INC.



COREY SMITH, PE  
Project Manager

Enclosures





**CITY OF WINFIELD  
PUTNAM COUNTY, WEST VIRGINIA  
PROPOSED  
CONTRACT #1 – WASTEWATER TREATMENT PLANT IMPROVEMENTS  
THRASHER PROJECT #101-020-1559**

**BID FORM**

**ARTICLE 1 – BID RECIPIENT**

1.01 This Bid is submitted to:

*City of Winfield  
12448 Winfield Road  
Winfield, WV 25213*

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

**ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS**

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

**ARTICLE 3 – BIDDER’S REPRESENTATIONS**

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum Date</u>
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work and including all AIS requirements.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous

Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 4 – BIDDER'S CERTIFICATION**

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
  - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
  - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
  - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
  - 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.



**ARTICLE 5 – BASIS OF BID****GENERAL**

The Bidder shall take notice of and shall be responsible for any local or state taxes levied and applicable, and the cost for the same shall be included as part of the submitted Bid.

The total Bid cost stated includes a complete operating installation including furnishing and installation of any and all changes or additions in plans, piping, mechanical work, additional electrical work, accessories, controls, etc. necessary to accommodate alternative equipment systems or materials used in construction.

**BID PROPOSAL**

The Bidder agrees to perform all required Work described in the detailed Specifications and as shown on the Plans for the complete construction and placing in satisfactory operation the 0.5 MGD Wastewater Treatment Plant Upgrades. The Project "Sequence of Construction" has been detailed in the Drawings and Specification Division 1, Project Summary, Section 011000. The Bidder agrees to perform all the Work proposed for the total of the following Bid prices.

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following prices(s):

5.02 Major Equipment

- A. The Bidder shall list on Schedule "A" equipment included as part of this bid, the manufacturer of each item of major equipment listed and referenced to the specifications.
- B. All major equipment listed in Schedule "A" is subject to qualifications in accordance with Section 16000: "Product Requirements".
- C. The Total Bid Price shall include furnishing and installing all equipment and accessories of the manufacture as listen on schedule "A".
- D. If the contract is awarded based on this bid, all items of equipment systems listen in Schedule "A" will be utilized in construction and guaranteed by the undersigned and his surety to meet the performance requirements. These requirements are defined generally in Section 16000: "Product Requirements" and more specifically in the referenced specification section for equipment items shown on schedule "A".

**Schedule “A”  
Major Equipment**

Description of item	Manufacturer
Mechanical Bar Screen System – Section 463332.00	
Manual Bar Screen System – Section 463332.00	
Screenings Washing and Compact Equipment – Section 463332.00	
Vortex Grit Removal System – Section 463332.00	
Polymer Feed System – Section 467621.00	
Belt Filter Press – Section 467621.00	
Lime Feed/Mixer System – Section 467621.00	
Sludge Cake Pump – Section 467621.01	
WWTP Lift Station Pumps – Section 432540.00	
Winfield Way Lift Station Pumps – Section 432520.00	
UV Disinfection System – Section 466656.00	
Non-Potable Water System – Section 432560.00	

**Schedule “B”  
SBR Basin Construction**

Description of item	Selected Method (Check One)
Pre-Cast Post-Tension	
Cast-in-Place	

**PROPOSED  
CONTRACT #1 – WASTEWATER TREATMENT PLANT IMPROVEMENTS  
FOR THE**

**CITY OF WINFIELD  
PUTNAM COUNTY, WEST VIRGINIA  
THRASHER PROJECT #101-020-1559**

**BID SCHEDULE**

*NOTE: Bid Unit PRICE amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern. Bids shall include sales tax and all other applicable taxes and fees.*

<b>Item</b>	<b>Quantity</b>	<b>Description with Unit Price Written</b>	<b>Unit Price</b>	<b>Total Price</b>
1	LS	Mobilization/Demobilization		
			Dollars	
			Cents	
2	LS	To provide all labor, equipment, materials, and services to furnish and install the proposed new Wastewater Treatment Plant includes construction of a new headworks which consists of one (1) center flow mechanical fine screens with screenings processing, one (1) manual bar screen, vortex grit removal system with classifier, with all associated piping and appurtenances; construction of two (2) sequencing batch reactors (SBRs), one (1) post-equalization (EQ), one (1) aerobic digester, installation of all associated equipment, electrical and controls, and all other necessary appurtenances; new operations building which consists of kitchen, laboratory, locker room and bathroom, garage bays, belt filter press, polymer feed system, lime feed system and all associated equipment and controls, utility room and electrical room to house all electrical controls and SCADA equipment; construction of a new UV disinfection building to house all necessary UV disinfection equipment, a new non-potable pumping station with hydropneumatic tank and all other necessary appurtenances; emergency standby generator with automatic transfer switch; and decommissioning of existing wastewater treatment plant. The work shall include the installation of SBR equipment provided as part of Contract #2. Site work shall include paving, grading, piping, sidewalks, fencing, bollards, and all other work related items. The work shall include all ancillary mechanical, electrical, instrumentation and controls, erosion and sediment controls, SCADA, spare parts and accessories, civil, structural, architectural, and other items needed to provide a complete fully tested and operable system.		
			Dollars	
			Cents	

Item	Quantity	Description with Unit Price Written	Unit Price	Total Price
3	LS	To provide all labor, equipment, materials, and services to provide capital improvements required by the electric company to provide adequate electrical service to the project site including additional power poles, transformers, meters, cable and/or conduit and other electrical accessories for the allowance amount of:		
		Twenty Thousand	Dollars	
		Zero	Cents	
			\$20,000	\$20,000
4	LS	To procure, deliver and install office furniture in the newly constructed Administrative Building as authorized by the Owner and Engineer for the allowance amount of:		
		Fifteen Thousand	Dollars	
		Zero	Cents	
			\$15,000	\$15,000
5	LS	Winfield Way Lift Station Rehabilitation, Complete		
			Dollars	
			Cents	
6	350 DT	Removal and Disposal of Sludge		
			Dollars	
			Cents	
<b>TOTAL BID:</b>				
			(\$	)

(Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

**NOTE: THE CONTRACTOR'S UNIT PRICES SHALL INCLUDE PURCHASE AND INSTALLATION, COMPLETE IN PLACE, PER BID ITEM IN ACCORDANCE WITH THE DETAILED SPECIFICATIONS.**

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

**METHOD OF AWARD**

If at the time this contract is to be awarded, the lowest total bid submitted by a qualified, responsible Bidder does not exceed the amount of funds then estimated by the Owner, as available to finance the contract, the construction contract will be awarded. If such bids exceed such amount, the Owner may reject all bids.

- A. Unit prices have been computed in accordance with paragraph 13.03.A of the General Conditions.
- B. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

**ARTICLE 6 – TIME OF COMPLETION**

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

**ARTICLE 7 – ATTACHMENTS TO THIS BID**

- 7.01 The following documents are submitted with and made a condition of this Bid:
  - A. Bid Opening Requirements

Note: Bid Opening Requirements (BOR-12) includes the American Iron and Steel Certification which needs to be filled out and signed by the Contractor. This certification also references two (2) attachments located in the Supplemental General Conditions (C-800) which were issued as part of RUS Bulletin 1780-35.

**ARTICLE 8 – DEFINED TERMS**

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

**ARTICLE 9 – BID SUBMITTAL**

BIDDER: *[Indicate correct name of bidding entity]*

\_\_\_\_\_

By:

*[Signature]*

\_\_\_\_\_

*[Printed name]*

\_\_\_\_\_

*(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest:

*[Signature]*

\_\_\_\_\_

*[Printed name]*

\_\_\_\_\_

Title:

\_\_\_\_\_

Submittal Date:

\_\_\_\_\_

Address for giving notices:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Telephone Number:

\_\_\_\_\_

Fax Number:

\_\_\_\_\_

Contact Name and e-mail address:

\_\_\_\_\_

\_\_\_\_\_

Bidder's License No.:

\_\_\_\_\_

*(where applicable)*

*NOTE TO USER: Use in those states or other jurisdictions where applicable or required.*

## SECTION 012000 - PRICE AND PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Schedule of Values.
- B. Application for Payment.
- C. Change Procedures.
- D. Defect Assessment.
- E. Unit Prices.
- F. Alternates.

#### 1.2 SCHEDULE OF VALUES

- A. Submit printed schedule on Progress Estimate schedule on EJCDC C-620 or Contractor's standard form or electronic media printout will be considered for this use.
- B. Submit Schedule of Values in duplicate within twenty (20) days after date established in Notice to Proceed.
- C. Format: Use Table of contents of this Project Manual. Identify each line item with number and title of major Specification Section. Also identify Site mobilization, bonds and insurance, and demobilization.
- D. Include within each line item, direct proportional amount of Contractor's overhead and profit.
- E. Revise schedule to list approved Change Orders with each Application for Payment.

#### 1.3 APPLICATION FOR PAYMENT

- A. Submit five (5) copies of each Application for Payment on EJCDC C-620 "Contractor's Application for Payment."
- B. Content and Format: Use Schedule of Values for listing items in Application for Payment.
- C. Submit updated construction schedule and payment schedule with each Application for Payment.
- D. Payment Period: Submit at intervals stipulated in the Agreement.



- E. Submit submittals with transmittal letter as specified in Section 013300 "Submittal Procedures."
- F. Substantiating Data: When Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
  - 1. Current construction photographs.
  - 2. Partial release of liens from major Subcontractors and vendors.
  - 3. Record Documents as specified in Section 017000 "Execution and Closeout Requirements," for review by Owner, which will be returned to Contractor.
  - 4. Affidavits attesting to off-Site stored products.
  - 5. Construction Progress Schedule, revised and current as specified in Section 013300 "Submittal Procedures."

#### 1.4 CHANGE PROCEDURES

- A. Submittals: Submit name of individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Engineer of any error, inconsistency, omission, or apparent discrepancy.
- C. Requests for Interpretation (RFI) and Clarifications: Allot time in construction scheduling for liaison with Engineer; establish procedures for handling queries and clarifications.
  - 1. Use Request for Information Form for requesting interpretations (provided by Engineer upon request).
  - 2. Engineer may respond with a direct answer on the Request for Information form, separate Engineer Response, EJCDC C-942 "Field Order," or EJCDC C-940 "Work Change Directive Form."
- D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on EJCDC C-942 "Field Order".
- E. Engineer may issue Notice of Change including a detailed description of proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with stipulation of overtime Work required and with the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 10 days.
- F. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change and the effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on the Work by separate or other Contractors.

- G. Stipulated Sum/Price Change Order: Based on Proposal Request or Work Change Directive and Contractor's maximum price quotation or Contractor's request for Change Order as approved by Engineer.
- H. Unit Price Change Order: For Contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of that which are not predetermined, execute Work under Work Directive Change. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.
- I. Work Change Directive: Engineer may issue directive, on EJCDC C-940 "Work Change Directive," instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.
- J. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
- K. Maintain detailed records of Work done on time and material basis. Provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.
- L. Document each quotation for change in Project Cost or Time with sufficient data to allow evaluation of quotation.
- M. Change Order Forms: EJCDC C-941 "Change Order."
- N. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- O. Correlation of Contractor Submittals:
  - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
  - 2. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of Work affected by the change, and resubmit.
  - 3. Promptly enter changes in Record Documents.

#### 1.5 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of Engineer or Owner, it is not practical to remove and replace the Work, Engineer or Owner will direct appropriate remedy or adjust payment.
- C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Owner.

- D. Defective Work will be partially repaired according to instructions of Engineer, and unit sum/price will be adjusted to new sum/price at discretion of Owner.
- E. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.
- F. Authority of Owner to assess defects and identify payment adjustments is final.
- G. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from transporting vehicle.
  - 4. Products placed beyond lines and levels of the required Work.
  - 5. Products remaining on hand after completion of the Work.
  - 6. Loading, hauling, and disposing of rejected products.

#### 1.6 MEASUREMENT AND PAYMENT

##### A. General Requirements

- 1. Contractor shall take measurements and compute quantities. Resident Project Representative and Engineer will verify measurements and quantities.
- 2. Unit Quantities: Quantities and measurements indicated on Bid Form are for Contract purposes only. Actual quantities provided shall determine payment.
  - a. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at Contracted unit sum/prices.
  - b. When actual Work requires 25 percent or greater change in quantity than those quantities indicated, Owner or Contractor may claim a Contract Price adjustment.
- 3. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.
- 4. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

##### B. Measurement of Quantities

- 1. Weigh Scales: Inspected, tested, and certified by applicable West Virginia weights and measures department within past year.
- 2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
- 3. Metering Devices: Inspected, tested, and certified by applicable West Virginia department within past year.
- 4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel, or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.

5. Measurement by Volume: Measured by cubic dimension using mean length, width, and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.
7. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
8. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

C. Unit Price Schedule:

1. Bid Item 1 – Mobilization/Demobilization
  - a. This item shall include the performance of construction preparatory operations, including the movement of equipment and personnel to and from the Project Site, establishment and decommissioning of Contractor's Field Office, storage buildings, and other facilities necessary to conduct Work under this Contract.
  - b. Payment shall be made at the lump sum (LS) price Bid for Mobilization/Demobilization, but in no case shall the total lump sum Bid Price exceed 3 percent of the total Bid.
  - c. Partial Payments of the lump sum Bid amount for mobilization/demobilization shall be as follows:
    - 1) The payment request for mobilization on the first estimate shall not exceed 3% of the total bid price for this contract. The balance of the lump sum Bid item shall be considered demobilization and shall be paid at Contract closeout.
    - 2) No reduction will be made, nor any increase be made, in the lump sum mobilization item amount regardless of decreased or increases in the final total Contract amount or for any other cause.
2. Bid Item 2 – To provide all labor, equipment, materials, and services to furnish and install the proposed new Wastewater Treatment Plant includes construction of a new headworks which consists of one (1) center flow mechanical fine screens with screenings processing, one (1) manual bar screen, vortex grit removal system with classifier, with all associated piping and appurtenances; construction of two (2) sequencing batch reactors (SBRs), one (1) post-equalization (EQ), one (1) aerobic digester, installation of all associated equipment, electrical and controls, and all other necessary appurtenances; new operations building which consists of kitchen, laboratory, locker room and bathroom, garage bays, belt filter press, polymer feed system, lime feed system and all associated equipment and controls, utility room and electrical room to house all electrical controls and SCADA equipment; construction of a new UV disinfection building to house all necessary UV disinfection equipment, a new non-potable pumping station with hydropneumatic tank and all other necessary appurtenances; emergency standby generator with automatic transfer switch; and decommissioning of existing lagoon plant. Site work shall include paving, grading, piping, sidewalks, fencing, bollards, and all other work related items. The work shall include all ancillary mechanical, electrical, instrumentation and controls, erosion and sediment controls, SCADA, spare parts and accessories, civil, structural, architectural, and other items needed to provide a complete fully tested and operable system.

- a. The cost for this Work shall be a lump sum.
  - b. Measurement for this bid item shall be based on the breakdown by Contractor in the approved Schedule of Values.
3. Bid Item 3 – To provide all labor, equipment, materials, and services to provide capital improvements required by the electric company to provide adequate electrical service to the project site including additional power poles, transformers, meters, cable and/or conduit and other electrical accessories for the allowance amount of \$20,000.
  - a. The costs associated with this allowance shall be in accordance with General Conditions Article 11. The Twenty Thousand Dollar (\$20,000.00) allowance shall cover any additional requirements of the electric company during the coordination of this project. This bid item specifically excludes any work shown on the contract documents. All work within the Contract Document shall be included in previous bid items.
4. Bid Item 4 – To procure, deliver and install office furniture in the newly constructed Administrative Building as authorized by the Owner and Engineer for the allowance amount of \$15,000.
  - a. The costs associated with this allowance shall be in accordance with General Conditions Article 11. The Fifteen Thousand Dollar (\$15,000.00) allowance shall cover any costs associated with the procurement, delivery, and installation of furniture in the newly constructed buildings during the coordination of this project. This bid item specifically excludes any work shown on the contract documents. All work within the Contract Document shall be included in previous bid items.
5. Bid Item 5 – Winfield Way Lift Station Rehabilitation, Complete
  - a. The cost for this item shall be a lump sum.
  - b. This Bid Item shall include all costs associated with the Winfield Way Lift Station Rehabilitation, including all materials and labor, as specified herein and within the Drawings for a complete and fully operating system.
  - c. This Bid Item shall also include all costs associated with temporary facilities, piping, fittings connections, pumps and other equipment, valves, tie-in to existing sewers and forcemains, coating/lining systems, demolition, grading, fencing, piping plugs, gravel, site work, electrical, instrumentation, programming and all other associated work and all other appurtenances.
  - d. All work shown or implied in the Contract Documents pertaining to the Winfield Way Lift Station shall be included in Bid Item 5.
  - e. Measurement and payment shall be based on the approved Schedule of Valves.
6. Bid Item 6 – Removal and Disposal of Sludge
  - a. This work includes all materials, labor, expenses, equipment, and appurtenances required to complete the sludge removal, drying and transport to Sycamore landfill. All tipping fees are the responsibility of the Contractor. The volume of sludge to be removed is the Engineers best estimate as reflected in the Bid Schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012000

SECTION 024120.00 - DECOMMISSIONING OF EXISTING WASTEWATER TREATMENT PLANT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the work associated with the decommissioning of the existing sewage lagoon Wastewater Treatment Plant (WWTP).
- B. The Contractor shall furnish all restoration labor, materials, equipment, necessary permits, and mobilization and demobilization, to perform sludge removal, dewatering, and disposal from the existing lagoons.
- C. This work will consist of removal, dewatering, and disposal of sludge from the existing lagoons to an accepting landfill; removal and disposal of lagoon equipment; removal of disinfection equipment from the existing WWTP; removal of effluent line from lagoon to chlorine contact chamber; removal of effluent line from chlorine contact chamber to Kanawha River; removal of existing outfall sign; and decommissioning of the chlorine contact chamber.
- D. The method of removal and disposal shall be approved by the Engineer and the WVDEP. The Contractor may choose to and dispose of the liquid at a nearby wastewater facility or dewater the sludge to a minimum of 20% solids and dispose at an accepting landfill.

1.2 COORDINATION

- A. Section 013000: "Administrative Requirements: Requirements for Coordination."
- B. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.

1.3 PREINSTALLATION MEETINGS

- A. Section 013000: "Administrative Requirements: Requirements for Pre-Installation Meeting."
- B. Convene minimum one (1) week prior to commencing Work of this Section.

1.4 QUALITY ASSURANCE

- A. Perform Work according to specified standards.
- B. Maintain one (1) copy of each standard affecting Work of this Section on Site.



## PART 2 - PRODUCTS

### 2.1 PUMPING/HAULING

- A. All temporary pumping equipment necessary to dewater lagoons shall be provided by Contractor to accomplish construction activity.
- B. All sludge or septage removal shall be provided by the Contractor through a licensed and permitted hauler.

### 2.2 DISINFECTION

- A. All equipment and chemicals required for disinfection of lagoons shall be provided by Contractor.

### 2.3 SOURCE QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Testing, Inspection, and Analysis."

## PART 3 - EXECUTION

### 3.1 REMOVAL OF SEWER FROM LAGOONS

- A. Liquid Removed from the existing lagoon wastewater treatment plant shall be either disinfected with the existing disinfection system and discharged to the Kanawha River, or pumped to the newly constructed WWTP adjacent to the lagoons and disinfected prior discharge to the Kanawha River.
- B. Removal of sludge from the existing lagoon wastewater treatment plant shall be accomplished by dewatering and hauled to a qualified landfill by a certified septage hauler for disposal. All sludge will be removed prior to removal of the liner. Lime shall be added to any small amounts of remaining sludge under the liner prior to re-grading activities.
- C. The City of Winfield has offered to allow the contractor to use the proposed sludge dewatering equipment at the newly constructed WWTP adjacent to the lagoons under the following conditions:
  - 1. All operational costs will be bared by the contractor
  - 2. All polymer used by the contractor will be replenished
  - 3. Any damage to the sludge dewatering equipment will be repaired at the expense of the contractor
  - 4. A new belt for the sludge press will be supplied to the owner

### 3.2 DISINFECTION OF STRUCTURES

- A. Disinfection of all existing concrete structures being removed shall be accomplished by the following procedure:

Pressure Wash. As a first step the Contractor shall pressure wash any existing basins or wet well involved in proposed construction. Pressure washing shall be conducted with a jet type water sprayer delivering water at a minimum temperature of 120°F.

Chlorination. As a second step, the Contractor shall pressure spray any existing structures or wet well involved in proposed construction with a 50 ppm to 100 ppm chlorine mixture. A suitable mixture would be one (1) liquid ounce of chlorine bleach to five (5) gallons of water.

### 3.3 WASTEWATER TREATMENT PLANT

- A. Contractor will notify Owner two weeks prior to decommissioning of the plant.
- B. Contractor shall allow Owner to remove any items from the existing plant (i.e., grating, pumps, etc.) prior to decommission.
- C. The existing chlorine contact chamber may be abandoned in place by crushing the concrete basin bottom, removing the top, and filling the basin to surface. Prior approval in writing shall be obtained by the Contractor from the Engineer prior to starting this activity. Fill material shall be fly ash, sand or clean fill material approved by the Engineer.
- D. All disinfection and chlorine injection equipment shall be removed from the existing WWTP as indicated on the drawings.
- E. All materials, equipment, and structures removed becomes the Contractor's property and responsibility for disposal

### 3.4 RECLAMATION OF SITES

- A. All cavities created by removal of tanks or basins shall be backfilled and compacted with clean fill material.
- B. All demolition sites shall be graded smooth and be reclaimed with fertilizer, lime seed, and mulch.
- C. Refer to Section 310513: "Soils for Earthwork" for backfill specifications and Section 329119: "Landscaping" for seeding and mulching specifications.
- D. Fine grading and landscaping shall be performed so as to not permit ponding of surface water or runoff.
- E. Existing catch basins, culverts, and drains are to remain open and free of debris.

3.5 PREPARATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Preparation."

3.6 FIELD QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Inspecting and Testing."
- B. Backfill will be placed according to methods described in Section 310513: "Soils for Earthwork"

END OF SECTION 024120.00

SECTION 034100 – CAST-IN-PLACE CONCRETE FOR PRECAST, POST-TENSIONED CONCRETE TANK BASE SLABS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes form materials, reinforcement, accessories, cast-in-place concrete, and slab finishing and curing for the base slabs of the precast, post-tensioned, concrete tanks for the entire project. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the mixing, placing and finishing of cast-in-place concrete.
- B. Related Sections include the following:
  - 1. Section 312000 “Earth Moving” for preparing the subgrade to support the tanks and for backfilling requirements.
  - 2. Section 034100 “Precast Structural Concrete”

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Include minimum required compressive strength.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork and accessories in accordance with ACI 301, ACI 347 and ACI 350.
- B. Perform concrete reinforcing work in accordance with ACI 301 and ACI 350.
- C. Perform cast-in-place concrete work in accordance with ACI 301 and ACI 350.

- D. Conform to ACI 305R when concreting during hot weather.
- E. Conform to ACI 306R when concreting during cold weather.
- F. Referenced Standards:
  - 1. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials”
  - 2. ACI 301, “Specifications for Structural Concrete”
  - 3. ACI 305R, “Guide to Hot Weather Concreting”
  - 4. ACI 306R, “Guide to Cold Weather Concreting”
  - 5. ACI 350, “Code Requirements for Environmental Engineering Concrete Structures”
  - 6. ACI 350.5, “Specifications for Environmental Concrete Structures”
  - 7. CRSI, “Manual of Standard Practice”

## PART 2 – PRODUCTS

### 2.2 FORM MATERIALS AND ACCESSORIES

- A. Form Materials: At discretion of Tank Supplier.
- B. Formed Construction Joints: Keyed joints as indicated on the tank Shop (Erection) drawings provided by the Tank Supplier. Provide holes in formwork to receive reinforcing across the joint.
- C. Vapor Retarder: ASTM D 4397, 6 mil thick, clear polyethylene film.

### 2.3 NON-PRESTRESSED REINFORCING STEEL

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Wire Reinforcement: ASTM A 1064, plain or deformed, flat sheet.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing
- D. Fabricate concrete reinforcement in accordance with ACI 301, ACI 350 and CRSI Manual of Standard Practice.

## 2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II or Type I/II.
- B. Supplementary Cementitious Materials
  - 1. Fly Ash: ASTM C 618, Class F.
  - 2. Slag: ASTM C 989, Grade 100 or 120, ground granulated blast furnace slag.
- C. Fine and Coarse Aggregates: ASTM C33, 1-inch maximum size.
- D. Concrete Reinforcing Fibers: ASTM C 116, high-strength industrial-grade fibers.
- E. Water: Potable; free from deleterious material that may affect setting or strength of concrete.
- F. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride or more than 0.15 percent chloride ions or other salts by weight of admixture.
  - 1. Water-Reducing Admixture: ASTM C 494, Type A.
  - 2. Retarding Admixture: ASTM C 494, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  - 4. Water-Reducing and Accelerating Admixture ASTM C494, Type E.
  - 5. High Range, Water-Reducing Admixture: ASTM C 494, Type A and F.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

## 2.5 CONCRETE MIXTURES

- A. Mix and deliver concrete in accordance with ASTM C 94, Option C.
- B. Select proportions for normal weight concrete in accordance with ACI 301, Method 1 or Method 2.
- C. Prepare design mixtures for each type of concrete required.
  - 1. Limit use of fly ash to 20 percent replacement of portland cement by weight.

2. Limit use of slag to 30 percent replacement of portland cement by weight.
- B. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 350 when tested in accordance with ASTM C 1218.
- D. Furnish concrete as indicated below:
  1. Compressive Strength (28 Days): 4,000 psi minimum
  2. Maximum Water-Cementitious Materials Ratio: 0.45
  3. Slump: 7 inches,  $\pm 1$  inch.
  4. Minimum cementitious content: 611 pounds per cubic yard
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6%,  $\pm 1-1/2\%$ .
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Do not use calcium chloride or admixtures containing calcium chloride.

## 2.6 WATERSTOPS

- A. Flexible PVC Waterstops: Corp of Engineers CRD-C 572 for embedding in concrete construction joints to prevent the passage of fluids through joints. Factory-fabricate corners, intersections and directional changes.
  1. Profile: Ribbed without center bulb.
  2. Dimensions: 6 inches by 3/8-inch-thick, non-tapered.
  3. Acceptable Products:
    - a. Greenstreak PVC Waterstop #679, or equal.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free, hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete.
  1. Acceptable Products:
    - a. Greenstreak Hydrotite<sup>®</sup> CJ-1030-4M, or equal.
- C. Self-Expanding Extrudable Waterstops: Extrudable, swelling, bentonite-free, one-part polyurethane.
  1. Acceptable Products:
    - a. SikaSwell<sup>®</sup> S-2, or equal



## 2.7 RELATED MATERIALS

- A. Crack Filler: ASTM C 881, two-part, moisture-tolerant, very-low-viscosity, epoxy injection adhesive for filling cracks.
  - 1. Acceptable Products:
    - a. Sikadur<sup>®</sup> 52, or equal
- B. Crack Sealer: ASTM C 920, Type S, Grade NS, Class 35 one-part polyurethane, elastomeric sealant, for sealing cracks.
  - 1. Acceptable Products:
    - b. Sikaflex<sup>®</sup>-1a, or equal

## PART 3 – EXECUTION

### 3.1 PREPARATION

- A. Proceed with base slab construction only after unsatisfactory conditions have been corrected in accordance with Section 03420, “Precast, Post-tensioned Concrete Tanks - Rectangular.”

### 3.2 FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements.
- B. Provide bracing to ensure stability of formwork.

### 3.2 EMBEDDED COMPONENTS AND OPENINGS

- B. Coordinate work of other sections in forming and setting openings, slots, keyways, sleeves, bolts, anchors, pipe sleeves and other embedded components.
- C. Install concrete accessories straight, level and plumb.
- D. Install water stops continuous without displacing reinforcing. Heat seal joints watertight.
- E. Place construction joint forms in accordance with base slab pouring sequence.

### 3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.

- B. Ensure reinforcing is clean, free of loose scale, dirt or other foreign coatings.
- C. Space reinforcement bars with minimum clear spacing in accordance with ACI 350, but not less than 1-1/2 inches.
- D. Place reinforcement bars and maintain cover in accordance with tolerances listed in ACI 117 and ACI 350.

### 3.4 PLACING CONCRETE

- A. Install vapor retarder under base slab as indicated on the tank Shop (Erection) drawings provided by the Tank Supplier.
- B. Ensure reinforcement, embedded components and formwork is not displaced during concrete placement.
- C. Deposit concrete as closely as practicable to final position. Prevent segregation of mix.
- D. Place concrete continuously between predetermined construction joints.
- E. Consolidate concrete.
- F. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- G. Screed base slab level. Maintain slab flatness meeting the Conventional floor surface classification as measured using the Manual Straightedge Method per ACI 117, Table 4.8.6.1, unless indicated otherwise on the tank Shop (Erection) drawings provided by the Tank Supplier.

### 3.5 FINISHING

- A. Steel-trowel finish unformed surfaces.
- B. In areas with floor drains, maintain slab level at walls and slope uniformly to drains.

### 3.6 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
  - 1. Concrete, except high-early strength concrete, shall be maintained above 50° F and in a moist condition for at least the first three days after placement.

2. When concrete could be exposed to more than one freezing and thawing cycle during construction, protect concrete from freezing until concrete strength of 3,500 psi is achieved. Strength shall be verified using field-cured cylinders.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

### 3.7 FIELD QUALITY CONTROL

- A. Place no concrete for the base slab until the subgrade has been inspected and approved by the Owner's Geotechnical Engineer.
- B. Perform field inspection and testing in accordance with ACI 301.
- C. Testing: Owner will engage accredited independent testing and inspecting agency to perform field tests and prepare reports.
1. Testing agency will report test results promptly and in writing to Contractor, Engineer of Record and Tank Supplier.
- D. Strength Test Samples:
1. Sampling Procedures: ASTM C 172
  2. Cylinder Molding and Curing Procedures: ASTM C 31, cylinder specimens, standard cured.
    - a. When there are early-age strength requirements, strength shall be evaluated using field-cured cylinders.
  3. Sample concrete and make one set of five 4" x 8" cylinders for every 50 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area.
    - a. Make additional sets of three 4" x 8" cylinders at the discretion of the Tank Supplier when required to verify early-age strength.
- E. Field Testing:
1. Slump Test Method: ASTM C 143
  2. Air Content Test Method: ASTM C 231
  3. Temperature Test Method: ASTM C 1067

4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

F. Cylinder Compressive Strength Testing:

1. Test Method: ASTM C39
2. Evaluation and Acceptance of Concrete: In accordance with ACI 350.
3. Test three 4" x 8" cylinders at 28 days.
4. Retain two cylinders for 56 days for testing when requested by Engineer.
5. Dispose of remaining cylinders when testing is not required.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replace defective concrete. Repairs will be permitted provided structural adequacy, serviceability and durability of concrete elements comply with requirements of this section.

END OF SECTION 033100

## SECTION 034100 – PRE-CAST STRUCTURAL CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the performance criteria, materials, design, production, and erection of rectangular precast, post-tensioned, concrete tanks for the entire project. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the rectangular precast, post-tensioned, concrete tanks shown on the Contract Drawings.
- B. Work includes, but is not limited to:
  - 1. Sequencing Batch Reactor Tank
- C. Related Sections include the following:
  - 1. Section 312000 “Earth Moving” for preparing the subgrade to support the tanks and for backfilling requirements.
  - 2. Section 033100 “Cast-in-Place Concrete for Precast” for concrete for the Precast, Post-tensioned Tank base slab.
  - 3. Section 055000 “Metal Fabrications” for furnishing and installing loose hardware items.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide rectangular precast, post-tensioned, concrete tanks capable of withstanding the following design loads within limits and under conditions indicated:
  - 1. Internal Fluid Loads: 65 pcf
  - 2. Basic Ground Snow Load: Per Sheet S1 of the Contract Drawings
  - 3. Backfill Loads:
    - a. Unit Weight: 120 pcf
    - b. Equivalent Fluid Pressure against Tank Walls: 55 pcf

4. Surcharge Loads: 250 psf
5. Design Groundwater Elevation: 581.00 ft
6. Design Flood Elevation: 500 Year Flood Elevation Per Contract Drawings

B. General Tank Design Criteria:

1. Wall thickness shall be as required by ACI 350 and not less than 16 inches.
2. Backfill shall not be used to offset fluid loads.
3. The tank walls shall be post-tensioned in accordance with ACI 350.
  - a. Tank walls shall have horizontal post-tensioned tendons to provide residual compression stress.
  - b. Minimum residual compression shall be 125 psi after allowance for all prestress losses.
4. Comply with ACI 350 requirements including, but not limited to:
  - a. Load factors.
  - b. Limits on stresses at transfer of prestress and under service load.
  - c. Minimum bonded reinforcement.
  - d. Concrete cover over reinforcement.
5. Flotation safety factors:
  - a. Whether due to flood or natural groundwater, minimum factor of safety shall be 1.25.
    1. Maximum allowable soil wedge angle from vertical: 16 degrees
6. The tank structure shall be designed for normal environmental exposure.
7. Design rectangular precast, post-tensioned, concrete tanks to allow for fabrication and construction tolerances, and to accommodate deflection, shrinkage and creep of primary tank structure. Maintain structural precast concrete deflections within limits of ACI 350.

C. Mat Foundation Base Slab Design Criteria:

1. Design the base slab to resist all imposed loads within the allowable bearing capacity listed below.
  - a. Net Allowable Bearing Capacity: 2,000 psf
  - b. Subgrade Modulus: 100 psi/in for point loading conditions, 20 psi/in for area loading conditions
  - c. Refer to Geotechnical Engineering Report by Terracon Consultants, Inc. dated December 12, 2014 for additional foundation design recommendations.
2. Minimum reinforcement in each orthogonal direction shall be in accordance with ACI 350.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Design Mixtures: For each concrete mixture. Include minimum required compressive strength.
  
- C. Shop (Erection) Drawings:
  - 1. Indicate configuration, thickness, dimensions and details of cast-in-place concrete base slab.
  - 2. Indicate size, spacing and details of all necessary base slab reinforcing.
  - 3. Indicate plan views, elevations, sections, and details necessary to install the tank.
  - 4. Indicate locations of all post-tensioned tendons.
  - 5. Indicate tendon stressing sequence and force, and theoretical elongations for all post-tensioned tendons.
  - 6. Include and locate all pipe penetrations. Indicate all penetration styles.
  - 7. Coordinate and indicate openings required by other trades.
  - 8. Indicate location of each precast concrete member by same identification mark placed on unit.
  - 9. Indicate relationship of structural precast concrete members to adjacent materials.
  - 10. Indicate locations and details of joint treatment.
  - 11. Indicate shim sizes and grout requirements.
  - 12. Indicate bearing pad sizes and materials.
  
- D. Comprehensive engineering design signed and sealed by a qualified professional engineer responsible for its preparation licensed in the State of West Virginia.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Tank Supplier and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
  
- B. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
  - 1. Cementitious materials.
  - 2. Aggregates.
  - 3. Reinforcing materials and post-tensioning strands.
  - 4. Admixtures.
  - 5. Bearing pads.



6. Other components specified in Contract Documents with applicable standards.
- C. Provide handling procedures, erection sequences, and temporary bracing as required for special conditions.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Tank Supplier Qualifications:
  1. Assumes responsibility for engineering rectangular precast, post-tensioned, concrete tanks to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer registered in the State of West Virginia.
  2. Precast Tank Engineer Qualifications: A professional engineer licensed in the State of West Virginia and experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for designs and installations of rectangular precast, post-tensioned, concrete tanks.
- B. Tank Supplier: Subject to compliance with requirements, provide rectangular precast, post-tensioned, concrete tanks by Dutchland, Inc. located in Gap, Pennsylvania, or pre-approved equal. Requests for prequalification must be received no less than 15 days prior to the bid date.
- C. Alternate Tank Supplier Pre-approval Requirements: Alternate Tank Suppliers wishing to become pre-approved shall comply with the Tank Supplier Qualifications listed above. Interested firms shall submit the following with their request for preapproval:
  1. The firm shall document having 25 consecutive years experience in designing, manufacturing, and installing tanks of similar arrangement, size and complexity using a fully compliant ACI 350 precast, post-tensioned system.
  2. The firm shall document the successful installation and performance of a minimum of ten similar facilities equal or greater in size and certify compliance of those structures with all applicable provisions of ACI 350 for a precast, post-tensioned structure including the required 125 PSI residual compression.
  3. The firm shall employ a full-time engineer on staff who meets the Precast Tank Engineer Qualifications listed above and who has served as the engineer in responsible charge of at least ten structures equal or greater in size.
  4. Interested firms shall document a first pass leak test history of no less than 95 percent of all their water holding basins passing the leak test on the first test over a twelve-month period.

5. The firm shall submit with its bid a reference sheet listing contact names and telephone numbers of at least five structures equal or greater in size designed and constructed by the firm.
  6. The firm shall submit with its request for preapproval a summary sheet documenting compliance with all the above qualifications.
  7. Additional pre-approved firms will be issued by name via addendum no less than 5 days prior to the bid date.
- D. Post-Tensioning Manufacturer Qualifications: Fabricating plant certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons."
- E. Post-Tensioning Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 Unbonded PT - Field Installation course.
1. Superintendent must receive training from post-tensioning supplier in the operation of stressing equipment to be used on Project.
- F. Post-Tensioning Inspector Qualifications: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 2 Unbonded PT - Inspector course.
- G. Design Standards: Comply with ACI 350, "Code Requirements for Environmental Concrete Structures" and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," applicable to types of structural precast concrete members indicated.
- H. Quality-Control Standard: For manufacturing procedures and testing requirements and quality control recommendations for types of members required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Concrete Products."
1. Comply with dimensional tolerances of PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."
- I. Plant Quality Control Manager Qualifications: The plant quality control manager shall be currently certified as a PCI Level 2 Plant Quality Control Technician.
- J. Plant Manager Qualifications: The plant manager shall be currently certified as a PCI Level 2 Plant Quality Control Technician.
- K. Referenced Standards:
1. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials"

2. ACI 301, "Specifications for Structural Concrete"
  3. ACI 318, "Building Code Requirements for Structural Concrete"
  4. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures"
  5. ACI 350.1, "Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures"
  6. ACI 350.3, "Seismic Design of Liquid-Containing Concrete Structures"
  7. ACI 350.4R, "Design Considerations for Environmental Engineering Concrete Structures"
  8. ACI 350.5, "Specifications for Environmental Concrete Structures"
  9. ACI 423.7, "Specification for Unbonded Single-Strand Tendon Materials and Commentary"
  10. ASCE 7, "Minimum Design Loads for Buildings and Other Structures"
  11. AWS D1.4, "Structural Welding Code – Reinforcing Steel"
  12. PCI MNL-116, "Manual for Quality Control for Plants and Production of Structural Concrete Products"
  13. PCI MNL-120, "PCI Design Handbook – Precast and Prestressed Concrete"
  14. PCI MNL-135, "Tolerance Manual for Precast and Prestressed Concrete Construction"
  15. PTI TAB.1, "Post-Tensioning Manual"
  16. PTI M10.2, "Specification for Unbonded Single Strand Tendons"
  17. PTI M10.3, "Field Procedures Manual for Unbonded Single Strand Tendons"
  18. PTI M55.1, "Specification for Grouting of Post-Tensioned Structures"
- L. Tank designs that rely on bolted or welded connections, or ship-lap joints, for primary, fluid-retaining walls shall not be allowed.
- M. Shotcrete for any part of the tank construction shall not be allowed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Deliver all precast concrete members in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.
- C. Handle and transport precast concrete members in a manner to avoid excessive stresses that could cause cracking or other damage.
- D. Store precast concrete members with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain post-tensioning materials and equipment from single source.

### 2.2 FORM MATERIALS

- A. Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.
  - 1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

### 2.3 NON-PRESTRESSED REINFORCING STEEL

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Welded Wire Reinforcement: ASTM A 1064, plain or deformed, flat sheet.
- D. Supports: Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

### 2.4 PRESTRESSING TENDONS

- A. ACI Publications: Comply with ACI 423.7, "Specification for Unbonded Single Strand Tendon Materials and Commentary."
- B. Prestressing Strand: ASTM A 416, Grade 270, 7-wire, low-relaxation, 0.6-inch-diameter strand with corrosion inhibitor conforming to ACI 423.7, with polypropylene tendon sheathing.
- C. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties; chemically stable and nonreactive with prestressing steel, nonprestressed reinforcement, sheathing material, and concrete.

D. Tendon Sheathing:

1. Virgin high-density polyethylene or polypropylene with a minimum thickness of 50 mils.
2. Continuous over the length of tendon to provide watertight encapsulation of strand.

E. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements and capable of developing 95 percent of actual breaking strength of strand.

1. Anchorage devices and coupler assemblies shall be fully-encapsulated with either plastic or epoxy coating.

F. Encapsulation System: Watertight encapsulation of prestressing strand consisting of the following:

1. Wedge-Cavity Caps: Attached to anchorages with a positive mechanical connection and completely filled with post-tensioning coating.
2. Sleeves: Attached to anchorage device with positive mechanical connection; overlapped a minimum of 4 inches with sheathing and completely filled with post-tensioning coating.
3. The encapsulation system shall meet the hydrostatic pressure testing requirements of ACI 423.7, except with a hydrostatic pressure of 10 psi, instead of the specified 1.25 psi.

## 2.5 ACCESSORIES

- A. Sheathing Repair Tape: Elastic, self-adhesive, moisture proof tape with minimum width of 2 inches (50 mm), in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.

## 2.6 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II or Type I/II.

1. For surfaces exposed to view in finished structure, use same type, brand, and mill source throughout the precast concrete production.

- B. Supplementary Cementitious Materials

1. Fly Ash: ASTM C 618, Class F with maximum loss on ignition of 6%.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

- C. Normal weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse, non-reactive aggregates. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- E. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride or more than 0.15 percent chloride ions or other salts by weight of admixture.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. Water-Reducing and Accelerating Admixture ASTM C494/C 494M, Type E.
  - 5. High Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type A and F.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 7. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C 1017M.

## 2.7 STEEL EMBEDDED MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M
- B. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with the minimum mechanical properties of PCI MNL 116, Table 3.2.3.
- C. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- D. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123, after fabrication.
  - 1. Galvanizing Repair Paint: Zinc paint with dry film containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035B or SSPC-Paint 20.

## 2.8 STAINLESS-STEEL EMBEDDED MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
- C. Stainless-Steel Headed Studs: ASTM A 276, with minimum mechanical properties for studs as indicated under MNL 116, Table 3.2.3.

## 2.9 BEARING PADS AND OTHER ACCESSORIES

- A. Provide one of the following bearing pads for structural precast concrete members as recommended by tank supplier for application:
  - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D 2240, minimum tensile strength 2250 psi per ASTM D 412.
  - 2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
  - 3. High-Density Plastic: Multimonomer, nonleaching, plastic strip capable of supporting loads with no visible overall expansion.
- B. Erection Accessories: Provide steel plates and brackets, clips, hangers, high density plastic shims, and other accessories required to install precast concrete members.

## 2.10 GROUT MATERIALS

- A. Nonshrink Grout: Premixed, prepackaged, non-metallic, shrink-resistant grout complying with ASTM C 1107, Grade C. Grout shall not contain chlorides.
  - 1. Acceptable Products:
    - a. SikaGrout 212<sup>®</sup>, or equal.
    - b. SikaGrout 328<sup>®</sup>, or equal.

## 2.11 PATCHING MATERIALS

- A. One-component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead applications. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.

- 1. Acceptable Products:

- a. ProSpec® BlendCrete, or equal.

## 2.12 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of concrete required.
  - 1. Limit use of fly ash to 25 percent replacement of portland cement by weight.
  - 2. Limit use of ground granulated blast-furnace slag to 40 percent replacement of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at Tank Supplier's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 350 or PCI MNL 116 when tested in accordance with ASTM C 1218/C 1218M.
- D. Normal weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal weight concrete.
- E. Precast Concrete:
  - 1. Compressive Strength (28 Days): 5,000 psi minimum.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
  - 3. Self-consolidating concrete must be utilized.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mixture Adjustments: Concrete mixture design adjustments may be made if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.



## 2.13 FORM FABRICATION

- A. Form: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and tensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions within fabrication tolerances specified.
  - 1. Edge and Corner Treatment: Uniformly chamfered or as built-in on standard forms.

## 2.14 FABRICATION

- A. Cast-in Plates, Inserts, Angles, and Other Hardware: Fabricate hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate hardware where it does not affect position of main reinforcement or concrete placement.
  - 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
  - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
  - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
  - 3. Provide cover requirements in accordance with ACI 350. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
  - 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces in accordance with ACI 350 and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- C. Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.

- D. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- E. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.
- F. Place self-consolidating concrete with minimal vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
- G. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.
- H. Identify pickup points of precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete member on a surface that will not show in finished structure.
- I. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on the performance of final product.

## 2.15 WATERSTOPS

- A. Flexible PVC Waterstops: Corp of Engineers CRD-C 572 for embedding in concrete construction joints to prevent the passage of fluids through joints. Factory-fabricate corners, intersections and directional changes.
  - 1. Profile: Ribbed without center bulb.
  - 2. Dimensions: 9 inches by 3/8-inch-thick, non-tapered.
  - 3. Acceptable Products:
    - a. Greenstreak PVC Waterstop #646, or equal.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free, hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete.
  - 1. Acceptable Products:
    - a. Greenstreak Hydrotite® CJ-1030-4M, or equal.
- C. Self-Expanding Extrudable Waterstops: Extrudable, swelling, bentonite-free, one-part polyurethane.
  - 1. Acceptable Products:

- a. SikaSwell® S-2, or equal

## 2.16 RELATED MATERIALS

- A. Joint/Crack Filler: ASTM C 920, Type S, Grade NS, Class 35 one-part polyurethane, elastomeric sealant, for sealing precast panel joints and minor cracks.
  1. Acceptable Products:
    - a. Sikaflex®-1a+, or equal
- B. High-Performance Joint Filler: ASTM C 920, Type S, Grade NS, Class 100/20 low-modulus, high-performance, one-part polyurethane-based, elastomeric sealant, for sealing precast panel joints subject to movement.
  1. Acceptable Products:
    - a. Sikaflex®-15 LM, or equal
- C. Sealant/Adhesive Primer: Specially-formulated primer to promote adhesion of sealants and adhesives to concrete.
  1. Acceptable Products:
    - a. Sikaflex® 429/202, or equal
- D. Joint Sealant, Epoxy: High-build, two-part, protective, solvent-free epoxy.
  1. Acceptable Products:
    - a. Sikagard® 62, or equal
- E. Joint Sealant, Urethane: Liquid-applied, elastomeric, urethane.
  1. Acceptable Products:
    - a. CIM 1000, or equal
- F. Epoxy Injection Adhesive: Two-part, moisture-tolerant, epoxy injection adhesive.
  1. Acceptable Products:
    - a. Sikadur® 52, or equal
- G. Chemical Grout: Expanding, polyurethane, chemical grout.
  1. Acceptable Products:
    - a. SikaFix® HH+, or equal
    - b. SikaFix® HH Hydrophilic, or equal

## 2.16 FABRICATION TOLERANCES

- A. Fabricate structural precast concrete members of shapes, lines and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

## 2.17 FINISHES

- A. Form Finish:
  - 1. Standard Grade: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are acceptable. Fill air holes greater than 1/4 inch in width that occur in high concentration (more than one per 2 square inches). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Allowable joint offset limited to 1/8 inch.
- B. Smooth steel-trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth, uniform finish.

## 2.18 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements. If using self-consolidating concrete also test and inspect according to ASTM C 1611, ASTM C 1712, ASTM 1610, and ASTM C 1621.
- B. Strength of precast concrete members will be considered deficient if units fail to comply with ACI 350 concrete strength requirements.
- C. Testing: If there is evidence that strength of precast concrete members may be deficient or may not comply with ACI 350 requirements, fabricator shall employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42 and ACI 350.
  - a. Test results shall be reported in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports shall include the following:
    - 1. Project identification name and number.

2. Date when tests were performed.
  3. Name of Tank Supplier.
  4. Name of concrete testing agency.
  5. Identification letter, name, and type of precast concrete member(s) represented by core tests; design compressive strength; type of failure; actual compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- D. Patching: If core test results are satisfactory and precast concrete members comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture or repair material, and finish to match adjacent precast concrete surfaces.
- E. Acceptability. Structural precast concrete members that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, and manufacturing tolerances, are unacceptable. Chipped, spalled or cracked members may be repaired. Replace unacceptable units with precast concrete members that comply with requirements.

### PART 3 – EXECUTION

#### 3.1 PREPARATION

- A. General Contractor shall prepare subgrade in accordance with Section 312000“Earth Moving” and the Geotechnical Engineering Report.

#### 3.2 EXAMINATION

- A. Owner’s Geotechnical Engineer shall inspect and approve the subgrade supporting the tank.
- B. Unsatisfactory conditions shall be corrected to the satisfaction of the Owner’s Geotechnical Engineer.
- C. General Contractor shall notify Tank Supplier in writing that supporting subgrade has been approved by the Owner’s Geotechnical Engineer.
- D. Proceed with base slab construction only after unsatisfactory conditions have been corrected.
- E. The stone sub-base shall be prepared, leveled, and graded to within  $\pm$  one inch of stone grade, as indicated on the approved Tank Supplier’s Shop (Erection) drawings.
- F. Excavation shall include a minimum of four feet in plan beyond the perimeter of the approved exterior wall line.

G. Site access roads:

1. Shall be provided and maintained by the General Contractor throughout the installation of the base slab and precast tank structure.
2. Shall be cleared, leveled, stoned, and free of mud to provide 14-feet of vertical clearance and 14-feet of horizontal clearance.
3. Shall be capable of handling 80,000 pounds GVWR.
4. Shall support live loaded trucks operating under their own power.
5. Shall allow drop-deck, spread axle combinations with 53-ft trailers. This includes a 60-foot-long sweep radius for corners and egress/regress to roadways.

H. Crane and concrete pump pads:

1. Shall be provided and maintained by the General Contractor.
2. Shall be cleared, leveled, stoned, and free of mud.
3. Tank Supplier shall communicate the required locations and sizes of the pads with the General Contractor.

### 3.3 CAST-IN-PLACE CONCRETE BASE SLAB

- A. Install the base slab in accordance with Section 033100 "Cast-in-Place Concrete for Precast, Post-tensioned Tanks."

### 3.4 ERECTION

- A. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.
1. Install temporary plastic spacing shims as necessary as precast concrete members are being erected.
  2. Use patching material to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
- B. Install post-tensioning tendons as soon as practical.
- C. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout open spaces at keyways, connections and joints where required or indicated with non-shrink, non-metallic grout. Retain flowable

grout in place until it gains sufficient strength to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Promptly remove grout material from exposed surfaces before it hardens.

- D. Field cutting of precast concrete members is not permitted without approval of the Precast Tank Engineer.

### 3.5 ERECTION TOLERANCES

- A. Erect structural precast concrete members level, plumb, square and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

### 3.6 TENDON INSTALLATION

- A. Inspect sheathing for damage before installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
  - a. Ensure that sheathing is watertight and there are no air voids.
  - b. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Immediately remove and replace tendons that have damaged strand.

### 3.7 TENDON STRESSING

- A. Stressing jacks and gauges shall be individually identified and calibrated to known standards at intervals not exceeding six months. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
- B. Stress tendons only under supervision of a qualified post-tensioning superintendent.
- C. Tendon stressing shall not begin until grout strength in the joints has attained at least 2,500 psi compressive strength.
- D. Tendon stressing shall be performed in the sequence indicated on the Shop (Erection) Drawings.
- E. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8-inch.

- F. Tendon elongations shall be recorded and compared to the theoretical elongations indicated on the Shop (Erection) Drawings. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and theoretical and measured elongations agree.
- G. If measured elongations exceed the tolerances indicated on the Shop (Erection) Drawings, the Precast Tank Engineer shall be notified for resolution.

### 3.8 TENDON FINISHING

- A. Strand tails may be cut once prestressing has been deemed acceptable.
- B. Do not cut strand tails or cover anchorages of tendons where elongations exceed tolerances until all discrepancies have been resolved to the satisfaction of the Precast Tank Engineer.
- C. Cut strand tails as soon as possible after approval of elongations.
- D. The tendon tails shall be cut using hydraulic shears.
- E. The strand length protruding beyond the wedges after cutting of the tendon tail shall be between 0.5-inch and 0.75-inch.
- F. Wedge-cavity caps shall be installed within one working day after cutting tendon tails.
- G. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.
- H. If stressing pockets are not able to be filled within ten days after tendon tail cutting, then temporary protection shall be provided.

### 3.9 FIELD QUALITY CONTROL

- A. Place no concrete for the base slab until the subgrade has been inspected and approved by the Owner's Geotechnical Engineer.
- B. Testing: Owner will engage accredited independent testing and inspecting agency to perform field tests and prepare reports.
  - 1. Testing agency will report test results promptly and in writing to Contractor, Engineer of Record and Tank Supplier.



- C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

### 3.10 PROTECTION OF PRESTRESSED REINFORCEMENT

- A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade components.
- B. Prevent water from entering tendons during installation and stressing.
- C. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

### 3.11 REPAIRS

- A. Repairs will be permitted provided structural adequacy, serviceability and durability of members are not impaired.
- B. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- C. Repair base slab shrinkage cracks as required for watertightness. Rout a ¼-inch vee-notch along the crack and fill the crack with epoxy injection adhesive.
- D. Surface chips or spalls shall be cleaned and then patched with patching material.
- E. Misaligned grout ports or connection ports in walkways may be repaired by either enlarging the existing port, or drilling a new one, as required. Coordinate with the Precast Tank Engineer to avoid internal reinforcing and hardware.
- F. Damage that occurs during the shipping, installation or construction process shall be brought to the attention of the Precast Tank Engineer for resolution.
- G. Additional repairs, if necessary, shall be performed as directed by the Precast Tank Engineer.
- H. Remove and replace damaged structural precast concrete members when repairs do not comply with specified requirements.

### 3.12 CLEANING

- A. Clean grout and any other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete members after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
  - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

### 3.13 TIGHTNESS TESTING

- A. Each cell of multi-cell tanks shall be considered a single containment structure and shall be tested individually, unless otherwise specified.
- B. The General Contractor shall commence tightness testing within five business days of notification that the structure is ready for testing.
- C. Testing shall be performed using the hydrostatic tightness test, which consists of two parts. Part 2 may be waived if approved by the Project Engineer-of-Record.
  - 1. Part 1 shall be a qualitative criterion.
  - 2. Part 2 shall be a quantitative criterion expressed as a maximum allowable volume loss of 0.05 percent per 24-hour period.
- D. No backfill may be placed against the walls or on the wall footings of the containment structures to be tested, unless otherwise specified.
- E. The initial filling of a new containment structure shall not exceed four feet per hour. Filling shall be continued until the water surface is at the design maximum liquid level, or either one inch below any fixed overflow level in covered containment structures or four inches in open containment structures, whichever is lower.
- F. Water for the initial filling shall be provided by the General Contractor. Use potable water unless otherwise specified.
- G. Part 1 – Qualitative criteria

1. If any water is observed on the containment structure exterior wall surfaces where moisture can be picked up on a dry hand, the containment structure shall be considered to have failed Part 1 of the hydrostatic test.
2. Wet areas on top of the wall footing shall not be cause to fail Part 1 unless the water can be observed to be flowing.
3. Although Part 2 of the test may begin prior to completion of repairs for Part 1, all defects causing the failure of Part 1 shall be repaired before acceptance of the containment structure.
4. The standard repair procedure for areas failing Part 1 is to inject chemical grout into the affected area. Consult with the Precast Tank Engineer before commencing any such repairs.

H. Part 2 – Quantitative criteria

1. Part 2 of the hydrostatic tightness test shall not be scheduled for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall also not be scheduled when the weather forecast indicates the water surface could freeze before the test is completed.
2. The vertical distance to the water surface shall be measured to within 1/16 inch from a fixed point on the containment structure above the water surface. The initial measurement shall not be taken until at least 24 hours after the tank is completely filled. Measurements shall be recorded at 24-hour intervals.
3. The test period shall be the theoretical time required to lower the water surface 3/8 inch, assuming a loss of water at the maximum allowable rate. However, the test period shall not be longer than five days.
4. In uncovered containment structures, evaporation and precipitation shall be measured.
5. At the end of the test period, the water surface shall be recorded to within 1/16 inch at the location of the original measurements. The water temperature and precipitation measurements shall be recorded.
6. The change in water volume in the containment structure shall be calculated and corrected, if necessary, for evaporation, precipitation, and temperature. If the loss exceeds the required criterion, the containment shall be considered to have failed Part 2 of the test.

I. Retesting

1. A restart of the test shall be required when test measurements become unreliable due to unusual precipitation or other external factors.
2. It shall be permitted to immediately retest a containment structure failing Part 2 of the hydrostatic test when Part 1 is passed. If the containment structure fails the second test or if not immediately retested after the first test failure, the interior of the containment structure shall be observed for probable problem areas by the Tank Supplier. The containment structure shall only be retested after the probable problem areas are repaired.

3. Containment structures shall be retested until they meet the required Part 1 and Part 2 criteria. Repairs shall be made before each retest.
- J. The containment structure shall be deemed substantially complete upon successful completion of tightness testing. All final payments, including retainage, for all structural elements related to the precast, post-tensioned tank, including the foundation system and cast-in-place base slab, shall be made at this time. This clause supersedes any conflicting clauses in the contract documents.

### 3.14 SPECIAL WARRANTY

- A. The Tank Supplier shall provide a two-year structural warranty to the Owner. The warranty shall at minimum include the following items:
1. The Tank Supplier shall provide a corporate guarantee not covered by any form of insurance or bond as a warranty for the precast tank that warrants the tank is free from structural defect due to faulty design, workmanship, or structural materials.
  2. The Tank Supplier shall warrant the structural aspects of the tank for a period of two years from the substantial completion date of the precast tank.
  3. The Owner must report in a timely manner any claim to the warranty in writing to the tank manufacturer within the effective coverage dates of the warranty.
  4. The Tank Supplier shall furnish, without charge to the Owner, all necessary labor and materials required to repair all structural defects subject to this warranty with a maximum cost of repair not exceeding the Tank Supplier's contract value of the tank and under the condition that the Tank Supplier has been paid in full for the project.
- B. Specific Exclusions from Warranty:
1. Maintenance items (sealants, coatings, equipment, plumbing, etc.), all non-structural items.
  2. Consequential damages, punitive damages, incidental costs, bodily injury, death, and damage to the property other than the tank.
  3. Emptying of tanks, inspection of tanks, processing of the water/wastewater, drying or cleaning of the tanks, filling of tanks, etc. complete in preparation for, and completion of repairs.

4. Defects or issues caused by accident, abuse, misuse, storage or processing of corrosive liquids, improper maintenance, negligence, modifications, additions, or deletions not made by tank manufacturer, improper or defective application, acts of God, force majeure, untimely action by Owner to minimize damage or losses, unstable or improperly designed or constructed soil/subgrade, or defects caused by work supplied by any party other than the Tank Supplier.
  5. A loss or defect that is covered by insurance.
- C. All materials and labor for work performed by the Tank Supplier which is not covered under the standard two-year limited structural warranty shall be warranted for a period of one (1) year from substantial completion of the tank per the Contract Documents.

### 3.15 BACKFILL

- A. General Contractor shall place and compact backfill in accordance with Section 312000 "Earth Moving."
- B. Do not commence backfilling around the tank until the tank has been examined and approved by the Engineer of Record.
- C. The General Contractor shall be responsible to protect the tank from damage by construction activity, equipment and vehicles. Damaged structures shall be repaired or replaced to the satisfaction of the Tank Supplier.
- D. When backfilling against the tank, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures, except where required for final grading.
- E. The excavation shall be kept free of water by the General Contractor at all times.

END OF SECTION 034100

## SECTION 263200 - TRANSFER SWITCHES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
  - 1. Automatic transfer switch.

#### 1.2 SUBMITTALS

- A. Product Data: Include ratings and dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- B. Wiring Diagrams: Detail wiring for transfer switches and differentiate between manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Test and inspection results for compliance with performance requirements in Part 3.
- E. Maintenance Data: For each type of product to include in maintenance manuals. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay-setting and calibration instructions, including software, where applicable.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing emergency maintenance and repairs at Project site with an eight-hour maximum response time.
- 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 (Level 3 or higher), to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain automatic transfer switch, bypass/isolation switch, remote annunciators, and remote annunciator and control panels through one source from a single manufacturer.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NEMA ICS 1.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 110.
- I. Comply with UL 1008.

## PART 2 - PRODUCTS

### 2.1 TRANSFER SWITCH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Generac Industrial Power
  - 2. Cummins Power Generation
  - 3. Caterpillar, Inc.
  - 4. Kohler Co.

### 2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where Transfer Switch Includes Internal Fault-Current Protection: Rating of switch and trip unit combination exceeds indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

- F. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral are double nominal rating of circuit in which switch is installed.
- G. Enclosures: General-purpose NEMA 1, Type 1 complying with NEMA ICS 6; UL 508, unless otherwise indicated.
- H. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- I. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
  - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
  - 2. Switch Action: Double throw; mechanically held in both directions.
  - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

## 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled, unless both sources are live.



## 2.4 AUTOMATIC TRANSFER-SWITCH FEATURES

- A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
- B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
- C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
- D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes; factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
- E. Test Switch: Simulates normal-source failure.
- F. Switch-Position Pilot Lights: Indicate source to which load is connected.
- G. Source-Available Indicating Lights: Supervise sources via transfer-switch, normal- and emergency-source sensing circuits.
  - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
  - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- H. Unassigned Auxiliary Contacts: Two normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
- I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
- J. Engine Starting Contacts: One isolated, normally closed and one isolated, normally open, rated 10 A at 32-V dc minimum.
- K. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes; factory set for five minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.
- L. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
2. Push-button programming control with digital display of settings.
3. Integral battery operation of time switch when normal control power is not available.

## 2.5 BATTERY CHARGER

- A. Switch mounted, pre-wired, current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
  1. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
  2. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
  3. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
  4. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.

## 2.6 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

## 2.7 SOURCE QUALITY CONTROL

- A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Floor-Mounted Switch: Level and anchor unit to floor.
- B. Identify components according to Division 26 Section "Basic Electrical Materials and Methods."

### 3.2 WIRING TO REMOTE COMPONENTS

- A. Match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

### 3.3 CONNECTIONS

- A. Ground equipment as indicated and as required by NFPA 70.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.
- B. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- D. Testing: Perform the following field quality-control testing under the supervision of the manufacturer's factory-authorized service representative in addition to tests recommended by the manufacturer:
  - 1. Before energizing equipment, after transfer-switch products have been installed:
    - a. Measure insulation resistance phase-to phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
    - b. Check for electrical continuity of circuits and for short circuits.
    - c. Inspect for physical damage; proper installation and connection; and integrity of barriers, covers, and safety features.
    - d. Verify that manual transfer warnings are properly placed.
    - e. Perform manual transfer operation.
  - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.
    - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
    - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown sequence.
- E. Coordinate tests with tests of generator plant and run them concurrently.

- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

### 3.5 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:
  - 1. Coordinate this training with that for generator equipment.
  - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
  - 3. Review data in maintenance manuals.
  - 4. Schedule training with Owner, through Engineer, with at least seven days' advance notice.
  - 5. Provide a minimum of four hours of instruction.

END OF SECTION 263200

## SECTION 263213 PACKAGED ENGINE GENERATOR

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes packaged diesel-engine generator sets with the following features and accessories:
  - 1. Engine generator set.
  - 2. Muffler.
  - 3. Outdoor enclosure.
  - 4. Starting battery.
  - 5. Base-Mounting fuel oil tank.

#### 1.2 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

#### 1.3 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance. Include the following:
  - 1. Dimensioned outline plan and elevation drawings of engine generator set and other components specified.
  - 2. Thermal damage curve for generator.
  - 3. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Detail wiring for power and control connections and differentiate between factory-installed and field-installed wiring.
- C. Field Test and Observation Reports: Test results and inspection records as specified in Part 3.
- D. Certified summary of prototype-unit test report.
- E. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

- F. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.
- G. Factory Test Reports: For units to be shipped for this Project, showing evidence of compliance with specified requirements.
- H. Sound measurement test report.
- I. Maintenance Data: For each packaged engine generator and accessories. Include the following:
  - 1. Detail operating instructions for both normal and abnormal conditions.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.
- B. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- D. Comply with NFPA 70.
- E. Comply with NFPA 99.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

#### 1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

#### 1.7 MAINTENANCE SERVICE

- A. Maintenance: At Substantial Completion, begin 12 months' full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in the manufacture and installation of original equipment.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar, Inc.; Engine Div.
  - 2. Kohler Co; Generator Division.
  - 3. Onan Corp; Industrial Business Group.
  - 4. Generac Power Systems, Inc.

### 2.2 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: Three phase, four wire.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- E. Limiting dimensions indicated for system components are not exceeded.
- F. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

### 2.3 GENERATOR-SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.

- C. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- H. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

#### 2.4 SERVICE CONDITIONS

- A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: 5 to 40 deg C.
  - 2. Relative Humidity: 0 to 95 percent.
  - 3. Altitude: Sea level to 1000 feet.

#### 2.5 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF-2.
- C. Rated Engine Speed: 1800 rpm.
- D. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
  - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  - 2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.



3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

E. Engine Fuel System: Comply with NFPA 37. System includes the following:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.

## 2.6 GOVERNOR

A. Type: Adjustable isochronous, with speed sensing.

## 2.7 ENGINE COOLING SYSTEM

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.

B. Radiator: Rated for specified coolant.

C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

1. Rating: 50-psig maximum working pressure with 180 deg F coolant, and non-collapsible under vacuum.
2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Coolant piping external to engine generator set. Use ASTM B 88, Type L copper tubing with brazed joints, sized as recommended by diesel engine manufacturer. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation and joint construction. Refer to Division 15 Section "Hydronic Piping" for materials and installation requirements for piping.

## 2.8 FUEL SUPPLY SYSTEM

A. Comply with NFPA 30 and NFPA 37.

- B. Base-Mounted Fuel Oil Tank: Factory-installed and -piped, listed and labeled fuel oil tank. Features include the following:
  - 1. Tank level indicator.
  - 2. Capacity: Fuel for twenty four hours' continuous operation at 100 percent rated power output.
  - 3. Vandal-resistant fill cap.
  - 4. Double wall.
  - 5. Leak detection and low level alarm.
  
- C. Interior Fuel Oil Piping: As specified in Division 15 Section "Fuel Oil Piping."

## 2.9 ENGINE EXHAUST SYSTEM

- A. Muffler: Residential type, sized as recommended by engine manufacturer. Measured sound level at a distance of 10 feet from exhaust discharge, is 95 dBA or less.
  
- B. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.

## 2.10 STARTING SYSTEM

- A. Description: 12 or 24-V electric, with negative ground and including the following items:
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Cranking Cycle: 60 seconds.
  - 5. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least twice without recharging.
  - 6. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.
  - 7. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 8. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above. Include accessories required to support and fasten batteries in place.
  - 9. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

## 2.11 CONTROL AND MONITORING

- A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Functional Description: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- D. Indicating and Protective Devices and Controls: Include the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch(es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. Start-stop switch.
  - 11. Overspeed shutdown device.
  - 12. Coolant high-temperature shutdown device.
  - 13. Coolant low-level shutdown device.
  - 14. Oil low-pressure shutdown device.
  - 15. Fuel tank derangement alarm.
  - 16. Fuel tank high-level shutdown of fuel supply alarm.
  - 17. Generator overload.
- E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

## 2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
  - 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
  - 2. Trip Settings: Matched to generator thermal damage curve as closely as possible.

3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Generator Protector: Microprocessor-based unit that continuously monitors current level in each phase of generator output, integrates generator heating effect over time, and predicts when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector performs the following functions:
1. Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
  2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.
  3. As heating effect on the generator of overcurrent approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect switch, and shuts down the generator set.
  4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

#### 2.13 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Dripproof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output-voltage operating band.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

- K. Subtransient Reactance: 12 percent, maximum.

#### 2.14 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments and control are mounted within enclosure.
- B. Description: Prefabricated or preengineered enclosure with the following features:
  - 1. Construction: Galvanized steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
  - 2. Structural Design and Anchorage: Adequate to resist loads imposed by 100-mph wind.
  - 3. Other structural loads, including roof, seismic, and auxiliary loads, are as indicated.
  - 4. Hinged Doors: With locking provisions.
  - 5. Finish: Two-coat enamel finish over cleaned and primed surfaces.
- C. Muffler Location: External to enclosure.
- D. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.

#### 2.15 FINISHES

- A. Outdoor Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

#### 2.16 SOURCE QUALITY CONTROL

- A. Factory Tests: Include prototype testing and Project-specific equipment testing (testing of equipment manufactured specifically for this Project).
- B. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 1. Tests: Comply with those required for Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
  - 2. Generator Tests: Comply with IEEE 115.
  - 3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.
- C. Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Perform tests at rated load and power factor. Include the following tests.
  - 1. Full load run.
  - 2. Maximum power.
  - 3. Voltage regulation.

4. Transient and steady-state governing.
5. Single-step load pickup.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing-in of cooling-system piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

#### 3.2 INSTALLATION

- A. Set packaged engine generator set on concrete bases.
  1. Support generator-set mounting feet on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide 3/4- to 1-1/2-inch gap between pump base and foundation for grouting.
  2. Adjust metal supports or wedges until generator is level.
- B. Install packaged engine generator to provide access for periodic maintenance, including removal of drivers and accessories.
- C. Install cooling-system piping, accessories, hangers and supports, and anchors for complete installation.
  1. Extend drain piping from heat exchangers to point of disposition.
- D. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Size piping according to manufacturer's written instructions.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
  1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 26 Sections. Proceed with equipment startup only after wiring installation is satisfactory.

#### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in Division 22 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
  1. Install piping adjacent to packaged engine generator to allow service and maintenance.
  2. Connect water supply to cooling system.

3. Connect cooling-system water supply and drain piping to diesel-engine heat exchangers. Install flexible connectors at connections to engine generator and remote radiator.
4. Connect exhaust-system piping to diesel engines.

B. Electrical wiring and connections are specified in Division 26 Sections.

C. Ground equipment.

1. 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 and UL 486B.

### 3.4 IDENTIFICATION

A. Identify system components according to Division 22 Section "Mechanical Identification" and Division 16 Section "Basic electrical Materials and Methods."

### 3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.

B. Testing: Owner will engage a qualified testing agency to perform field quality-control testing.

C. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.

D. Tests: Include the following:

1. Tests recommended by manufacturer.
2. InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

E. Coordinate tests with tests for transfer switches and run them concurrently.

- F. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- G. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- H. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

### 3.6 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
- B. Contractor shall completely fill the fuel tank for start-up and then re-fill the tank prior to placing into service.**

### 3.7 CLEANING

- A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
  - 1. Coordinate this training with that for transfer switches.
  - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
  - 3. Review data in maintenance manuals.
  - 4. Schedule training with Owner, through Engineer, with at least seven days' advance notice.
  - 5. Minimum Instruction Period: Eight hours.

END OF SECTION 263213



## SECTION 432540.00 – PROPOSED WWTP LIFT STATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This section includes the work associated with the construction of the proposed WWTP Lift Station.
- B. The Contractor shall furnish labor, materials, equipment to construct the WWTP lift station including pumps, pump rails, electrical control panel, controls, concrete structures, piping, valves, and all other associated appurtenances.
- C. Section Includes:
  - 1. Pumps
  - 2. Controls
  - 3. Valves
  - 4. Concrete Structures
  - 5. Accessories

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Shop Drawings
- D. Performance Data
  - 1. Based on actual tests of similar equipment and include sufficient data to demonstrate suitability of both the pump and driver for the conditions specified.
  - 2. The data shall include the type and make of pump, size, capacity, motor horsepower, motor speed, and performance curve, with design duty points clearly indicated.
- E. Submittals shall be submitted based on the requirements in Section 013300 - Submittal Procedures. Submittals shall include the following:
  - 1. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation

shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

2. Submit pump type and capacity.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted, including NPSH curve when applicable.
4. Submit electrical characteristics and connection requirements.
5. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
6. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
7. Manufacturer Reports: Certify that pumps have been installed according to manufacturer's instructions.
8. Qualifications Statement:
  - a. Submit qualifications for manufacturer.

### 1.3 CLOSEOUT SUBMITTALS

- A. Closeout Submittals must be received by Engineer and Owner before the equipment specified in this Section can be considered Substantially Complete.
- B. Operation and maintenance data.
- C. Provide duplicate or photocopies of stamped nameplates of each pump provided.
- D. Manufacturer's representative reports from equipment start-up.
- E. Spare parts: Repair kit for each pump containing at a minimum the following:
  1. O-ring kit
  2. Bearings
  3. Upper and Lower Seals

### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 674 for submersible sewage pumps suitable for use in classified locations.
- C. Materials and Workmanship shall be in accordance with the following standards as referenced herein.
  1. ANSI - American National Standards Institute.

2. ASTM - American Society for Testing and Materials.
3. AWS - American Welding Society.
4. HI - Hydraulic Institute.
5. IEEE - Institute of Electrical and Electronics Engineers.
6. NEMA - National Electrical Manufacturers Association.
7. AFBMA - Anti-Friction Bearing Manufacturers Association.
8. API - American Petroleum Institute.

D. Shop Pump Test

1. Submit performance test data based on testing of each pump furnished that is 30 HP and over, unless noted otherwise.
2. Perform performance tests in accordance with the Test Code of the HI except as modified herein, and demonstrate compliance with the operating conditions specified.
3. Notify and afford the Engineer the opportunity to witness the test on pumps larger than 100 hp.
4. Base the pump test acceptance criteria on HI Level 11A11 performance.

E. Shop Motor Tests

1. Tests shall be performed in accordance with ANSI/IEEE Standard 112 and ANSI C52.1, parts 12 and 20 (NEMA MG1).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Ship all units assembled as much as practical.
2. Label all units with all labeling intact and legible with item name, model number, size, and manufacturer's name.

B. Storage

1. Store all units, accessories, and components in the manufacturer's original package, under cover and protected from damage.
2. Maintain a grease coating on all bearings and shafts to prevent corrosion.
3. Turn pump shafts at intervals recommended by the pump manufacturer.

C. Handling

1. Handle all units and components in accordance with the manufacturer's instructions.
2. Use lifting rings and canvas harnesses for lifting to prevent scratching or abrading finished surfaces.

1.6 WARRANTY

1. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

2. All equipment provided under this Section shall be furnished with a two (2) year warranty on materials and workmanship from the date of Substantial Completion. The Owner will return any equipment found defective to the manufacturer for inspection and validation of the defect. Defective equipment will be repaired or replaced at manufacturer's discretion and shipped back to Owner at no charge.

## PART 2 - PRODUCTS

### 2.1 Pumps

#### A. Manufacture

1. The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the contractor to coordinate with the "selected" equipment manufacturer by use of this specification and all related design drawings for any necessary adjustments, modifications or alterations to standard products to ensure that the product complies with all sections of this specification. Candidate manufacturers include Flygt, Meyers, or Engineers approved equal.

#### B. Description:

1. Submersible, Non-Clog, Sewage Pumps mounted in a wet well application:
2. Factory-assembled and -tested sewage pump unit mounted in a wet well application. Pumps shall be heavy duty, suitable for continuous, efficient, and dependable service under operating conditions imposed by the installation and specific pump specification
  - a. All castings shall be free of warp, fins, gas and pit holes, and other defects that might impair strength or appearance.
  - b. All welding shall be in accordance with the standards of the American Welding Society.
3. Pump type: Submersible non-clog, meeting the requirements for Class 1, Division 1, explosion-proof, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump modified to be mounted in a dry well application.
4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support. Castings shall have a minimum tensile strength of 30,000 pounds per square inch (psi) and conform to the applicable ASTM standard.
  - a. All steel shall conform to the applicable ASTM standard
  - b. Pumps and motor casing shall have O-ring gaskets at all casing and motor cover joints.
  - c. Provide the casing with a replaceable wearing ring.
5. Impeller: Cast iron, statically and dynamically balanced, non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.

- a. Provide with replaceable impeller wear ring constructed of stainless steel dissimilar to casing wear ring.
6. Pump and Motor Shaft: 420 Stainless steel, with factory-sealed, grease-lubricated ball bearings.
7. Bearings: Properly lubricated, antifriction type, and capable of withstanding all radial and thrust loads.
  - a. Bearing housings shall be rigidly supported, and exclude dirt and foreign matter from the bearings.
  - b. Designed for a minimum L10 life of 100,000 hours at the operating point in accordance with ABMA.
8. Seals: Mechanical.
  - a. Equip each pump with two independent mechanical seals separated by an oil reservoir.
  - b. The lower seals shall be tungsten carbide.
9. Pump Bases
  - a. Mount pump and motor on a common cast iron or fabricated steel base unless noted otherwise.
  - b. Sufficiently reinforce and brace the base to withstand all shock loads and resist all wearing and buckling during pump operation.
10. Nameplate: Attach a stamped stainless steel nameplate to each pump in a clearly visible, easily accessible location. Stamp each nameplate with the following for each pump.
  - a. Manufacturer's name.
  - b. Model number.
  - c. Serial number.
  - d. Design capacity, gallons per minute (gpm). This shall be in a larger font size from the other information.
  - e. Design head, feet.
  - f. Design speed, revolutions per minute (rpm).
  - g. Voltage
  - h. Hertz
  - i. Full load amps
11. Guide-Rail Supports: 316 Stainless Steel
  - a. Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
  - b. Guide Rails: Vertical pipes made of Type 316 Stainless Steel, attached to baseplate and wet well opening. Provide intermediate stainless steel guide rail brackets for guide rails greater than 20 feet in length.
  - c. Baseplate: Type 316 Stainless Steel plate, attached to basin floor, supporting guide rails and stationary elbow.

- d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
- e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
- f. Stationary Elbow: Fixed discharge-elbow fitting with flange those mates to movable-elbow flange and support attached to baseplate.
- g. Lifting Chain: Stainless steel; attached to pump and cover at wet well opening.

12. Capacities and Characteristics:

- a. NPSHR/NPSHA ratio shall be the minimum recommended by ANSI/HI 9.6.1 American National Standard for Centrifugal and Vertical Pumps for NPSH Margin.
- b. Number of Pumps: Two Pumps.
- c. Each Pump:
  - 1) Solids Handling Capability: 2 inches minimum.
  - 2) Discharge Pipe Size: 3-inch.
  - 3) Motor Horsepower: 7.5 hp
  - 4) Minimum efficiency: 51%
  - 5) Maximum Speed: 1740 rpm
  - 6) Electrical Characteristics:
    - a) Phases: 3
    - b) Hertz: 60
    - c) Volts: 400

13. Duty Points/Performance Requirements

- a. Operating Condition:

- 1) Condition

	1 Pump Operating
Capacity, gpm	135
Total Head, feet	39
NPSHA, feet	25

2.2 MOTORS

- A. Motor: Hermetically sealed, with built-in thermal overload protection, leak detection, and lifting eye or lug.
- B. Pump motor power and control cable shall be a single unit, and be suitable for submersible pump applications, which shall be indicated by a code embossed on the cable.
  - 1. Provide cable strain relief assemblies as indicated on the Drawings
  - 2. Cable shall be sized in conformance with NEC; shall be of adequate length; and include a grounding plug and cable-sealing assembly for connection at pump.
- C. Motors shall be provided with a soft starter located in the pump control panel.

D. Performance

1. Rated for variable speed, soft start, or continuous duty and normal starting torque, unless otherwise specified or shown.
2. Temperature rise shall be in accordance with NEMA limits for the class of insulation, service factor, and enclosure specified.
3. Performance shall conform to the requirements of NEMA MG1 Part 12 and shall be expressed as indicated in NEMA MG1-12.30, and a report for routine tests shall be submitted based on IEEE Test Procedure 112, Method B.
4. Minimum 1.15 service factor rating unless noted otherwise.
5. The pump brake horsepower (bhp) requirements shall not exceed the motor nameplate horsepower (hp) under the operating conditions.
6. NEMA Premium Efficiency type except for submersible motors.
7. Inverter Duty: All motors shall have the following features in addition to those listed above.
  - a. Designed for use with soft starters.
  - b. Inverter-grade, NEMA Design B, 1,600-volt, Class F insulated moisture resistant windings.
  - c. Service factor of 1.0 when operated from a VFD.
  - d. Normally closed thermostat on stator windings.
  - e. Meeting requirements of NEMA MG1 Part 31.
8. Designed for intermittent or continuous 24 hours per day operation.
9. Capable of sustaining a minimum of 10 starts per hour.

E. Assembly and Fabrication

1. Minimum NEMA Class F insulation.
2. Enclosure shall have liquid cooled outer jacket
3. Provide and mark motor terminals as required for the application described in NEMA MG1 Section 2 and required in Division 26, "Electrical."

F. Motor Nameplate

1. Attach a stamped stainless steel nameplate to each motor clearly visible showing operational data in accordance with NEMA MG-1.

2.3 SWING CHECK VALVES

- A. See Specification 400565.23 "Swing Check Valves"

2.4 PLUG VALVES

- A. See Specification 400562.00: "Plug Valves"

## 2.5 CONCRETE STRUCTURES

- A. Concrete shall be constructed according to Specification 033000: "Cast-In-Place Concrete" or Section 330513: "Manholes and Structures"

## 2.6 CONTROLS

### A. PERFORMANCE REQUIREMENTS

1. Sequence of Operation:
  - a. Operate two pumps in lead/lag mode.
  - b. Control pumps by individual Hand-Off-Auto selector switches located on pump control panel. Provide manual start-stop control of pumps using "hand" and "off" positions of each Hand-Off-Auto switch. Automatically control pumps in "auto" position with level transducer as follows:
    - 1) When liquid level in wet well rises to elevation of "lead pump start", start lead pump. When lead pump is started, run pump until liquid level in wet well is drawn down to "pump stop" elevation, and then shut down lead pump.
    - 2) When lead pump cannot keep up with influent flow, liquid level in wet well rises to "lag 1 pump start" elevation that starts lag pump. When lag pump is started, run pump until liquid level in wet well is pumped down to "pump stop" elevation and shut down lead and lag pumps.
    - 3) Automatically alternate lead/lag status of pumps after each pumping cycle. Provide manual selection of lead pump.
  - c. When thermal switches are provided in motor windings to detect high temperature in motor, wire switch to relay located in pump control panel. Provide normally open contact on relay wired in series with pump starter, and normally closed contact on relay wired to "Motor High Temperature" alarm light located on control panel. When high temperature occurs in motor windings, shut down pump and energize high temperature alarm light.
  - d. When pump seal leak sensor is provided and located in pump housing, wire sensor to seal failure relay located in pump control panel. Wire normally open contact on relay to "Seal Failure" alarm light located on control panel. When seal leak occurs, energize seal failure alarm light.
  - e. Provide a pair of dry contacts in pump control panel for each of following:
    - 1) Surge Protection Failure
    - 2) Phase Loss
    - 3) Pump No. 1 Auto
    - 4) Pump No. 2 Auto
    - 5) Pump No. 1 Motor High Temperature/Seal Failure Alarm
    - 6) Pump No. 2 Motor High Temperature/Seal Failure Alarm
    - 7) Wet Well Level
    - 8) Wet Well High Level Alarm.
    - 9) Intrusion Switch Alarm
  - f. Provide one (1) spare pair of dry contacts.

### B. COMPONENTS

1. Control Panel Enclosure:



- a. Enclosure shall be NEMA 4X rated consisting of a continuous hinged outer door with 3-point, padlockable hasp and aluminum inner door for mounting of H-O-A switches, indicating lights, time meters, etc.
  - b. Enclosure shall be fabricated of heavy 14 gauge stainless steel and shall be sized to properly accommodate all equipment and include a thermostat control.
    - 1) Furnish appropriately sized means of heating and cooling to maintain internal temperatures between 40°F and 98°F
  - c. Enclosure outer door shall be provided with a positive stop to hold open at 90°.
  - d. Identify control panel components with engraved nameplate mounted on inside of panel.
  - e. Mount components, not mounted on front of inner door, on removable back panel secured to enclosure with collar studs.
  - f. Install wiring in neat, workmanlike manner and group, bundle, support and route horizontally and vertically for neat appearance.
  - g. Terminate wires leaving panel at terminal strips inside enclosure.
  - h. Identify terminals and wires in accordance with panel wiring diagrams.
  - i. Furnish copper grounding plate inside control panel for terminating ground wires.
2. All components shall be DIN Rail mounted or secured to back panel with bolts in threaded holes.
  3. Transient Voltage Surge Suppressor: Furnish three (3) modular three-phase transient voltage surge suppressors (TVSS), one for each VFD, in control panel to protect panel components from potential damage from transient voltages caused by lightning or surges on incoming power line.
    - a. Furnish TVSS in accordance with Section 264313 – Surge Protection for Low-Voltage Electrical Power Circuits
  4. Three Phase Monitor:
    - a. Furnish three phase monitor in pump control panel to monitor incoming power and sense loss of any one of three phases.
      - 1) Inhibit pump operation when phase loss occurs.
      - 2) DIN Rail mounted.
  5. Motor Circuit Protector Type Circuit Breakers:
    - a. Furnish properly sized motor circuit protector type, molded case circuit breaker for each pump motor starter.
      - 1) Type: Quick-make, quick-break, individually mounted.
      - 2) Minimum Interrupting Capacity: 22,000 amperes rms symmetrical at 480 volts.
      - 3) Motor circuit protector type circuit breakers shall be Square D FAL Series.
  6. Control Transformer: Furnish 480 volt to 120 volt control transformer in pump control panel to provide 120 VAC control power. Size transformer to power connected devices and protect with primary and secondary fusing.
  7. Circuit Breakers:
    - a. Furnish quick-make, quick-break, thermal-magnetic, molded case type, individually mounted and identified, as shown on the Drawings.
    - b. Circuit breakers to be Square D QOU series.
  8. Selector Switches:
    - a. NEMA Type 4X, 30.5 mm, heavy-duty, industrial, non-illuminated, maintained contact type with double-break silver contacts and metal mounting collar.
    - b. Selector switches to be manufactured by Square D, KS Series.
  9. Pilot Lights:

- a. NEMA Type 4X, 30.5 mm, heavy-duty, industrial, transformer type, LED push-to-test with metal mounting collar.
    - 1) Voltage Rating: 120 volts AC.
    - 2) Color Caps: Green for "run" and red for "alarm".
  - b. Furnish "run" pilot light for each pump. Energize each light through auxiliary contact on pump motor starter.
  - c. Furnish "motor high temperature" and "seal failure" alarm pilot light for each pump.
  - d. Pilot lights to be manufactured by Square D, KT Series.
10. Legend Plates for Pilot Devices:
- a. Furnish 2-1/4 inch square plastic legend plate for each selector switch, push button and pilot light.
  - b. Color: Gray with white lettering.
11. Relays:
- a. Heavy-duty, general purpose type, with 15 amp contacts.
    - 1) PIN type terminals that plug-in to socket.
    - 2) DIN rail mounted to inside of panel enclosure.
    - 3) Contact Configuration: As required for proper operation of control logic.
    - 4) Operating Power: 120 volts AC or 24 volts DC, as shown on Drawings.
    - 5) Relays shall be provided with test flags and LED indicators
    - 6) DPDT or 3PDT, as required by Drawings.
    - 7) Relays to be manufactured by Square D, Zelio RPM Series.
12. Elapsed Time Meters:
- a. Manufacturer: ENM Counting System Designs
  - b. Resettable, time totalizer type.
    - 1) Furnish synchronous motor to drive set of six digit readout wheels to indicate total time pump motor starter is energized.
    - 2) Readout: Six-digit including 1/10 digit.
    - 3) Range: 0 to 99999.9 hours.
    - 4) Voltage Rating: 120 volts.
  - c. Furnish elapsed time meter for each pump. Energize each elapsed time meter through auxiliary contact on pump motor starter.
13. Terminal Blocks:
- a. Furnish terminal blocks in control panel for field wiring.
    - 1) NEMA type, rated for 600 volts AC, 35 Amp.
    - 2) Identify with permanent machine printed marking in accordance with terminal numbers shown on panel wiring diagrams.
    - 3) Furnish 12 spare terminal blocks in control panel.
14. Wiring:
- a. Furnish pump control panel completely wired by manufacturer.
  - b. Furnish wiring, workmanship, and schematic wiring diagrams in compliance with UL 508. Isolate wiring and terminal blocks by voltage levels to greatest extent possible.
  - c. Wiring: Stranded tinned copper, Type MTW or THW, 600 volts, color coded as follows:
    - 1) Line and Load Circuits, AC Power: Black.
    - 2) AC Control Circuit Less than Line Voltage: Red.
    - 3) DC Control Circuit: Blue.
    - 4) Interlock Control Circuits from External Source: Yellow.
    - 5) Equipment Grounding Conductor: Green.

- 6) Current Carrying Ground: White.
        - d. Minimum Size of Control Wiring: Number 16.
        - e. Tag control wiring at both ends in control panel with legible permanent coded wire marking sleeve. Mark with white PVC tubing sleeves with machine printed black marking. Mark in accordance with wire numbers shown on control wiring diagrams and terminal strip numbers.
  15. Nameplates:
    - a. Furnish laminated phenolic nameplates on front of inner panel.
    - b. Color: White with black engraved letters.
    - c. Minimum Size of Engraving: 1/4 inch.
- C. LIQUID LEVEL CONTROL SYSTEM
1. Owner shall furnish liquid level control system to monitor wet well level and start and stop pump motors in response to changes in wet well level as set forth herein.
  2. Contractor shall install liquid level control system.
  3. Initiate pump controls (low water level alarm, pump(s) off, lead pump start, lag pump start, and high water level alarm) by level transducer.
- D. SOURCE QUALITY CONTROL AND TESTS
1. Perform a factory test of completed control panel by demonstrating operation of control functions. Provide certified test results.
  2. Factory assemble and test each control and alarm function.
- 2.7 ACCESSORIES
- A. Anchor Rods
1. Anchor rods, washers, and nuts shall be Type 316 stainless steel and shall be of ample size and strength for the intended purpose. Size and number shall be as recommended by the manufacturer.
- B. Pressure Gauges: Pressure gauges shall be as specified on the Contract Drawings.
- C. Suction Hand Hole Reducer
1. Pump shall come complete with a suction-mounted, flanged cast iron eccentric reducer with a large hand hole.
- D. Thermal Motor Protection. Include temperature switches for all size motors.
1. Temperature Switches
    - a. Equip the motor with three embedded temperature switches in the stator.
    - b. Temperature switches shall be normally closed (NC) configuration.
    - c. Connect temperature switch wiring to terminals in the motor conduit compartment.
    - d. Incorporate temperature switch operation with the motor control.
    - e. Provide motor terminal box of adequate size to allow installation of motor terminal kits without interfering with terminals or damaging control wiring.

- E. Moisture Sensor: Include a leakage sensor in the stator housing.
- F. Shaft Seals (as required)
  - 1. Split-Face Mechanical Seals
    - a. A temperature rating of 250 degrees Fahrenheit (°F) or higher.
    - b. Hydraulically balanced.
    - c. Materials of Construction.
      - 1) Seal Faces. Silicon carbide/silicon carbide or tungsten carbide/silicon carbide.
      - 2) Hardware, Glands, and Sleeves. 316 stainless steel.
      - 3) Elastomers. EPR, Viton.
      - 4) Springs. Hastelloy C or ElgHoy.
    - d. Subject to compliance with the Specifications, provide the seals from Flygt.
  - 2. Cartridge Single Seals.
    - a. A temperature rating of 250° F. or higher.
    - b. Hydraulically balanced.
    - c. Materials of Construction.
      - 1) Seal Faces: Silicon carbide/silicon carbide or tungsten carbide/silicon carbide.
      - 2) Hardware, Glands, and Sleeves. 316 stainless steel.
      - 3) Elastomers. EPR or EPDM.
      - 4) Springs. Hastelloy C.
    - d. Subject to compliance with the specifications, provide the seals from Flygt.
  - 3. Throat Bushings
    - a. Provide a close-fit throat bushing.
    - b. Subject to compliance with the Specifications, provide the bushings from Flygt.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. A. Site Verification of Conditions. Before installation of equipment, verify that:
  - 1. All clearances have been met.
  - 2. Bases, anchors, supports, and openings are located correctly and are of the proper size and material.

- B. Variations: Correct any variations from the requirements shown or required by the manufacturer at no additional cost to the Owner. Submit all methods of correction in writing.

### 3.2 PREPARATION

- A. Protect all surface areas from damage. Protect all finished floors with a waterproof, oil-resistant cover to prevent staining from oil and/or grease.

### 3.3 INSTALLATION

- A. General: Install all pumps and components in accordance with the manufacturer's instructions and the conforming Shop Drawings, including all gasket seals, isolation dampeners, cleanouts, drains, gauges, motors, controls, and power wiring.
- B. Piping as shown is typical for the specified pump. Actual pump piping connections shall vary among pump manufacturers. Coordinate pump piping connections with pump supplier and piping supplier.
- C. Set anchor rods in accordance with the approved manufacturer's conforming submittals.
- D. Lubrication: Furnish and apply an initial supply of grease and oil as recommended by the manufacturer. Grease and oil the equipment throughout all testing until substantial completion.
- E. Base: Anchor and grout the base in accordance with the manufacturer's recommendations. Connect base drain to nearest floor drain.
- F. Interface with Other Products
  1. Complete all electrical power and control connections under Division 26 – Electrical.
  2. Paint the equipment in accordance with Section 099010 - Coating Systems For Wastewater Equipment
  3. Install and connect all piping.
  4. Perform field quality control as specified in this specification.

### 3.4 REPAIRS AND RESTORATION

- A. Repair or replace any damage to the pump or motor or chips, dents, scratches, stains, or other disfiguring of surrounding floors, walls and/or accessories to the satisfaction of the Owner and/or Engineer at no additional cost to the Owner.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service and Start-Up
  1. A qualified representative of each equipment manufacturer shall start up the pumps in accordance with Section 017900, "Demonstration and Training".

2. Representative shall spend at least 1 day performing the required services for each type of pump.

B. Noise and Vibration limitations. For an acceptable installation, the pump and motor combination shall operate without excessive vibration, noise, or bearing temperatures, under the specified conditions. Guidelines to establish excessive pump vibration shall be as described in ANSI/HI 9.6.4.

### 3.6 CLEANING

A. Clean the pump, motor, accessories, and surrounding areas of all foreign material, grease, and oil stains.

B. Remove all rags, sticks, debris, and construction materials. Replace damaged equipment components in like kind at no additional cost.

C. After cleaning, provide protective covering for each piece of equipment.

### 3.7 SPARE PARTS

A. Spare parts shall be submitted by Contractor before the equipment will be considered Substantially Complete.

B. Spare parts shall include the following:

1. O-Ring kit
2. Bearings
3. Upper and Lower Seals

END OF SECTION 432520

## SECTION 463333 - SEQUENCING BATCH REACTOR SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. SECTION INCLUDES: The specifications for SBR equipment and controls under this section lists the equipment and controls that will be supplied by Contract #2 of this project. The specifications for SBR equipment and controls under this section supersede specifications for equipment and controls specified elsewhere in the contract documents and drawings. Purchased components such as gear reducers, pumps, motors, valves, and actuators shall be provided with standard recommended manufacturers paint, unless otherwise specified within this section.

The SBR area electrical classification shall be rated for Class I Division II Group D. Motors within the basin shall be rated for a temperature code T2A (280 Deg.C).

Contractor shall be responsible for providing all ancillary equipment, valves, pipes, and appurtenances to ensure a properly operational SBR system provided by Contract #2.

#### 1.2 BASIN STRUCTURES REQUIRED

##### A. SBR STRUCTURE

1. The SBR system shall be field erected in two basins as shown in the Contract #1 drawings:
  - a. Inside Dimensions: 47.0 ft. x 47.0 ft.
  - b. Side Water Depth:
    - Minimum Operating Level: 13.4 ft. SWD
    - Maximum Operating Level: 21.0 ft. SWD
    - Top Of Wall: 23.0 ft.

##### B. POST-EQUALIZATION BASIN STRUCTURE

1. The Post-Equalization/Holding basin shall be field erected in one basin as shown in the Contract #1 drawings:
  - a. Inside Dimensions: 47.0 ft. x 30.0 ft.
  - b. Side Water Depth:
    - Minimum Operating Level: 1.5 ft. SWD
    - Maximum Operating Level: 9.4 ft. SWD
    - Top Of Wall: 23.0 ft.

##### C. AEROBIC DIGESTER/SLUDGE HOLDING BASIN STRUCTURE

1. The Aerobic Digester/Sludge Holding basin shall be field erected in one basin as shown in the Contract #1 drawings:
  - a. Inside Dimensions: 47 ft. x 16 ft.
  - b. Side Water Depth:
    - Maximum Operating Level: 21.0 ft. SWD
    - Top Of Wall: 23.0 ft.

### 1.3 SBR DESIGN REQUIREMENTS

A. The manufacturer of the SBR system shall be completely responsible for the proper design of their system, including but not limited to; diffused aeration equipment, transfer pumps, mixers, decanters, and controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the plans and specifications.

B. The jobsite conditions are:

1. 0.5 MGD Avg. daily flow
2. 1 MGD Maximum daily flow
3. Design Loadings

	Influent	Effluent
BOD	300 mg/l	10 mg/l
TSS	260 mg/l	10 mg/l
NH3-N	32 mg/l	
Total Nitrogen		5 mg/l
Phosphorus	8 mg/l	

- C. Wastewater temperature 50°F to 68°F
- D. Jobsite elevation 582 feet MSL
- E. Ambient air temperature 30°F to 85°F
- F. Alpha (maximum value allowed) 0.85
- G. Beta (maximum value allowed) 0.95
- H. F/M ratio 0.075 lb BOD5/lb MLSS - Day
- I. MLSS at low water level 4500 mg/l
- J. Maximum Cycles at Max. Daily Flow 4/day/basin
- K. Oxygen Requirements  
1.25 lbs O2/lb BOD5 applied  
4.60 lbs O2/lb NH3-N applied
- L. Minimum Aeration Time 2.1 hrs/cycle at maximum daily flow  
Minimum Mixing Time 4 hrs/cycle at maximum daily flow  
Minimum Settling Time 1 hrs/cycle at maximum daily flow

### 1.4 COORDINATION

- A. Section 013000: "Administrative Requirements: Requirements for Coordination."
- B. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.



## 1.5 PREINSTALLATION MEETINGS

- A. Section 013000: "Administrative Requirements: Requirements for Pre-Installation Meeting."
- B. Convene minimum one (1) week prior to commencing Work of this Section.

## 1.6 SUBMITTALS

- A. Submittals shall be submitted based on the requirements in Section 013300 - Submittal Procedures. Submittals shall include the following:
  - 1. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration
  - 2. Submit pump type and capacity.
  - 3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted, including NPSH curve when applicable.
  - 4. Submit electrical characteristics and connection requirements.
  - 5. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - 6. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
  - 7. Manufacturer Reports: Certify that pumps have been installed according to manufacturer's instructions.
  - 8. Qualifications Statement:
    - a. Submit qualifications for manufacturer.

## 1.7 CLOSEOUT SUBMITTALS

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Submittals."
- B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert elevations.
- C. Complete system Operation and Maintenance manuals shall be available in hardcopy and electronic form. The electronic form shall be provided in .pdf format and be fully bookmarked. Manuals shall address:
  - 1. General project information

2. Installation and start-up
3. Process design and operational control description
4. Mechanical, electrical and field instrumentation component descriptions
5. Maintenance and troubleshooting
6. Mechanical and electrical drawings

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to specified standards.
- B. Maintain one (1) copy of each standard affecting Work of this Section on Site.

#### 1.9 QUALIFICATIONS

- A. The SBR System shall be supplied by a company of good reputation that is regularly engaged in the manufacture and fabrication of SBR wastewater treatment systems. The manufacturer's experience shall include a minimum of ten (10) installations where equipment of similar size and design has been in operation successfully in a similar process for a minimum of five (5) years. As a minimum, the supplier shall be the manufacturer of the following components: mixers, decanters, diffusers, and controls.
- B. The Contractor shall assign full responsibility for the functional operation of all SBR System components to a Single Source Supplier. This Supplier shall be responsible for all engineering necessary in order to select, furnish, inspect the installing contractor's equipment installation and connections, calibrate, and place into operation the SBR System along with all other equipment and accessories as specified herein.
- C. Ashbrook Simon-Hartley is considered an Engineers approved qual.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
  1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  2. Protect piping and appurtenances by storing off ground.
  3. Provide additional protection according to manufacturer instructions.

#### 1.11 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication and indicate on Drawings.

## PART 2 - PRODUCTS

### 2.1 SBR EQUIPMENT

#### A. MANUFACTURER

The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the "selected" equipment manufacturer to coordinate with the contractor of Contract #1 of this project and by use of this specification and all related design drawings for any necessary adjustments, modifications or alterations to standard products to ensure that the product complies with all sections of this specification. Candidate manufacturers include Aqua Aerobics Systems, Inc., Ashbrook Simon-Hartley, or Engineers approved equal.

### 2.2 INFLUENT PLUG VALVE (To Be Provided by Contract #2)

- A. Description: Furnish two (2), 12 inch diameter electrically operated flanged plug valve for each basin to control the influent flow.

Valves shall be a PEC 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, neoprene coated cast iron plug, assembled and tested with a 115 volt, single phase, 60 cycle open/close service electric actuator. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size.

Each valve shall include a manual override with limit switch feedback to the micro-processor in both the open and closed positions. Field wiring and junction/box disconnect shall be provided by the installing contractor.

Provisions for valve access shall be provided by the installing contractor.

Supply of valve vault(s) with drain for the valve(s) shall be the responsibility of the installing contractor.

### 2.3 DIRECT DRIVE MECHANICAL MIXER (To Be Provided by Contract #2)

- A. Description: Furnish two (2) mechanical floating mixer and related equipment accessories as described herein for each basin. Each mixer shall consist of a motor, direct-drive impeller driven at a constant speed, an integral flotation unit, and impeller volute. The equipment shall incorporate design enhancements that provide for three (3) years without routine maintenance (greasing). Mechanical Floating Mixer shall be manufactured by Aqua-Aerobic Systems, Inc.
- B. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007).
- C. Mixer drive motor: Each mixer shall have a zone of complete mix of 47.0 feet square at 21.0 feet water depth and a direct pumping rate of 7,680 GPM with a recirculation rate of 253,000

GPM and a basin turnover of 1.4 minutes at maximum water level. Complete mix shall be defined as maintaining biological suspension of all mixed liquor suspended solids with an MLSS of 4500 mg/l or less without the introduction of air.

The motor shall be rated for 10 horsepower at 900 RPM and wired for 460 volt, 60 hertz, three-phase service. The motor shall be standard efficiency, vertical P base design, totally enclosed fan cooled TEFC, and generally rated for severe duty. The motor shall in all cases equal or exceed standard NEMA specifications. A minimum service factor of 1.15 shall be furnished.

The motor winding shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A labyrinth seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft shall be manufactured from 17-4 PH stainless steel.

Motor bearings shall be regreasable. Sealed bearings are not acceptable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of combined radial and axial thrust type. The lower motor bearing inner brace shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the nut from backing off. Snap ring type bearing retainers will not be acceptable.

Submerged motors, jet pumps, submerged gear motors or gearboxes shall not be acceptable.

- D. Motor Mounting Base: The motor shall be securely mounted onto a solid 304 stainless steel base which is integral with the motor base extension. All submersed wetted motor mounting base components shall be constructed of 304 stainless steel.

The upper portion of the motor mounting base, immediately below the lower motor bearing, shall include two independent acting air seals. The two seals shall be capable of sealing off the flow of air from the suction action of the pumped flow, and prevent backflow of liquid during impeller reversal. The lower end of the motor base extension shall be provided with a rotating backflow seal that will prevent grit from being introduced into the anti-deflection insert reservoir, but shall allow liquid to contact the shaft. The backflow seal shall not require scheduled lubrication or maintenance.

- E. Flootation: Each unit shall be equipped with a modular float constructed of fiber reinforced polyester skin (FRP) with a central float passage of a size to allow installation and removal of the pump impeller. The minimum diameter of the float shall be 84 inches and the minimum thickness 12-1/4 inches. The float shall be foamed full of polyurethane foam of the closed cell type, and shall be totally sealed to prevent the foam from being in contact with the external environment.

The minimum reserve buoyancy shall be 1425 pounds.

- F. Impeller: The impeller shall be designed to pump the liquid from near the surface and direct it down toward the vessel/basin bottom. The impeller shall be a two-blade marine type precision

casting of 316 or 15/5 stainless steel and shall be specifically designed for the application intended. It shall be dynamically and hydraulically balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw. Impeller shall be capable of being reversed to cause back flow liquid movement without causing damage to the mixer chassis and without causing upflow liquid damage to the motor bearing and windings. No liquid spray or other liquid leakage upward onto the surface of the motor support surface or flotation chassis will be allowed.

- G. Intake Volute Assembly: The impeller shall operate in a volute made of 304 stainless steel plate, minimum 3/16 inch thick.
- H. Vibration: The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.
- I. Cable Mooring System: Each unit shall be provided with a maintenance cable mooring system complete with mooring cable, clips, thimbles, quick disconnects, anchors, and extension springs as shown on the drawings. Mooring cable, anchors, and hardware shall be 304 stainless steel. Field attachment of mooring points to the tank shall be the responsibility of the installing contractor.
- J. Cable Mooring Electrical Service Cable: Each unit shall include #12-four conductor power cable wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the float, and basin wall terminations. Electrical cable aerial cable ties for attachment of electrical service cable to the mooring cable shall be provided. Attachment of cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

304 stainless steel adhesive anchors for attachment of mooring system components to the basin wall shall be provided.

#### 2.4 DECANTER ASSEMBLY (To Be Provided by Contract #2)

- A. Description: Furnish two (2) 8x7 mechanical floating decanter and related equipment accessories as described herein for each basin. Each decanter shall consist of an integral flotation unit, a stainless steel movable weir assembly, and an electric motor driven actuator to open and close the weir.
- B. Performance: Each decanter shall be capable of withdrawing decant fluid from 4-6 inches beneath the liquid surface, regardless of liquid depth, down to the minimum allowable water level specified below. The decant liquid shall be drawn through an adjustable weir opening of 2-6 inches. The weir shall be circular in shape and permit liquid to enter the decanter from the entire 360 degrees without obstruction.

Maximum allowable water level in the basin is 21.0 ft.  
Minimum allowable water level in the basin is 13.4 ft.

The centerline of each decant pipe must be located 1.0 ft. below the low water level by the installing contractor.

Each decanter shall be rated for an average flow of 2083.0 gallons per minute.

- C. Weir Actuator: Weir actuator shall include a reversible electric motor operated linear actuator. The actuator shall be capable of operating with a closing force of 1500 lbs. and shall operate from a 115 volt, single phase, 60 hertz source. Adjustable limit switches shall be included to permit adjustment of the weir opening. A spring shall be included to provide for travel after the weir has closed and provide desired closure pressure. A corrosion resistant removable cover shall be included to provide protection to the actuator and motor during normal operation. The power section is painted steel. Decanter power section shall include an aluminum band clamp heater. #14 AWG ten conductor power cable shall be provided from the NEMA 7 junction box of the unit to the basin wall. Supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.
- D. Weir: The weir shall be constructed of 304 stainless steel, be circular in shape, and shall include vortex control baffles permanently affixed to the weir. The weir shall be attached to the actuator through a removable single shaft or linkage which shall also function as the torque restraint.
- E. Flootation: Each unit shall be equipped with a modular float constructed of fiberglass filled with closed cell polyurethane foam having a minimum 2.0 lbs./ft<sup>3</sup> density. Float shall be completely sealed to prevent the foam from being in contact with the external environment. Float shall have 875 lbs. reserve buoyancy to ensure stability and to provide support flotation required during decanter servicing. A urethane type seal shall be molded into the bottom of the float assembly to receive the decanter weir.
- F. Decanter Discharge Pipe: Each decanter shall include a 304 stainless steel elbow with 12" diameter 304 schedule 10 stainless steel discharge pipe. The installing contractor shall provide a 3/4" valve with hose bib connection on the decant line between the decanter and the decant valve.

Each decanter shall include two 12" diameter stainless steel flex joints. Flex joints shall be constructed of 304L stainless steel flanges and 321 stainless steel bellows. Flex joints shall utilize heavy duty 304L stainless steel hinges with over-travel stops and full perimeter welds. Flex joints shall carry a minimum rating of 50,000 cycles per EJMA calculations, the Elastic Joint Manufacturer's Association. Flex joints shall be full port diameter, and not reduce flow area of the nominal pipe size. Flex joints shall be fully crated and provided with shipping bars that immobilize and protect the flex joint prior to final installation. Flex joints constructed of plastic or rubber material are not acceptable.

All piping, supports, gaskets, and hardware beyond the terminating flange of the decant pipe flexible joint shall be supplied by the installing contractor.

- G. Decanter Restrained Mooring System: Each decanter shall include a stainless steel mooring frame attached to the float. Two 4" diameter Schedule 10 stainless steel mooring post assembly with base plate shall be provided to assure consistent location of the decanter in the basin. Mooring post shall be filled with concrete by the installing contractor.

Stainless steel dewatering support posts consisting of two 4" diameter Schedule 10 vertical pylons with base plates shall be provided. Each support with base plate shall be affixed to the basin floor with 304 stainless steel adhesive anchors.

Top and bottom mooring post supports constructed of stainless steel shall be provided for attachment to the basin wall by the installing contractor.

- H. Decant Flow Control Valve: Furnish two (2) 12" diameter electrically operated butterfly valve for each basin to control the decant rate.

Valves shall be a BAW AWWA C-504 Class 150B butterfly valve with ANSI Class 125 flanged end ASTM A-126 Class B cast iron body, EPDM seat, cast iron disk with 316 stainless steel edge, 304 stainless steel shaft assembled and tested with a 460 volt, three phase, 60 cycle open/close service electric actuator. Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions. Field wiring and junction/box disconnect shall be provided by the installing contractor. Butterfly Valves shall be Milliken or DeZurik. Actuator shall be Rotork IQT 500.0

Provisions for valve access shall be provided by the installing contractor.

Each valve shall include a 15 ft. valve stem extension constructed of stainless steel. Intermediate valve supports and hardware required for mounting of the extension shall be provided by the installing contractor.

## 2.5 SBR TRANSFER PUMP (To Be Provided by Contract #2)

- A. Description: Furnish two (2) submersible non-clog sludge pump for each basin. Each pump shall be equipped with 3.5 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 130 GPM at 23 TDH. Each unit shall be fitted with an adequate length of galvanized steel lifting chain of adequate strength to permit raising and lowering the pump. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). SBR Transfer Pumps shall be per selected manufacturer.

The 3" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A stainless steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by galvanized steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump,

with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 3" diameter PEC 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, neoprene coated cast iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Plug Valve shall be Milliken, DeZurik, or Nibco.

Each pump shall include a 3" diameter check valve with cast iron body and bronze disk to prevent backflow. Check Valve shall be Milliken, Nibco, or DeZurik.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

- B. Pump Hoist Assembly: Furnish one stainless steel portable hoist assembly. Each hoist shall be rated for a safe load of 500 lbs., lift of 30 feet, 36" minimum reach and a 60" maximum reach. Hoist shall consist of 1/4" diameter 304 stainless steel cable, painted steel lifting hook, zinc plated winch, painted cast iron sheave, and 304 stainless steel snap hook.

Furnish a total of seven stainless steel platform socket assemblies.

Each socket assembly shall include 304 stainless steel adhesive anchors for anchoring the platform socket to the basin wall.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

## 2.6 RETRIEVABLE FINE BUBBLE AIR DIFFUSER ASSEMBLIES (To Be Provided by Contract #2)

- A. Description: The aeration system shall be a fine bubble diffused air system and shall be a retrievable configuration as shown on the contract drawings. The aeration system shall be capable of delivering 785 SCFM per basin. Air Diffusers shall be per selected manufacturer.

Furnish three retrievable air diffuser assemblies for each basin. Each assembly shall consist of membrane diffusers, frame assembly, manifold weldment, vertical air column, track/beam, flexible air line, isolation valve, and lifting mechanism. A total of 25 duplex diffuser tubes shall be provided for each diffuser rack. The 4" diffuser manifold weldment shall be constructed of 304 stainless steel. The entire assembly shall be located such that each diffuser centerline is twelve (12) inches above the basin floor.

Air diffuser assemblies shall be of the tubular, non-clog, fine bubble type with a flexible perforated air release membrane. Disc and panel diffuser designs are not acceptable. The diffuser membrane shall be constructed from EPDM rubber and be suitable for continuous or



intermittent aeration. Each membrane shall be held in place by two 304 stainless steel band clamps. The membrane shall include UV inhibitor and compounds designed for resistance to chemical attack, weathering, fatigue, and aging. The diffuser assemblies shall have double backflow prevention to prevent liquid from passing into the aeration header. Backflow prevention shall consist of self sealing slits and membrane clamping over the circumference of the diffuser support pipe. The membrane exterior surface shall be smooth as to inhibit biological film growth. The membrane shall inflate during aeration and deflate when the airflow is discontinued, further restricting biological film growth. The membrane shall be cleanable in place with water from a high pressure wash. Each diffuser membrane shall be supported over its' full length and circumference by a support tube. Tube diffuser shall be of non-buoyant design. Diffusers which are of buoyant design are not acceptable.

The vertical air column shall be constructed of stainless steel. Each diffuser assembly shall include a 3" diameter wire reinforced EPDM flexible air line with quick disconnect end fittings, and a galvanized steel threaded flange, elbow and ny-glass (304 stainless steel) quick disconnect adapters. All air distribution piping, gaskets, and hardware beyond the threaded flange shall be supplied by the installing contractor. The vertical track/beam assembly shall be stainless steel. The vertical track/beam shall support the lifting mechanism assembly during operation and servicing.

Each assembly shall include a stainless steel diffuser hoist assembly with base socket to receive a portable electric winch. A total of (one) portable electric winch shall be provided for the diffuser assemblies. The winch mechanism shall be of sufficient design capacity to raise the diffuser rack assembly to the servicing position. The portable electric winch shall operate from a 115 volt, single phase, 60 hertz electrical supply rated for 12.6 full load amps. The winch shall be provided with a total of 8 feet of electrical cable. Supply of electrical power supply, wiring and junction box for winch shall be the responsibility of the installing contractor.

Each diffuser assembly shall include a 3" diameter manually operated isolation butterfly valve for connection to the main air distribution piping by the installing contractor. Valve gaskets and hardware are to be provided by the installing contractor.

Valve shall be a Wafer style butterfly valve with cast iron body, EPDM seat, aluminum bronze disk and one piece stainless steel shaft.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the diffuser assemblies to the basin.

## 2.7 SBR BLOWERS (To Be Provided by Contract #2)

- A. Description: There shall be furnished three 30 HP, 460 volt, 60 cycle, three phase rotary lobe type, positive displacement blowers with premium efficient, T.E.F.C. U.S. Electric, Class F insulation, motor. Each blower shall be capable of delivering 393 SCFM of air at a discharge gauge pressure of 10.6 psig. The blowers shall be manifolded for individual and/or combined operation. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). Aeration Blowers shall be per selected manufacturer.

Each blower assembly shall be complete and mounted on a base weldment with four corner anti-vibration mountings, designed for direct application on a concrete slab or other solid

foundation. Each assembly shall be suitable for shipment as a complete unit, factory assembled (less discharge pipe fittings) as much as possible to facilitate shipping and handling.

Equipment shall include a blower, electric motor, belts and sheaves, inlet filter/silencer, discharge silencer, discharge check valve, rubber inlet sleeve and discharge connection, pressure relief valve, galvanized steel acoustic hood with oil drip pan, 6" butterfly discharge isolation valve, and rubber expansion joint. A personnel protection guard shall be included over the belts and sheaves.

2.8 AIR CONTROL VALVES (To Be Provided by Contract #2)

- A. Description: Furnish two (2) 6" diameter electrically operated butterfly valve for each basin to control the air flow.

Valves shall be a BAW AWWA C-504 Class 150B butterfly valve with ANSI Class 125 flanged end ASTM A-126 Class B cast iron body, EPDM seat, cast iron disk with 316 stainless steel edge, 304 stainless steel shaft assembled and tested with 115 volt, single phase, 60 cycle open/close service electric actuator. Valves shall be Milliken, DeZurik, or Nibco. Actuators shall be per selected manufacturer.

Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions. Field wiring and junction/box disconnect shall be provided by the installing contractor.

Provision for valve access shall be provided by the installing contractor.

2.9 SBR PRESSURE TRANSDUCER (To Be Provided by Contract #2)

- A. Description: Furnish one (1) submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Transducers shall be suspended on a removable mounting pipe assembly. 304 stainless steel pipe, 304 stainless supports and 304 stainless steel anchors shall be provided. Field attachment of the pipe and supports to the basin shall be the responsibility of the installing contractor. A moisture excluding aneroid bellows shall be supplied loose for installation in the junction box/ disconnect. Attachment and supply of the junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Transducer shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring.

2.10 SBR LEVEL SENSORS (To Be Provided by Contract #2)

- A. Description: Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical

cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor. Level Sensors shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

2.11 SBR JUNCTION BOX (To Be Provided by Contract #2)

- A. Description: NEMA 4X 304 stainless steel junction box shall be provided. The junction box shall contain intrinsically safe relays and terminal blocks for terminating electrical controls and components. Field wiring and installation of the junction box shall be the responsibility of the electrical contractor.

2.12 SBR CONTROLLER (To Be Provided by Contract #2)

- A. Description: Furnish one (1) Multi Parameter Probe Module(s) per basin. The module shall receive the digital input from a maximum of two devices. The controller will communicate with the main PLC via 4-20 mA signals. The module will have a NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish and shall be AC powered from a 100-230VAC, 60Hz power source. Each probe module shall include a sun shield. Multi-Parameter Probe shall be per selected manufacturer.

2.13 SBR DISSOLVED OXYGEN SENSORS (To Be Provided by Contract #2)

- A. Description: Furnish one (1) dissolved oxygen sensor per basin. The probe shall be a continuous-reading probe utilizing luminescent sensor technology, and shall provide electrolyte-free operation without requiring sample conditioning. Sensors shall be suspended on a removable mounting pipe assembly. 304 stainless steel pipe, 304 stainless supports and 304 stainless steel anchors shall be provided. Field attachment of the pipe and supports to the basin shall be the responsibility of the installing contractor. Field wiring, conduit, and installation of cable shall be the responsibility of the installing contractor. Dissolved Oxygen Sensors shall be per selected manufacturer.

2.14 POST-EQUALIZATION BASIN TRANSFER PUMPS (To Be Provided by Contract #2)

- A. Description: Furnish three submersible non-clog transfer pumps. Each pump shall be equipped with 5 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 350 GPM at 18 TDH. Each unit shall be fitted with an adequate length of stainless steel lifting chain of adequate strength to permit raising and lowering the pump. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). Pumps shall be Flygt, Meyers, or Engineers approved equal.

The 4" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A stainless steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by stainless steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 4" diameter PEC 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, neoprene coated cast iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Plug Valve shall be Milliken, DeZurik, or Nibco.

Each pump shall include a 4" diameter check valve with cast iron body and bronze disk to prevent backflow. Check Valve shall be Milliken, Nibco, or DeZurik.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

2.15 POST EQ FIXED PVC COARSE BUBBLE DIFFUSER SYSTEM (To Be Provided by Contract #2)

- A. Description: The aeration system shall be a coarse bubble diffused air system and shall be a fixed configuration as shown on the contract drawings. The aeration system shall be capable of delivering 199 SCFM per basin.

Furnish one (1) fixed coarse bubble diffuser system for each basin. The diffuser system shall consist of diffusers, supports, manifold, and riser pipe. Each diffuser section shall be constructed of Schedule 80 PVC. The diffuser manifold pipe internal to the basin shall be constructed of Schedule 80 PVC. Diffuser pipes shall be not less than three-inch nominal diameter. Each diffuser section shall be supplied with uniformly-spaced machined orifices located on the top of each section. Size and number of orifices shall be provided to ensure a uniform air distribution.

Each diffuser section and manifold pipe shall be supported at span lengths not greater than 6 feet by galvanized steel supports. No unsupported end shall be longer than 2 ft. Diffuser sections shall be secured to the supports with a corrosion resistant retainer. Support brackets shall be adjustable to provide header leveling within  $\pm 1/4$  inch of a fixed elevation for each aeration basin.

Diffuser system shall be field assembled by the installing contractor. All submerged PVC joints 8" and smaller shall be socket welded joints. Expansion joints shall be included to compensate for thermal expansion for PVC manifold runs longer than 40 feet. Pipe sizing, location and supports shall be as shown on the drawings. Diffuser sections and internal manifold piping shall have flange connections for disassembly.

The 4" diameter galvanized steel riser pipe shall terminate in a flanged connection at the top of the basin wall. All piping, gaskets, and hardware beyond the riser pipe's flanged connection shall be the provided by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the diffuser supports.

#### 2.16 POST EQ BLOWERS (To Be Provided by Contract #2)

- A. Description: There shall be furnished one 10 HP, 460 volt, 60 cycle, three phase rotary lobe type, positive displacement blowers with premium efficient, T.E.F.C. U.S. Electric, Class F insulation, motor. Each blower shall be capable of delivering 199 SCFM of air at a discharge gauge pressure of 4.6 psig. The blowers shall be manifolded for individual and/or combined operation. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). Blowers shall be per selected manufacturer.

Each blower assembly shall be complete and mounted on a base weldment with four corner anti-vibration mountings, designed for direct application on a concrete slab or other solid foundation. Each assembly shall be suitable for shipment as a complete unit, factory assembled (less discharge pipe fittings) as much as possible to facilitate shipping and handling.

Equipment shall include a blower, electric motor, belts and sheaves, inlet filter/silencer, discharge silencer, discharge check valve, rubber inlet sleeve and discharge connection, pressure relief valve, galvanized steel acoustic hood with oil drip pan, 3" butterfly discharge isolation valve, and rubber expansion joint. A personnel protection guard shall be included over the belts and sheaves.

#### 2.17 POST EQ PRESSURE TRANSDUCER (To Be Provided by Contract #2)

- A. Description: Furnish one (1) submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Transducers shall be suspended on a removable assembly consisting of PVC support pipe and EPDM hose. Removable assembly shall be supported by 304 stainless steel supports and guide rail, and 304 stainless steel anchors. Field attachment of the guide rail and supports to the basin shall be the responsibility of the installing

contractor. A moisture excluding aneroid bellows shall be supplied loose for installation in the junction box/ disconnect. Attachment and supply of the junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Pressure Transducer shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring.

2.18 POST EQ LEVEL SENSOR (To Be Provided by Contract #2)

- A. Description: Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor. Level Sensor shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

2.19 POST EQ JUNCTION BOX (To Be Provided by Contract #2)

- A. Description: NEMA 4X 304 stainless steel junction box shall be provided. The junction box shall contain intrinsically safe relays and terminal blocks for terminating electrical controls and components. Field wiring and installation of the junction box shall be the responsibility of the electrical contractor.

2.20 POST EQ CONTROLLER (To Be Provided by Contract #2)

- A. Description: Furnish one (1) Multi Parameter Probe Module(s) per basin. The module shall receive the digital input from a maximum of two devices. The controller will communicate with the main PLC via 4-20 mA signals. The module will have a NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish and shall be AC powered from a 100-230VAC, 60Hz power source. Each probe module shall include a sun shield. Multi-Parameter Probe shall be per selected manufacturer.

2.21 POST EQ DISSOLVED OXYGEN SENSOR (To Be Provided by Contract #2)

- A. Description: Furnish one (1) dissolved oxygen sensor per basin. The probe shall be a continuous-reading probe utilizing luminescent sensor technology, and shall provide electrolyte-free operation without requiring sample conditioning. Sensors shall be suspended on a removable mounting pipe assembly. 304 stainless steel pipe, 304 stainless supports and 304 stainless steel anchors shall be provided. Field attachment of the pipe and supports to the basin shall be the responsibility of the installing contractor. Field wiring, conduit, and installation of cable shall be the responsibility of the installing contractor. Dissolved Oxygen Sensor shall be per selected manufacturer.

2.22 AEROBIC DIGESTER TRANSFER PUMPS (To Be Provided by Contract #2)

- A. Description: Furnish one submersible non-clog sludge pumps. Each pump shall be equipped with 3 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 130 GPM at 20 TDH. Each unit shall be fitted with an adequate length of 304 stainless steel lifting chain of adequate strength to permit raising and lowering the pump. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). Pumps shall be Flygt, Meyers, or Engineers approved equal.

The 3" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A 304 stainless steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by 304 stainless steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 3" diameter PEC 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, neoprene coated cast iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Plug Valve shall be Milliken, DeZurik, or Nibco.

Each pump shall include a 3" diameter check valve with cast iron body and bronze disk to prevent backflow. Check Valve shall be Milliken, Nibco, or Dezurik.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

2.23 AEROBIC DIGESTER FIXED PVC COARSE BUBBLE DIFFUSER SYSTEM (To Be Provided by Contract #2)

- A. Description: The aeration system shall be a coarse bubble diffused air system and shall be a fixed configuration as shown on the contract drawings. The aeration system shall be capable of delivering 474 SCFM per basin.

Furnish one (1) fixed coarse bubble diffuser system for each basin. The diffuser system shall consist of diffusers, supports, manifold, and riser pipe. Each diffuser section shall be constructed of Schedule 80 PVC. The diffuser manifold pipe internal to the basin shall be constructed of Schedule 80 PVC. Diffuser pipes shall be not less than three-inch nominal diameter. Each diffuser section shall be supplied with uniformly-spaced machined orifices located on the top of each section. Size and number of orifices shall be provided to ensure a uniform air distribution.

Each diffuser section and manifold pipe shall be supported at span lengths not greater than 6 feet by galvanized steel supports. No unsupported end shall be longer than 2 ft. Diffuser sections shall be secured to the supports with a corrosion resistant retainer. Support brackets shall be adjustable to provide header leveling within  $\pm 1/4$  inch of a fixed elevation for each aeration basin.

Diffuser system shall be field assembled by the installing contractor. All submerged PVC joints 8" and smaller shall be socket welded joints. Expansion joints shall be included to compensate for thermal expansion for PVC manifold runs longer than 40 feet. Pipe sizing, location and supports shall be as shown on the drawings. Diffuser sections and internal manifold piping shall have flange connections for disassembly.

The 6" diameter galvanized steel riser pipe shall terminate in a flanged connection at the top of the basin wall. All piping, gaskets, and hardware beyond the riser pipe's flanged connection shall be the provided by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the diffuser supports.

2.24 AEROBIC DIGESTER BLOWERS (To Be Provided by Contract #2)

- A. Description: There shall be furnished one 30 HP, 460 volt, 60 cycle, three phase rotary lobe type, positive displacement blowers with premium efficient, T.E.F.C. U.S. Electric, Class F insulation, motor. Each blower shall be capable of delivering 474 SCFM of air at a discharge gauge pressure of 9.6 psig. The blowers shall be manifolded for individual and/or combined operation. Motors shall be in compliance with the Energy Independence and Security Act of 2007 (EISA 2007). Blowers shall be per selected manufacturer.

Each blower assembly shall be complete and mounted on a base weldment with four corner anti-vibration mountings, designed for direct application on a concrete slab or other solid foundation. Each assembly shall be suitable for shipment as a complete unit, factory assembled (less discharge pipe fittings) as much as possible to facilitate shipping and handling.

Equipment shall include a blower, electric motor, belts and sheaves, inlet filter/silencer, discharge silencer, discharge check valve, rubber inlet sleeve and discharge connection,



pressure relief valve, galvanized steel acoustic hood with oil drip pan, 6" butterfly discharge isolation valve, and rubber expansion joint. A personnel protection guard shall be included over the belts and sheaves.

2.25 AEROBIC DIGESTER PRESSURE TRANSDUCER (To Be Provided by Contract #2)

- A. Description: Furnish one (1) submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Transducers shall be suspended on a removable assembly consisting of PVC support pipe and EPDM hose. Removable assembly shall be supported by 304 stainless steel supports and guide rail, and 304 stainless steel anchors. Field attachment of the guide rail and supports to the basin shall be the responsibility of the installing contractor. A moisture excluding aneroid bellows shall be supplied loose for installation in the junction box/ disconnect. Attachment and supply of the junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Pressure Transducer shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring.

2.26 AEROBIC DIGESTER LEVEL SENSOR (To Be Provided by Contract #2)

- A. Description: Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor. Level Sensor shall be per selected manufacturer.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

2.27 AEROBIC DIGESTER JUNCTION BOX (To Be Provided by Contract #2)

- A. Description: NEMA 4X 304 stainless steel junction box shall be provided. The junction box shall contain intrinsically safe relays and terminal blocks for terminating electrical controls and components. Field wiring and installation of the junction box shall be the responsibility of the electrical contractor.

2.28 AEROIC DIGESTER DISSOLVED OXYGEN SENSORS (To Be Provided by Contract #2)

- A. Description: Furnish one (1) dissolved oxygen sensor per basin. The probe shall be a continuous-reading probe utilizing luminescent sensor technology, and shall provide electrolyte-free operation without requiring sample conditioning. Sensors shall be suspended on a removable mounting pipe assembly. 304 stainless steel pipe, 304 stainless supports and 304

stainless steel anchors shall be provided. Field attachment of the pipe and supports to the basin shall be the responsibility of the installing contractor. Field wiring, conduit, and installation of cable shall be the responsibility of the installing contractor. Dissolved Oxygen Sensors shall be per selected manufacturer.

2.29 CONTROL PANEL (To Be Provided by Contract #2, Excluding Parts B.11, B.12, and B.13)

- A. Description: The control system shall be designed to optimize the process while minimizing operator attention and to accommodate the continuous maximum daily flow without adjusting cycle structures. The control software program shall be factory tested prior to installation at the jobsite.

The control system shall be a timer based system with level overrides and shall provide control, sequence, monitoring, and alarm annunciation capabilities. The operator shall be able to access the timer values and set points through the operator interface panel to allow for adjustment of cycle times and system flexibility. The control system shall be designed to automatically accommodate the plant's full range of loads and flows.

A complete control system shall be provided as described in the following and as shown on the contract drawings: The control system shall include a circuit breaker disconnect, control transformer, branch protection, motor starters, microprocessor control, indicator lights, HAND-OFF-AUTOMATIC selector switches.

The incoming service of the control system shall be 120 volt, 60 hertz, single-phase.

B. Controls included in panel:

1. UV System Control: The SBR control panel will send a signal to the UV system to control the UV based on quantity of post EQ pumps operating.
2. SBR Equipment Description
  - a. Two (2) 10 HP Mixers\*
  - b. Two (2) 3.5 HP Sludge Pumps\*
  - c. Three (3) 30 HP Blowers\*
3. Aerobic Digester Equipment Description
  - a. Two (2) 3 HP Sludge Pumps\* (Pump operation to be provided from the Belt Filter Press Control Panel. See specification 463333.)
  - b. One (1) 30 HP Blowers\*
4. Post SBR Holding Equipment Description
  - a. Three (3) 5 HP Transfer Pumps\*
  - b. One (1) 10 HP Blower\*
5. In addition, controls (as shown on the contract drawings) for the following equipment shall be included within the SBR control panel:
  - a. SBR Equipment Description
    - Two (2) Influent Valves
    - Two (2) Decanter Actuators
    - Two (2) Decanter Valves
    - Two (2) Air Control Valves
    - Two (2) 4-20 mA D.O. signals
    - Two (2) 4-20 mA Pressure Transducers

- Two (2) Level Sensors
- One (1) Common Alarm
- b. Aerobic Digester Equipment Description
  - One (1) 4-20 mA D.O. signal
  - One (1) 4-20 mA Pressure Transducer
  - One (1) Level Sensor
- c. Post SBR Holding Equipment Description
  - One (1) 4-20 mA D.O. signal
  - One (1) 4-20 mA Pressure Transducer
  - One (1) Level Sensor

6. Control Panel Wiring and Assembly: All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum.

All control panel single conductor wire shall be 16 AWG multi-strand machine tool wire (MTW) minimum, with PVC insulation.

Wire colors are as follows:

208 VAC or higher	-	Black
120 VAC control power	-	Red
Neutral	-	White
Ground	-	Green
AC Power from remote source	-	Yellow
Neutral from remote source	-	White with Yellow Stripe
24 VDC (+)	-	Blue
24 VDC (-)	-	White with Blue Stripe
VDC (+) from remote source	-	Orange
VDC (-) from remote source	-	White with Orange Stripe
Intrinsically Safe	-	Light Blue

All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be a self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.

Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° F (50°C). Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.

Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag. The tag shall be white with black lettering.

7. Control Panel Quality Assurance: All Control panels shall be UL certified. Testing by manufacturer's electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:

Point to point testing of all wiring prior to application of power

Intended supply voltage shall be applied to the enclosure  
All components shall be tested for proper operation and calibration  
The PLC and operator interface program shall be loaded and functionally checked  
All components shall be checked to confirm proper mounting specifications have been followed  
Enclosure shall be inspected for defects and repaired if necessary  
All labeling of wires and devices are correct, properly installed and clean

The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above.

Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e. finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

8. Control Enclosure: The automatic controls shall be provided in a UL listed, NEMA Type 12 mild steel (12 gauge) floor mount enclosure that provides a degree of protection for electrical controls and components from dust, dripping water and external condensation of non-corrosive liquids. The enclosure is intended for indoor installation. Enclosure shall include gasketed overlapping doors with a 3-point latch mechanism operated by an oil tight key-lock handle. The enclosure shall have white polyester powder paint inside with ANSI 61 gray polyester powder paint outside over phosphatized surfaces. The enclosure shall include a painted white mild steel (10 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by per selected manufacturer.  
The control enclosure shall be mounted remotely.
9. Corrosion Inhibitor: Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection during shipment and storage of the enclosure.  
The corrosion inhibitor shall be per selected manufacturer
10. Main Disconnect Circuit Breaker: A UL listed, automatic molded case 3-pole disconnect breaker shall be provided in the control enclosure(s). The primary function of the disconnect switch shall be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/FAL, HDL, JDL, LAL, MGL, PGL or approved equal.
11. Variable Frequency Drive: UL Listed Variable Frequency Drives (VFD) shall be provided to control SBR blowers. The VFD's shall control pump and/or blower speed via an analog signal from the PLC. The VFD output frequency shall be programmable. The VFD shall be provided in a NEMA Type 20 panel mount package and rated for an operating temperature of -4° to 122°F (-20° to 50°C). The VFD shall have a 65 kA maximum short circuit rating when protected with an Allen Bradley 140M motor circuit protector or Class CC/J fuse. The VFD shall be per selected manufacturer.

12. Transformer: A step-down multi-tap transformer shall be supplied when there is a necessity to reduce incoming 3-phase power to 120 VAC single-phase. The transformer power wire connections (incoming and outgoing) shall be protected with a finger-safe cover to protect against accidental contact. Primary and secondary fuse protection shall be provided. Transformer shall be UL listed and of continuous wound construction with vacuum impregnated with non-hygroscopic thermosetting varnish. Transformer shall be per selected manufacturer.
13. Transformer Primary and Secondary Fuse: Properly rated fuses and fuse blocks shall be provided for primary and secondary protection of the transformer. Each fuse shall be equipped with a thermoplastic cover to protect against accidental contact. Clip style fuse block shall be rated up to 600 VAC and 100 amps, dual element, time delay fuses shall be rated up to 600 VAC. Fuse blocks and fuses shall be UL listed. Fuses shall be Littelfuse Class CC or approved equal. Fuse blocks and fuse covers shall be per selected manufacturer.
14. Circuit Breaker: All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be per selected manufacturer.
15. Fuse: Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be Littelfuse or approved equal. Fuse holders for discrete devices shall be rated to 600 VAC and 30 Amps. Fuse holders for analog devices shall be rated to 300 VAC and 15 Amps. Fuse holders shall be Allen Bradley, Rockwell Automation, or engineers approved equal.
16. Operator Device: Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for all automatic controlled equipment. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:
  - Amber – Alarm active, caution
  - Green – Valve open, motor running
  - Red – Valve closed
  - White – InformationAll operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Allen-Bradley 800H, Square D 9001, or approved equal.
17. High Frequency Noise Filter: A UL listed active tracking filter shall be provided to protect the PLC and HMI power feeds from high-frequency noise and low-energy transients. It shall be designed for a single phase input voltage of 120/240VAC operating at 47 to 63 Hz. The unit shall reduce normal mode transients to plus or minus 2 volts, provide surge

capacity of 45,000 amps and protect in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be an Islatrol IC+ or approved equal.

18. Single-Phase Type 1 Surge Protective Device: A UL Listed type 1 surge protective device shall be provided in the control enclosure to protect incoming single-phase power from external surges caused by lightning or power switching. The surge protector shall be a Square D SDSA3650 or approved equal.
19. Uninterruptible Power Supply: A UL listed uninterruptible power supply suitable for location in a UL 508 panel shall be provided to protect the HMI and PLC from short power outages by switching to an emergency battery backup without data loss or downtime. Nominal input voltage and output voltage shall be 120VAC with an autosensing input frequency of 47 to 63 Hz. The output power capacity shall be 650W / 1000VA. The UPS shall be provided with an audible alarm and LED status indicators and operate from 32° to 122°F (0° to 50°C). The UPS shall be an Allen Bradley 1609-B1000N.
20. Ground Fault Duplex Receptacle: A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be per selected manufacturer.
21. 24 Volt DC Power Supply: A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The power supply shall be an Allen Bradley, Rockwell Automation, or engineers approved equal.
22. Control Relay: UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall be Allen Bradley 700-HK, Square D, or approved equal.
23. Terminal Block: Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be per selected manufacturer.
24. Programmable Logic Controller: Automatic operation of the SBR shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics

shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an per selected manufacturer.

Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4 – Analog output (4 point) modules.

25. PLC Power Supply: Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.
26. Discrete Input Module: Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
27. Discrete Output Module: Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
28. Analog Input Module: Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
29. Analog Output Module: Backplane current draw at 5 VDC = 120mA, at 24VDC = 170mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
30. Remote Access Ethernet Modem: A UL listed, remote access Ethernet modem shall be supplied to provide connection capability between the Ethernet PLC network to a standard analog phone line. The device shall be complete with 4 RJ-45 10/100 full/half duplex network ports with on RJ-12 modem port capable of line rates (V90) of 56K thru 28K bps. The unit shall meet compliance with FCC Part 68,  
  
Part 15-Class b, UL/CSA Certified, CTR 21, CE. Mounting shall be on 35 mm-din rail with an operating input of 8 to 48V DC. The remote access Ethernet modem shall be a Rockwell Automation, Allen-Bradley, or engineers approved equal.
31. Human Machine Interface: The operator interface shall be a NEMA Type 12, 13, 4X rated, 10.4" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 800 x 600 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 10".

## 2.30 SCADA MONITORING SYSTEM (To Be Provided by Contract #2)

A SCADA (Supervisory Control And Data Acquisition) system shall be provided by the SBR equipment supplier as described herein and as shown on the contract drawings.

The SCADA functionality includes custom designed software with the following distinct features:

- Detailed, dynamic graphics depicting regions of the facility and specific equipment within each area
- Drill-down feature to provide detailed pop-up windows for pieces of equipment
- Simple, intuitive navigation
- System setpoint and preset adjustments
- Consolidated alarm summary for all monitored areas, plus an alarm log
- Event log which may capture operator commands as well as process/equipment functions
- Historical data logging, providing long term storage of data to assist with plant optimization
- Historical trending of analog and/or discrete variables. Trends also provide real time values, zoom/pan, and pause features
- Security – both the operating system and graphical package have multiple levels of logins.
- Picture/video screen captures – allows screen captures to be saved to a file or sent to a printer

The SCADA system includes remote access capabilities through either a dial-up modem or broadband access. The remote access not only facilitates support from the SCADA supplier (to address concerns or future upgrades), but also allows remote access by the operations personnel to help assess a situation when away from the site.

The SCADA system shall be designed, programmed and functionally tested by the SCADA manufacturer prior to shipment. All software packages shall be provided with licenses that can be transferred to the end user.

The SCADA system shall be provided loose for installation, interconnection, and field wiring by the installing contractor.

### 1. Monitored Equipment

The SCADA system shall provide monitoring and control of remote functions and processes for the following wastewater applications.

- Sequencing Batch Reactor System
- UV Disinfection System

The SCADA system shall provide monitoring of remote functions and processes for the following wastewater applications.

- Packaged Headworks
- Influent Flow
- Effluent Flow
- Belt Press and Post Lime Equipment
- Non-Potable Water System
- Plant Pump Station
- Collection System Lift Stations for Future SCADA Monitoring (7 Total Sites)



2. SCADA System Hardware

The SCADA system provided shall meet or exceed the following hardware specifications. At the time of manufacture, components specified below shall be subject to "or equal" or "up-grade" status to provide for the most current model available.

3. Personal Computer (Pc)

Dell Precision Tower 5810 XL, with 5-Year ProSupport  
Processor: Intel® Xeon® E5-1620 v3 Quad Core, 3.5GHz  
Memory: 16GB DDR4, 2400MHz RDIMM ECC  
Monitor: Dell UltraSharp™ 24 inch Widescreen  
Video: 1GB  
Boot Hard Drive: 500GB SATA, 16MB DataBurst Cache™  
Second Hard Drive: Identical to boot hard drive  
Operating Mode: RAID 1  
Removable Media: 16X DVD+/-RW, with read/write support software  
Keyboard: USB Quiet Keyboard  
Mouse: USB Optical mouse with scroll  
NIC: 10/100/1000 Ethernet

4. Printer

Color inkjet printer with printer cable

5. Uninterruptable Power Supply (Ups)

APC battery backup UPS, 1000VA minimum

6. PC Operating System And Productivity Software

Operating system: Microsoft® Windows 10 Professional  
Productivity software: Microsoft® Office Home and Business 2016  
Anti-virus / Anti-spam / Firewall: 10 year subscription  
Screen capture/edit software: TechSmith® SnagIt®

7. Graphical Software

Rockwell Software FactoryTalk View SE Station  
Rockwell Software FactoryTalk View SE Development

8. Programming Software For PLC

Rockwell Software RSLogix 5000 (IEC-61131-3 compliant)

9. Programming Software For HMI

Rockwell Software FactoryTalk View Studio ME

## 10. Autodialer

Furnish one (1) (Raco Verbatim) Automatic Dialing Remote Monitoring system. The autodialer shall have 8 channels and dial up to 16 phone numbers, 60 digits in length, and operate on a standard telephone line. Telephone line shall be provided by the installing contractor. When an alarm condition occurs, the autodialer shall automatically dial preprogrammed telephone numbers and report the station identification and specific alarm condition that exists. Calls may also be made directly to the unit at any time from any telephone for a complete status report. Front panel LED indicators shall show system operation, alarm status, battery condition, and provide system operation information at the site. User-entered programming shall be kept intact for up to ten years, even when all power is removed from the unit. A rechargeable gel cell battery shall keep the system operating in the event of a power failure.

### 2.31 SOURCE QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Testing, Inspection, and Analysis."
- B. The floating mixer(s) shall be shop inspected and tested prior to shipment. Testing shall consist of the following:
  - 1. Project and nameplate data verification per assembly documentation
  - 2. Dynamic balancing
  - 3. Final inspection
- C. Actuated valves shall be tested to manufacturer test protocol prior to shipment. Testing shall consist of the following:
  - 1. Project and nameplate data verification per assembly documentation
  - 2. Limit switch and torque switch setup and cycle test
  - 3. Hydrostatic test (two pressurization cycles) for all plug and butterfly valves

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Examination."
- B. Verify that field dimensions are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Preparation."

### 3.3 INSTALLATION

- A. The installation of the equipment furnished by the manufacturer shall be the responsibility of the installing contractor in accordance with all requirements of the contract documents.

### 3.4 FIELD QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Inspecting and Testing."

B. Inspection:

1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Engineer.
2. Repair damaged valve or provide new, undamaged valve.
3. After installation, inspect for proper supports and interferences.

- 3.5 START-UP: The equipment manufacturer shall furnish the services of a factory trained representative for a maximum of 3 trips and 12 eight-hour days at the jobsite to inspect the installing contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

### 3.6 SPARE PARTS TO BE SUPPLIED

- A. The following spare parts shall be supplied by the SBR equipment manufacturer:

Quantity	Description
One (1)	Decanter linear actuator with capacitor.
One (1)	Decanter limit switch with arm.
One (1)	Input card.
One (1)	Output card.
Fifty (50)	Membrane Kits
One (1)	Crimping Tool Oetiker #1098
Two (2)	3" Blower inlet filter
Ten (10)	6" Blower inlet filter
One (1) set	10 HP V-belts
Four (4) sets	30 HP V-belts

### 3.7 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

- B. All equipment provided under this Section shall be furnished with a two (2) year extended warranty on materials and workmanship from the date of Substantial Completion. The Owner will return any equipment found defective to the manufacturer for inspection and validation of

the defect. Defective equipment will be repaired or replaced at manufacturer's discretion and shipped back to Owner at no charge.

END OF SECTION 463333

## SECTION 466656 - UV DISINFECTION SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. SECTION INCLUDES: The work under this section shall cover furnishing a complete and operational open channel, gravity flow, ultraviolet (UV) disinfection system. The system shall be complete with UV modules, weirs, baffle plates, an electrical enclosure housing the electronic ballasts, power distribution and system control, UV intensity sensor, automatic mechanical wiping, system with compressed air system and all necessary supports required for installing the UV modules into a concrete channel as shown on the contract drawings and specified herein. The UV system control panel shall receive a 4-20 mA input from the SBR control panel indicating the post equalization flow rate. This signal shall allow the UV control panel to power the appropriate banks to achieve disinfection.
- B. START-UP AND FIELD SERVICES:
1. A field service technician or start-up engineer of the UV System Supplier shall commission the UV equipment.
  2. Local manufacturer's representatives are not acceptable to perform these tasks unless authorized by the UV System Supplier.
  3. The field service technician shall certify that all equipment is properly installed and that the plant operators have been trained on proper operation and maintenance procedures
  4. The manufacture shall provide one (1) trip for a total of three (3) days for installation inspection, start-up, system commissioning, and operator training.

#### 1.2 DESIGN CRITERIA

A. Wastewater Treatment

Prior to the UV system the effluent has undergone secondary treatment by a Sequential Batch Reactor (SBR).

B. Design Conditions

- |   |                       |
|---|-----------------------|
| 1. Peak Design Flow   | 1.0 MGD               |
| 2. Average Design Flow  | 0.5 MGD               |
| 3. Total Suspended Solids (maximum)   | 30 mg/L               |
| 4. Design UV Transmittance at 253.7 nm  | 65 %                  |
| 5. Maximum Headloss (incl. Level Control System & freefall)<br>@ Peak Disinfection Flow | 6.1 in                |
| 6. Microbiological requirements   |                       |
| a. Maximum inlet concentration:   | F.C. < 100,000 /100ml |
| b. Maximum outlet concentration:<br>@ 30 day geometric mean                             | F.C < 200 /100ml      |

1.3 COORDINATION

- A. Section 013000: "Administrative Requirements: Requirements for Coordination."
- B. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.

1.4 PREINSTALLATION MEETINGS

- A. Section 013000: "Administrative Requirements: Requirements for Pre-Installation Meeting."
- B. Convene minimum one (1) week prior to commencing Work of this Section.

1.5 SUBMITTALS

- A. Submittals shall be submitted based on the requirements in Section 013300 - Submittal Procedures. Submittals shall include the following:
  - 1. A copy of this specification section and the referencing section and all other applicable specification sections governing the UV disinfection system and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration
  - 2. Submit UV system type and capacity.
  - 3. Submit electrical characteristics and connection requirements.
  - 4. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - 5. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
  - 6. Manufacturer Reports: Certify that UV system has been installed according to manufacturer's instructions.
  - 7. Qualifications Statement:
    - a. Submit qualifications for manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Submittals."
- B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert elevations.

- C. Complete system Operation and Maintenance manuals shall be available in hardcopy and electronic form. The electronic form shall be provided in .pdf format and be fully bookmarked. Manuals shall address:
1. General project information
  2. Installation and start-up
  3. Process design and operational control description
  4. Mechanical, electrical and field instrumentation component descriptions
  5. Maintenance and troubleshooting
  6. Mechanical and electrical drawings

#### 1.7 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. All equipment provided under this Section shall be furnished with a two (2) year warranty on materials and workmanship from the date of Substantial Completion. The Owner will return any equipment found defective to the manufacturer for inspection and validation of the defect. Defective equipment will be repaired or replaced at manufacturer's discretion and shipped back to Owner at no charge.

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to specified standards.
- B. Maintain one (1) copy of each standard affecting Work of this Section on Site.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  2. Protect piping and appurtenances by storing off ground.
  3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication and indicate on Drawings.

PART 2 - PRODUCTS

2.1 UV Disinfection System

A. MANUFACTURER

The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the contractor to coordinate with the "selected" equipment manufacturer by use of this specification and all related design drawings for any necessary adjustments, modifications or alterations to standard products to ensure that the product complies with all sections of this specification. Candidate manufacturers include Wedeco, Trojan, or Engineer's approved equal.

B. Performance Requirements:

1. The UV dose produced by the system shall be at a minimum of 50 mJ/cm<sup>2</sup> with one bank out of service at the end of lamp life, design UV transmittance and design flow rate.
2. Dose calculation shall be in accordance with the point source summation method as described in the US EPA Design Manual (EPA/625/1-86-021), without exceptions.
3. Certification from the Lamp Manufacturer to substantiate initial lamp UV-C output after 100 hours burn in shall be submitted. Bidders who fail to provide such certification with the bid shall be considered non responsive and be disqualified.
4. The dose calculation shall be based on the UV-C output at a wavelength of 253.7 nm, under consideration of a maximum quartz sleeve transmittance of 92% at the end of lamp life.
5. The UV dose will be adjusted using an end of lamp life factor of 0.5 of initial UV lamp output. The use of a higher aging factor will be considered only upon review and approval of independent 3rd party certificate submitted with the bid. Aging factors exceeding 0.87 are considered unrealistic and shall not be accepted to prevent underdesign of the system.
6. The UV dose will be adjusted using a quartz sleeve fouling factor of 0.8 when sizing the system in order to compensate for attenuation of the minimum dose due to sleeve fouling during operation. The use of a higher fouling factor will be considered only upon review and approval of independent 3rd party certificate submitted with the bid. Fouling factors exceeding 0.96 of clean, clear quartz sleeves are considered unrealistic and shall not be accepted.

C. General

1. The system shall be designed for immersion of the UV lamps in the effluent within their protective quartz sleeve. Both electrodes and the full arc length of the lamp shall be below the water surface. Systems which prevent uniform cooling of the lamp electrodes (e.g., vertical lamp systems) by the effluent shall not be permitted.



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2. The UV lamps shall be arranged horizontally, parallel to the flow to minimise headloss.
3. All wetted channel metal parts shall be fabricated of 304 stainless steel. Aluminium wetted materials shall not be used
4. All module materials exposed to UV light shall be 316 stainless steel, quartz glass, Teflon, Viton, or other suitable long-term UV resistant materials.

D. UV Lamps

1. Lamps shall be low-pressure mercury amalgam “doped”, high intensity type. No liquid mercury shall be inside the lamp.
2. Medium pressure or other lamp types with a polychromatic UV output and a lower UV efficiency compared to low pressure lamps shall not be acceptable.
3. Each lamp shall be tested in UV-output, lamp current and lamp voltage from supplier. All results shall be stored in a database referencing to the individual lamp number. The lamp number shall be printed on the lamp surface.
4. Useful lamp life shall be guaranteed at 14,000 operating hours for each lamp under normal operation conditions. Normal operation conditions include a maximum of four on/off cycles per 24 operating hours.
5. UV lamps shall not require a long cool down period (>10 minutes) prior to re-start should the power to the UV system fail or be interrupted for a short period of time.
6. Each lamp base shall incorporate a dielectric barrier or pin isolator. The pin isolator shall consist of a non-conductive divider placed between the lamp pins to prevent direct arcing across the pins in moist conditions. The barrier shall be dielectrically tested for 2500 volts.
7. The UV manufacturer shall ensure disposal of returned lamps (old/used) at no costs to the owner upon receipt of the returned lamps at the manufacturing headquarters.
8. Energy input to the lamp shall be variable from 50 -100% of electrical power. Lamps with no capability to automatically vary the UV power output in operation shall not be permitted.

E. UV Modules

1. The UV modules shall be designed for periodic submergence without causing failures or damage to the system or components. They shall not contain any components, such as electronic cards, that cannot withstand submergence.
2. Each UV module shall be equipped with an interlock switch, which will automatically disconnect power to its associated UV bank if the module is raised from the UV channel or the quick disconnect plug is removed.
3. The UV module design and mounting shall provide plug and socket quick disconnect facilities enabling non-technical personnel to carry out lamp replacement, wiper insert replacement, etc. without the need for any tools or specialist isolation procedures.
4. Lamps shall be removable with the quartz sleeve and wiper system remaining in place.
5. The UV lamp sleeve shall be a single piece of clear fused quartz circular tubing, which shall not be subject to degradation over the life of the system
6. The lamp socket shall be centered against the inside of the quartz sleeve and shall be retained by a cap nut with a ribbed exterior surface providing a positive handgrip for tightening / loosening without the need for any tools. This connection includes a self-contained o-ring, sealing the lamp and socket module (independently from the quartz sleeve).

F. Wiping System

1. Each UV module shall be equipped with an automatic wiping system with selectable wiping frequency and an adjustable number of wiping strokes.

2. Systems without automatic mechanical wiping or systems requiring chemicals or removal of the module from the channel as the only means of cleaning will not be acceptable.
3. The automatic wiping system shall be pneumatically powered and shall use Teflon/Viton sandwich wipers to clean the quartz sleeves.
4. The actuator for the wiping system shall be a pneumatic cylinder mounted to the underside of the module top plate. It shall not come in contact with the effluent to prevent damage, sealing challenges, replacement difficulties etc.
5. The wiping system shall be controlled by the UV system control unit and provide a fully automatic, unattended operation.
6. The number of wiping strokes per interval shall be factory preset for optimum effect and shall be easily reset by the owner from 1 to 5 strokes per interval.
7. The wiper blade brush or other cleaning device in contact with the quartz sleeve shall be non-metallic and shall not damage or scratch the quartz sleeve or sensor in any way.

G. UV Monitoring System

1. A submersible UV sensor shall continuously sense the UV intensity produced in each bank of UV lamp modules.
2. The sensor shall be according to ÖNORM M 5873-1 and shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm. It's sensitivity at 254 nm shall be higher than 95%. Sensors whose sensitivity to other wavelengths amounts to more than 5% of the total sensitivity shall not be allowed.
3. The UV intensity monitoring system shall be field calibrated. To ensure regular UV sensor field calibration a reference UV sensor device shall be supplied with the UV system.
4. The measured intensity shall be fed into the UV systems control unit and used for continuous UV output modulations. The UV intensity sensor shall provide this control of the lamp by monitoring real-time wastewater quality, lamp aging, and quartz sleeve fouling changes. This signal shall be sent to the control unit for inclusion in the UV dose calculation. Additionally it shall be displayed on the operator interface as an absolute value in mW/cm<sup>2</sup>. UV Manufacturers who do not provide lamp modulation based upon the UV intensity sensor signal and flow rate are not acceptable.
5. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and hence false alarms for low intensity.
6. The UV sensor design shall be such that sensor removal can be easily conducted without removal of the module from the channel.

H. Water Level Control

1. A fixed finger weir located at the channel outlet shall provide control of water level in the UV channel.
2. Each channel shall have one fixed overfall weir.
3. Water level control with moving parts shall not be acceptable.

I. The Electrical Enclosure

1. The electrical system shall provide segregation of plant services and supplies into sensible groups to allow for safe and simple maintenance or servicing. Sensitive electronic components e.g. electronic ballast cards shall not be exposed to the risk of being flooded.
2. All heat sensitive components shall be adequately cooled with dry air utilizing forced or natural ventilation. Systems that lack positive mechanical heat transfer such as fans or heat exchanger for the sensitive electronic components are not acceptable.

3. Systems or designs that expose sensitive electrical or electronic components to excess humidity or poor air quality for cooling are not acceptable.
4. The enclosure for the UV system shall be IP54/ Type 12 painted sheet steel. The ambient temperature within the building shall not exceed 104°F (40 °C).
5. The electrical enclosure shall be a separate enclosure to house the control unit, operator interface, ballast cards and plant interface termination points associated with each individual UV bank.
6. Electrical power supply to the enclosure shall be 480/277 volts (+/- 10%), 60 Hz, WYE plus ground (L1, L2, L3, N, GND) (cUL).
7. The UV system controller shall monitor hardwired protection circuits, e.g. Module Lifted, Module Connected, Cabinet High Temperature, Bank Isolation, etc. which will shut the appropriate area of plant down directly, to aid rapid fault finding when personnel attend site.
8. Each electrical enclosure shall be equipped with a temperature control device, which will shut off this part of the UV system in case of surpassing the critical limit of 50°C = 122°F.

J. The Electronic Ballast

1. The ballasts shall be electronic microprocessor controlled, designed as slot cards fitting into a rack system with a plug connector for ease of maintenance.
2. Each ballast shall drive a pair of lamps with independent control and monitoring circuits, and providing individual lamp status information to the UV system controller.
3. The ballast shall detect lamp failure and initiate a re-strike sequence, independently from any external influence. The ballast shall attempt three re-starts before shutting off.
4. The ballast shall incorporate a galvanic separation of the two circuits. In case of the secondary circuit operating in abnormal conditions regarding voltage and/or amperage, the ballast shall shut off the lamp concerned. Ballasts without this feature shall be equipped with one GFC per ballast.
5. The ballast shall incorporate a temperature controlled pre-heat circuit to minimize lamp failure on start up.
6. The operating power factor for the ballasts shall be min. 0.99.
7. Option: The ballast shall be capable of varying the power output between 50 – 100%.
8. The lamps shall be square wave driven by the ballasts.
9. The ballasts shall be tested on line disturbances up to 4000 V
10. Ballasts requiring liquid closed loop re-circulating heat exchanger systems, e.g. propylene glycol, for cooling shall not be permitted.
11. Ballasts, for which replacement a watertight seal needs to be broken, shall not be permitted.
12. Ballasts, for which replacement the removal of the module is required, shall not be permitted.

K. Control and Instrumentation

1. The UV Disinfection Management System shall control and display the ON/Off cycling of the UV bank, individual lamp status, alarm messages, UV dose and intensity, bank wiping system status and lamp power of the UV banks.
2. Low UV dose alarms shall be provided to detect possible water quality problems, flow rate too high (flow rate signal required by others) or fouling of the system. Alarm set point shall be field adjustable.
3. The Management System shall utilize a UV sensor located within the UV bank(s) to accurately sense any change in UV intensity (i.e. wastewater quality, lamp aging, and quartz sleeve fouling). The sensor signal together with the flow rate signal shall be fed

into the smart controller as input parameters to accurately control and adjust UV lamp output to the required level under all operation conditions.

4. Systems that rely on calculated lamp intensity reduction due to aging instead of measured UV intensity for UV dose calculations and UV system control are not acceptable.

## 2.2 SOURCE QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Testing, Inspection, and Analysis."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Examination."
- B. Verify that field dimensions are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Preparation."

### 3.3 INSTALLATION

- A. The installation of the equipment furnished by the manufacturer shall be the responsibility of the installing contractor in accordance with all requirements of the contract documents.

### 3.4 FIELD QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Inspecting and Testing."
- B. Inspection:
  1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Engineer.
  2. Repair damaged valve or provide new, undamaged valve.
  3. After installation, inspect for proper supports and interferences.

### 3.5 CLEANING

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Cleaning."

END OF SECTION 466656.00

## SECTION 467621 – SLUDGE DEWATERING EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. SECTION INCLUDES: The work included under this section consists of all labor, tools, equipment and services necessary to furnish and supervise installation of one (1) belt filter press, one (1) polymer make-up system, and, one (1) lime post treatment module, complete, including necessary supports and foundations, control systems, and any other appurtenances in connections between all associated equipment.

The Belt Filter Press furnished under this contract shall feature a vertical arrangement of pressure rollers that permits 205 degree minimum wrap on each roller.

- B. START-UP: The manufacturer shall include the services of a factory trained field engineer for the purposes of installation inspection, equipment start-up, polymer selection, performance testing and training of plant personnel regarding proper operation and maintenance of the equipment. Start-up and operator training will be provided for a period of three (3) days on-site, to be completed in one (1) trip.

#### 1.2 DESIGN CRITERIA

A. Belt Filter Press

1. The Belt Filter Press shall be built to dewater aerobic digested sludge to 19% solids.

B. Liquid Polymer System

1. The polymer preparation system shall be built to prepare and age polymer solution in a continuous automatic operation using liquid polymer.
2. The polymer preparation system shall have an adjustable polymer pump capable of metering up to 8 gallons per hour of concentrated polymer solution. The polymer system shall be capable of preparing up to 1,800 gallons per hour of polymer solution varying between 0.2 and 0.6 % concentration.

C. Lime Post Treatment Module

1. The mixer shall be capable of processing a mixture of sludge and pulverized quicklime at a rate of 12,000 lbs/hr. The bulk density of the lime sludge mixture shall be approximately sixty (65) pounds per cubic foot.
2. Electrical motor shall be 5.0 HP, 1800 RPM, 3 phase, 60 Hertz, 230/460 VAC, TEFC, rated for continuous chemical service applications and have a 1.15 service factor.
3. Electrical controls and interlocks for the complete system shall be included in the main control panel of the belt filter press.

### 1.3 COORDINATION

- A. Section 013000: “Administrative Requirements: Requirements for Coordination.”
- B. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.

### 1.4 PREINSTALLATION MEETINGS

- A. Section 013000: “Administrative Requirements: Requirements for Pre-Installation Meeting.”
- B. Convene minimum one (1) week prior to commencing Work of this Section.

### 1.5 SUBMITTALS

- A. Submittals shall be submitted based on the requirements in Section 013300 - Submittal Procedures. Submittals shall include the following:
  - 1. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration
  - 2. Submit pump type and capacity.
  - 3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted, including NPSH curve when applicable.
  - 4. Submit electrical characteristics and connection requirements.
  - 5. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - 6. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
  - 7. Manufacturer Reports: Certify that pumps have been installed according to manufacturer's instructions.
  - 8. Qualifications Statement:
    - a. Submit qualifications for manufacturer.

### 1.6 CLOSEOUT SUBMITTALS

- A. Section 017000: “Execution and Closeout Requirements: Requirements for Submittals.”

- B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert elevations.
- C. Complete system Operation and Maintenance manuals shall be available in hardcopy and electronic form. The electronic form shall be provided in .pdf format and be fully bookmarked. Manuals shall address:
  - 1. General project information
  - 2. Installation and start-up
  - 3. Process design and operational control description
  - 4. Mechanical, electrical and field instrumentation component descriptions
  - 5. Maintenance and troubleshooting
  - 6. Mechanical and electrical drawings

#### 1.7 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. All equipment provided under this Section shall be furnished with a two (2) year warranty on materials and workmanship from the date of Substantial Completion. The Owner will return any equipment found defective to the manufacturer for inspection and validation of the defect. Defective equipment will be repaired or replaced at manufacturer's discretion and shipped back to Owner at no charge.

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to specified standards.
- B. Maintain one (1) copy of each standard affecting Work of this Section on Site.
- C. System Responsibility: Vested responsibility for operation and control of the BFP system, which is comprised of all equipment controlled by the BFP control panel, is the BFP manufacturer's.
- D. Source Quality Control: The belt filter press shall be designed, fabricated, assembled, and tested by the belt filter press manufacturer in their own facility. In order to provide maximum quality assurance, all aspects of the design, fabrication, and assembly, shall be performed by personnel employed by the manufacturer. The belt filter press manufacturer shall at the same facility maintain a suitable spare parts inventory.
- E. Factory Quality Control Test: Prior to shipment, the belt filter press and control panel shall be factory tested at the place of assembly. Factory test each pre-assembled, pre-wired, lubricated, and aligned BFP and its associated control panel to be supplied to the job site. Prior to shipment, verify through a one-hour continuous operating test that the BFP and associated equipment operate smoothly, noiselessly, vibration free, and without overheating of any bearing or motor. Particular attention must be given to assure that the BFP is properly aligned for maintaining the centerline-to-centerline tracking of the belts relative to the machine. Submit a certified test report to the Engineer for approval, prior to shipping that demonstrates compliance

with all applicable industry standards, manufacturing quality control, and the functional intent of these Specifications.

- F. The owner/engineer shall, at their option, be permitted to witness the factory quality control test at the manufacturer's facility. The manufacturer shall give the owner/engineer a minimum of two- (2) weeks notice prior to testing.
- G. Testing will be conducted as follows:
1. The objective of the test will be to measure throughput, dewatered sludge solids concentration, polymer usage and filtrate solids.
  2. Suitable means, acceptable to the Engineer, shall be provided to measure sludge feed rate, filtrate flow rate, washwater feed rate and polymer feed rate.
  3. Testing shall be conducted for a least one 6-hour period. During the test period the following data shall be collected at 30-minute intervals by the Construction Manager:
    - a. Measure belt speed
    - b. Record polymer type, concentration and feed rate
    - c. Collect polymer sample
    - d. Record sludge feed rate
    - e. Record filtrate feed rate
    - f. Record washwater feed rate
    - g. Collect 200-ml filtrate sample for lab analysis
    - h. Collect 200 ml dewatered sludge sample for lab analysis
    - i. Collect 200 ml dewatered sludge sample for lab analysis
- H. The alternate bid manufacturer and Contractor shall absorb all costs associated with changes in layout, piping, controls, electrical wiring, etc. (including engineering costs) if the alternate bid manufacturer is accepted.

## 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  2. Protect piping and appurtenances by storing off ground.
  3. Provide additional protection according to manufacturer instructions.



## 1.11 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication and indicate on Drawings.

## PART 2 - PRODUCTS

### 2.1 Belt Filter Press

A. Manufacturers:

The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the contractor to coordinate with the "selected" equipment manufacturer by use of this specification and all related design drawings for any necessary adjustments, modifications or alterations to standard products to ensure that the product complies with all sections of this specification. Candidate manufacturers include Charter Machine Company, Metuchen, New Jersey; Ashbrook Corporation, Houston, Texas; and Or-Tec Incorporated, Cleveland, Ohio.

B. Belt Filter Press Main Frame

1. Main frame design is crucial as it is the support structure of the entire machine. The main frame shall be a box frame of welded and bolted MC channels conforming to ASTM Specification A36 and designed to accommodate all operating and static loads without significant deflection, deformation or vibration. Maximum operational loading shall be defined as the sum of the belt tension load based on a belt tension of 50 pli; friction loads; roller, equipment and sludge loads; any loads induced by the belts; and any loads induced by the torque of the drive. The pressure zone main beams shall have a moment of inertia of at least 60 inches to the fourth power. The frame safety factor shall be greater than 7.1.
2. Main frame coating is crucial to the protection of the press main frame. All frame members shall be prepared and coated according to ASTM A123, hot dip galvanized to a minimum 5 mil thickness. All frame members shall be drilled and machined, and all bolted connections shall be disassembled prior to galvanizing.

C. Flocculator

1. The belt filter press shall be furnished with an upstream sludge-conditioning device consisting of an inline adjustable orifice venturi type mixer complete with polymer injection device. The mixer shall be designed to condition the sludge with polymer to result in a degree of flocculation that will produce the greatest amount of dewatering while maintaining the highest quality filtrate.
2. Location of the flocculation device will vary with the application. Several locations may be specified with the unused locations plumbed with spool pieces.

D. Gravity Dewatering Zone

1. The gravity-dewatering zone shall consist of an extending horizontal belt with neoprene sealed sidewalls. Sludge shall be distributed on the horizontal belt through a stainless steel head-box. A series of eleven (11) rows of plows shall be arranged along the sludge

path to achieve maximum drainage of free water from the sludge. The sixty-one (61) individual sludge plows shall be constructed of polyethylene. Belt press manufacturers' whose gravity deck height exceeds 72" (as measured from the base plane of the press frame to the top of the plow assembly), shall supply an elevated walkway with safety handrails and access stairs along three (3) sides of the press.

2. The complete sludge plow assembly can be raised away from the filter belt for cleaning purposes by operating a 4-way pneumatic hand valve. The free-floating, individual plows shall ride on the belt. Each individual plow shall be replaceable without disassembly and removal of the plow grid, and without the use of hand tools.
3. Sludge from the upper gravity area shall be distributed onto the lower horizontal belt by a baffled type 304 stainless steel chute.
4. Midway through the lower gravity area, an adjustable stainless steel sludge leveling bar shall evenly apply the sludge across the full belt width.
5. The gravity belts shall be supported by rollers and a grid of high-density polyethylene wear bars.
6. The minimum effective dewatering area of the upper and lower gravity dewatering zones shall be, 80.79 square feet as measured along a single belt.

E. Wedge Zone

1. The wedge zone shall be provided in order to gently apply and gradually increase the pressure on the thickened sludge. The wedge zone shall consist of a wedge-shaped roller and adjustable grid formation in which the two belts gradually converge to form the cloth/cake sandwich. Support for the filter belt shall be by rollers and a grid of high-density polyethylene wear bars. The minimum effective dewatering area of the wedge zone shall be, 50.65 square feet as measured along the lower belt.

F. High Pressure/Shear Zone

1. The high pressure/shear zone shall consist of a minimum of eight (8) rollers. The first shall be a 1/4" thick perforated drum of 26" diameter with perforations of minimum 7/8" diameter and minimum 34% open area. The succeeding rollers shall be solid faced decreasing in diameter from 20" to 14" to 11" and arranged in a vertical configuration with belt to roller contact exceeding 205 degrees. The total high pressure dewatering area shall be a minimum of; 101.92 square feet as measured along the length of a single belt in contact with the pressure rolls.

G. Cake Discharge Zone

1. Adjustable pneumatically loaded doctor blades shall be mounted at the discharge rollers for removing sludge cake from both belts. The doctor blades shall be power retractable and can be held away from the filter belts for cleaning and maintenance. The amount of pressure the doctor blades exert equally against both belts can be varied while the machine is operating. The adjustment of the doctor blades can be regulated from a pneumatic control panel located on the press.
2. The doctor blades shall be made from UHMW polyethylene. The blades shall be rigidly reinforced to provide even gentle pressure on the belts with a minimal amount of abrasiveness and shall be capable of providing passage clearance for the belt seam without injuring the seam.
3. A 14-gauge type 304 stainless steel chute shall be provided for directing the sludge to the next destination.

H. Rollers

1. All rollers shall be designed for a maximum deflection of 0.0133" at mid span under maximum loading conditions. Maximum loading shall be defined as the sum of the belt tension load at 50 pli; friction loads; equipment and sludge loads; any loads induced by the elasticity of the belts; and any loads induced by the torque of the drive. Minimum roll safety factor shall be 5.89.
  2. The perforated drum shall be of through shaft design with internal bulkhead and matched deflection of shaft and end plates. All other rollers shall be of stub shaft design with each stub secured by an end plate and an internal bulkhead. Assembly of rollers, shafts, end plates, and bulkheads shall be of machined concentricity and by means of continuous weld.
  3. Drive rollers and tracking rollers shall be coated with a minimum 3/8" thick synthetic rubber of 60 durometer to provide the friction required for efficient belt drive and tracking. All other solid rollers shall be coated to the point of insertion of the bearing with Rilsan Nylon II to a thickness of 25 mil by the Electro Static, Fusion Bonded Rilsan Powder Dispersion Process.
  4. The perforated drum shall be hot dip galvanized to a minimum thickness of 5 mil and shall be totally free of projections that may shorten belt life.
  5. The pressure rollers shall be arranged vertically on alternating sides of the main pressure channel. The diameters of the rollers starting with the perforated roll shall decrease in size up through the vertical stack to the first of five 10 3/4" diameter rolls, with each roller separately pan drained to prevent rewetting of the sludge on the preceding rollers.
- I. Roller Bearings and Seals
1. Roller bearings shall have an L-10 rating greater than 1,000,000 Hours per AFBMA test procedure under maximum loading conditions as the sum of the belt tension load at 50 pli and calculated at a belt speed of 5 meters per minute. All bearings shall be greasable with all grease fittings located for servicing from the machine exterior. All roller bearings shall be double row spherical roller type. All bearings shall have quadruple lip contact seals.
  2. All bearing housings shall be class 30 cast iron one-piece pillow block type with end cap. Bearing housings shall be coated with Rilsan Nylon II to a thickness of 25 mil by the Electro Static, Fusion Bonded Rilsan Powder Dispersion Process.
  3. All Tower Press roller bearings shall be guaranteed for five (5) years.
- J. Belt Tensioning
1. Belt tensioning shall be maintained pneumatically and controlled from the press mounted pneumatic control center.
  2. Each filter belt shall be tensioned by a pair of noncorrosive pneumatic cylinders attached to a rigid tensioning assembly. The tensioning assembly shall be attached to each tensioning cylinder in such a way as to assure parallel movement of the tensioning roller.
  3. Each belt shall be tensioned individually, with capability of changes with the machine operating. Tensioning pressure shall be gauged at the pneumatic control center. Tensioning cylinders shall be power retractable for belt replacement and emergency detensioning.
  4. The tensioning arrangement shall accommodate a minimum of  $\pm 2\%$  increase in belt length throughout the anticipated belt life.
- K. Belt Tracking
1. Belt tracking shall be totally pneumatic and shall function as a continuous automatic belt guidance system. Each belt shall be tracked individually by a type 304 stainless steel

- paddle arm and analog system sensor which monitors one edge of the belt and pneumatically signals a noncorrosive pneumatic cylinder for corrective positioning when required. That corrective motion shall be smooth, minimal, and adjustable.
2. Each belt tracking assembly shall be center pivoting complete with bearings to minimize dewatering belt stretch and wear.
- L. Pneumatic Control System
1. All belt press pneumatic system controls, belt tensioning, tracking, doctor blade, and sludge plow grid controls shall be frame mounted on the belt press in a 304 S/S NEMA 4X enclosure. Belt and doctor blade tensioning adjustments, sludge plow grid adjustments, low air alarm switch, and tensioning valves for on/off control shall be mounted inside the enclosure. Belt and doctor blade tensioning on/off, tension gauges, and plow grid lift levers and adjustment controls shall extend through the enclosure for easy access. The enclosed controls shall be preceded by an oil coalescing filter and a three (3) micron air filter regulator with gage. One (1) 1/2" female NPT supply air connection shall only be required to the total pneumatic system. Lubrication of the pneumatic system shall not be required.
  2. Each belt press shall be furnished with a receiver mounted single stage air compressor. The unit shall be complete with 17 gallon ASME Code receiver rated for 200 psi, pressure gauge, automatic overload protector, intake air filter-muffler, pressure switch, safety valve, tank drain, outlet valve, and constant speed regulator. The motor shall be 1.5 HP, TEFC with 1.15 service factor.
- M. Belt Wash Stations
1. Each filter belt shall be equipped with a belt wash station for constant belt washing. Each station shall include a manifold with removable stainless steel nozzles, internal handwheel operated brush, handwheel operated flush valve, and stainless steel neoprene skirted enclosure for containing spray mist. Belt spray water and flush water shall be collected in stainless steel pans and plumbed to the base sump to prevent rewatering of sludge process. Spray nozzles shall be suitable for use with non-potable plant effluent water.
  2. A washwater booster pump shall be provided and neatly installed near the belt press. The pump shall be centrifugal type with replaceable wear rings and shall be plumbed into the belt wash system by the Contractor.
- N. Filter Belts
1. Filter belts shall be of polyester monofilament wovenware with minimum tensile strength of 890 pounds per lineal inch. Edges shall be chamfered and belt seams shall be type 316 stainless steel clipper type. Mesh shall be selected for optimal pressure dewatering of the pertinent sludge. Belts shall be self-threading under power for replacement.
  2. Replacement of filter belts shall be accomplished without any disassembly of any part of the belt filter press except the belt joints.
- O. Drive Motor
1. The belt drive shall be variable speed, shaft mounted on one drive roller shaft. Drive shall transfer to the second drive roller by means of a gear combination. The gears shall be enclosed by a solid, stainless steel enclosure. The drive motor shall be severe duty TEFC of ample power for starting and operating under normal conditions without exceeding the nameplate horsepower and shall have a service factor of 1.15.

2. The drive shall be Variable Frequency Drive using AC motor and quadruple gear speed reducer. Speed control of the drive shall be in the belt press control panel. The inverter, start/stop and speed control of the drive shall be in the belt press control panel.

P. Washwater Booster Pump

1. Washwater booster pump will provide water to the belt filter press wash stations.
2. The washwater booster pump will come complete with galvanized base and integrally mounted up to a TEFC motor.
3. Controls for the washwater booster pump will be located in the belt filter press control panel.

Q. Air Compressor

1. Air compressor will provide air supply to the filter press belt tensioning and belt tracking.
2. The air compressor shall be a single stage compressor driven by 1.5 HP, TEFC motor capable of supplying 5.3 cfm air delivered at 120 psi.
3. Controls for the air compressor will be mounted in the belt press control panel.

R. Access Platform

1. The Belt Press shall be supplied with one (1) access platform.
2. The platform deck shall be of adequate length & width and include section located on one-side of the belt filter press as shown on the contract plans. The platform is floor supported and is elevated appropriately to access all components requiring maintenance.
3. The platform height shall be such that the belt filter press is easily visible and accessible for operation, cleaning and maintenance. The platform shall be constructed such that its placement will not interfere with routine maintenance and operation of the belt filter press. The Contractor shall furnish and supply all necessary platform foundations and anchor supports for a complete system.
4. Handrails and vertical stairs shall be provided for the platform. Kick (toe) plates shall be provided which shall project a minimum of 4 inches above the walking surface.
5. The platform and supports shall be constructed of structural aluminum and it shall be designed to carry a live load of 200 pounds per square foot not to exceed the working stresses for materials in 2009 ICC Code and OSHA requirements. All walking surfaces shall be non-slip grip strut type and all hardware shall be type 304 stainless steel.

S. Factory Wiring

1. All equipment and components shall be factory wired using non-metallic, flexible liquid-tight conduit and fittings wired to numbered terminal blocks in a frame mounted NEMA 4X junction box. All conduit shall be run and secured inside the MC channel frame wherever possible.

T. Safety Features

1. Each belt filter press shall be equipped with a lanyard type safety switch with cable encircling three sides of the press at an easily accessible height.

2. Each belt tensioning system shall have a limit switch that shall shut down the system in the event of total belt failure.
3. The belt tracking system shall have a limit switch on each side of the press that shall shut down the system in the event of belt tracking failure.
4. Each pneumatic control center shall have a pressure switch that shall shut down the system in the event of low air pressure.
5. Each gear drive shall have a solid stainless steel enclosure.

U. Electrical Control Panel

1. System Controls:
  - a. General Requirements: Each belt filter press shall be provided with a control panel that will contain the necessary control devices and equipment for controlling the dewatering process as described herein. The control panel shall meet the following general requirements:
    - 1) The control panel shall accept a 460 volts, 60 hertz, 3-phase ac power input. A main disconnect circuit breaker and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system.
    - 2) IEC rated motor starters shall be provided for the air compressor, belt wash water booster pump, cross conveyor, and the discharge conveyor.
    - 3) Variable frequency drive (VFD) shall be provided for the belt drive and sludge feed pump.
    - 4) Short circuit protection for each motor shall be accomplished utilizing fuses. Individual thermal overload protection shall be provided (except for the belt drive and sludge feed pump).
    - 5) A control power transformer shall be included that will provide 120 volts, ac control power to the system.
    - 6) An industrial programmable logic controller (PLC) located in the control panel shall perform all logic functions for the system.
    - 7) A CONTROL POWER ON/OFF switch shall be located on the front of the control panel. When in the ON position, the CONTROL POWER ON pilot light will be illuminated and control power shall be distributed to the control system. When in the OFF position, the control system shall be held de energized.
    - 8) An EMERGENCY STOP pushbutton shall be located on the control panel. It shall be a mushroom head style pushbutton that when depressed shall immediately de energize all moving equipment in the system.
    - 9) An alarm horn shall be included with the control panel for audible alarm annunciation along with a horn silencing button in the front of the panel.
    - 10) Sludge Cake Pump Motor starter shall be provided as part of the Belt Filter Press Control Panel. Motor Starter shall be compatible with 14.8 HP motor.
2. Control and Pilot Devices: As a minimum, the following control and pilot devices shall be located on the front of the control panel with nameplates as worded below in UPPERCASE LETTERS:
  - a. Pushbuttons:
    - 1) AUTO START
    - 2) AUTO STOP
    - 3) SYSTEM RESET
    - 4) ALARM SILENCE

- 5) AIR COMPRESSOR START
  - 6) AIR COMPRESSOR STOP
  - 7) WASHWATER PUMP START
  - 8) WASHWATER PUMP STOP
  - 9) BELT DRIVE START
  - 10) BELT DRIVE STOP
  - 11) SLUDGE PUMP START (PUMP LOCATED IN AEROBIC DIGESTER)
  - 12) SLUDGE PUMP STOP (PUMP LOCATED IN AEROBIC DIGESTER)
  - 13) POLYMER SYSTEM START
  - 14) POLYMER SYSTEM STOP
  - 15) CROSS CONVEYOR START
  - 16) CROSS CONVEYOR STOP
  - 17) SLUDGE CAKE PUMP START
  - 18) SLUDGE CAKE PUMP STOP
  - 19) LIME SYSTEM START
  - 20) LIME SYSTEM STOP
  - b. Selector Switches:
    - 1) PRESS HAND/OFF/AUTO MODE
    - 2) CONTROL POWER ON/OFF
  - c. Indicator Lights:
    - 1) PREWET CYCLE ON
    - 2) POSTWASH CYCLE ON
    - 3) AIR COMPRESSOR RUNNING
    - 4) WASHWATER PUMP RUNNING
    - 5) BELT DRIVE RUNNING
    - 6) SLUDGE PUMP RUNNING
    - 7) POLYMER SYSTEM RUNNING
    - 8) CROSS CONVEYOR RUNNING
    - 9) SLUDGE CAKE PUMP RUNNING
    - 10) LOW AIR PRESSURE
    - 11) BELT OVERTRAVEL
    - 12) BELT BROKEN
    - 13) LOW POLYMER
    - 14) LIME SYSTEM RUNNING
  - d. Speed Potentiometers:
    - 1) SLUDGE PUMP SPEED (PUMP LOCATED IN AEROBIC DIGESTER)
    - 2) BELT DRIVE SPEED
3. Signal Input and Output Devices:
- a. Discrete Input Signals: The control panel shall receive the following discrete input signals from normally open dry contacts in external devices (contacts close when the equipment runs or a fault occurs):
    - 1) POLYMER SYSTEM RUNNING
    - 2) POLYMER SYSTEM FAIL
  - b. Discrete Output Signals: The control panel shall provide the following discrete signals for transmission using normally open dry contacts (contacts close when the equipment is called to run or a fault occurs):
    - 1) PRESS RUNNING
    - 2) PRESS FAULT

4. Sequence of Operation:
  - a. Automatic Mode of Operation:
    - 1) The press may be operated in the automatic mode by placing the HAND/OFF/AUTO selector switch in the AUTO position. The operator will next press the AIR COMPRESSOR START pushbutton and allow the pressure to reach normal operating level.
    - 2) After the air pressure has reached operating level, the operator will press the AUTO START pushbutton, this will energize the washwater pump and belt drive, illuminate the PREWET CYCLE ON pilot light and start the pre wet time delay. After the pre wet timer times out, the sludge pump, polymer system, cross conveyor and the discharge conveyor will be energized.
    - 3) Pressing the AUTO STOP pushbutton will de energize the sludge pump and polymer system, illuminate the WASHDOWN CYCLE ON pilot light and start a washdown time delay. After the washdown timer has timed out, the belt drive, washwater pump, cross conveyor and discharge conveyor will be de energized.
  - b. Manual Mode of Operation
    - 1) To operate the press in the manual mode, the operator will place the HAND/OFF/AUTO selector switch in the HAND position. The operator will next start the air compressor by pressing the AIR COMPRESSOR START pushbutton. After the air pressure has reached operating level, start the washwater pump by pressing the WASHWATER PUMP START pushbutton.
    - 2) The operator will not proceed until the belts are allowed to be fully tensioned. No interlock shall be provided to prevent the operator from starting the belt drive in the manual mode. Pressing the BELT DRIVE START pushbutton will energize the belt drive. At this time, the operator will start the cross conveyor by pressing the CROSS CONVEYOR START pushbutton, the discharge conveyor by pressing the DISCHARGE CONVEYOR START pushbutton, the sludge pump by pressing the SLUDGE PUMP START pushbutton and the polymer pump by pressing the POLYMER SYSTEM START pushbutton.
    - 3) The system will be stopped by pressing the respective STOP pushbutton in the reverse order stated above.
5. Faults:
  - a. When any of the following fault conditions occur, in automatic or manual mode, the appropriate fault indicator will be illuminated, the alarm horn will sound and the belt filter press and associated equipment will be de energized:
    - 1) LOW AIR PRESSURE (amber light)
    - 2) BELT OVERTRAVEL (amber light)
    - 3) BELT BROKEN (amber light)
    - 4) LOW POLYMER (amber light)
    - 5) BOOSTER PUMP FAULT (flashing run light)
    - 6) BELT DRIVE FAULT (flashing run light)
    - 7) SLUDGE PUMP FAULT (flashing run light)
    - 8) CROSS CONVEYOR FAULT (flashing run light)
    - 9) SLUDGE CAKE PUMP FAULT (flashing run light)

6. Components:



- a. Enclosures: Control panel enclosures shall be free-standing, fabricated of type 304 stainless steel and shall be suitable for NEMA 4X service. Enclosures shall be manufactured by Saginaw Manufacturing.
- b. Wiring: All power and control wiring shall be 600 volt, type SIS insulation stranded copper and shall be sized for the required load, 14 AWG minimum.
- c. Circuit Breakers: Circuit breakers for the main disconnect shall be thermal magnetic molded case units. Circuit breakers shall be Square D, Class 650, Type FAL.
- d. Motor Starters: Motor starters shall be full voltage, nonreversing, IEC style across the line units. Coils shall be 120 volts ac. Siemens type Sirius 3RT10.
- e. Selector Switches: All selector switches shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Selector switches shall be Idec Series TWTD.
- f. Pushbuttons: All pushbuttons shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Pushbuttons shall be Idec Series TWTD.
- g. Pilot Lights: Pilot lights shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Units shall be 120 VAC full voltage incandescent type. Pilot lights shall be Idec Series TWTD.
- h. Terminal Blocks: Terminal blocks shall be high density, solderless box lug style, with 600-volt rating. Terminal blocks shall be Allen Bradley, Rockwell Automation, or Engineers approved equal.
- i. Control Relays: Control relays shall be general purpose type with a 10 amp contact rating, miniature square base and internal on status pilot light. Relays shall be Allen Bradley, Rockwell Automation, or Engineer's approved equal.
- j. Programmable Logic Controller (PLC): The PLC shall be a modular type with discrete and analog capabilities. The CPU shall have 6K minimum RAM for user instructions. The unit shall have battery backed RAM and EEPROM backup. The PLC shall be an Allen Bradley, Rockwell Autmation, or Engineer's approved equal.
- k. Variable Frequency Drive (VFD): The VFD shall be UL listed and shall be per selected manufacturer.

V. Utility Requirements

1. Electrical - 460 volt, 3 phase, 60 Hz
2. Power (HP)
  - a. Belt Drive - 5.0
  - b. Air Compressor - 1.5
  - c. Wash Water - 7.5
  - d. Booster Pump - 5.0
3. Belt Wash Water
  - a. Water @ 85 psi - 55 gpm  
(minimum)
4. Pneumatics - 3 cfm at 80-psi min., 250 psi maximum

W. Summary of Construction Materials

1. Main Frame
  - a. Box frame of welded and bolted MC channels conforming to ASTM A36, then hot dip galvanized according to ASTM A123.
2. Flocculator

- a. Type 304 stainless steel and UHMW polyethylene.
3. Perforated Roller
  - a. Carbon steel, hot dip galvanized according to ASTM A123.
4. Sludge Plows
  - a. Polypropylene, 20% glass filled
5. Drive Rollers
  - a. Carbon steel coated with 3/8" thick synthetic rubber, 60 durometer.
6. Tracking Rollers
  - a. Carbon steel coated with 3/8" thick synthetic rubber, 60 durometer.
7. Other Rollers
  - a. Carbon steel coated with 25 mil Rilsan II Nylon.
8. Bearings
  - a. Double row spherical roller type.
9. Bearing Seals
  - a. Quadruple lip contact seals with gasketed cast iron end caps.
10. Pneumatic Cylinders
  - a. 200 psi rating, anodized aluminum tube with stainless steel tie rods, teflon seals, graphite bearing, lubrication not required.
11. Belt Tracking
  - a. Fully pneumatic analog.
12. Belt Tensioning
  - a. Fully pneumatic.
13. Belt Wash Stations
  - a. Hand wheel operated internal brush type with stainless steel manifold, valve, nozzles, brush, aluminum handwheel and type 304 stainless steel enclosure with neoprene seals.
14. Belts
  - a. Monofilament polyester weave selected for function and particular sludge. Seams are 316 stainless steel clipper type.
15. Filtrate Pans
  - a. Type 304 stainless steel.
16. Sludge Chutes
  - a. Type 304 stainless steel.
17. Cake Discharge Chute
  - a. Type 304 stainless steel.
18. Water Plumbing
  - a. PVC, schedule 80.
19. Pneumatic Plumbing
  - a. Polyethylene tubing, 120 psi work, 625 psi burst.
20. Doctor Blades
  - a. UHMW polyethylene
21. Junction Box
  - a. NEMA 4X type 304 stainless steel
22. Pneumatics Station
  - a. NEMA 4X type 304 stainless steel
23. Assembly Hardware
  - a. Type 304 stainless steel

## 2.2 Polymer Preparation System

### A. Liquid Polymer Metering Pump

1. One (1) high efficiency-metering pump shall be supplied to transfer the concentrated liquid polymer solution to the polymer dilution panel.
2. The pump shall have a 200:1 output range achievable by independently varying the stroke length and stroke frequency.
3. The pump shall have a combination back pressure - injection check valve.
4. A constant speed, 3.5 amp, 120 volt AC solid state electronic pulser with protection shall be supplied to drive the pump.
5. The pump shall be mounted to an 11-gauge stainless steel base plate for ease of installation and maintenance.

### B. Polymer Storage Tank

1. One polymer holding tank shall be supplied to store and age the diluted polymer solution before it is pumped to the belt press.
2. The tank shall be constructed out high-density polyethylene and designed to satisfy loaded weights and mixing forces, including proper support for the mechanical mixer.
3. The minimum working capacity of the polymer storage tank shall be 50 gallons.
4. The tank shall contain a 3/4" suction drain/discharge connected to the polymer pump.
5. The storage tank shall contain three (3) level sensors (LS 1, 2, and 3) that control the polymer system's operation. The name, location and a brief description of operation for each level sensor is given below:

Name	Location	Description
LS 1	High level sensor	Shuts make-up system off
LS 2	Mid level sensor	Refills dilution tank
LS 3	Low level sensor	Shuts polymer pump off

### C. Mechanical Mixer

1. One mechanical mixer with an 8" marine type propeller shall be attached to the mounting bracket on the polymer mixing tank.
2. The mixer shaft and propeller shall be constructed of type 304 stainless steel.
3. The mixer motor shall be 1725 RPM, 0.75 Hp, single phase, 60 Hertz, 120 volt, gear motor drive with 350-RPM output speed.

### D. Piping and Valves

1. All piping and valves shall be 1" diameter, schedule 80 PVC unless otherwise specified below.
2. Suction side of pump shall be 3/4" diameter, schedule 80 PVC.

### E. Polymer Dilution Panel

1. One rotameter type flow meter with a 0 to 20 GPM range shall be installed on the water dilution line to meter the dilution water added to the polymer storage tank.
2. One static in-line mixer shall be installed down stream of the polymer injection point to insure adequate mixing of the concentrated polymer solution and dilution water prior entering the polymer storage tank.
3. One rotameter type flow meter with a 0 to 20 GPM range shall be installed on the polymer line to meter the polymer feed rate to the belt filter press.
4. All flowmeters and static mixer shall be mounted on a type 304 stainless steel mounting plate, such that they may be removed quickly and easily for cleaning.

5. The dilution panel will be attached and preplumbed to the polymer system.
6. All piping and valves shall be 1" diameter, schedule 80 PVC.

F. Polymer Feed Pump

1. One variable speed, positive displacement, polymer pump shall be provided to pump the diluted polymer solution to the belt filter press.
2. All fasteners shall be stainless steel.
3. The pump will be a positive displacement progressive cavity type as manufactured by Robbins and Myers, Moyno Series 300, and will be driven by a DC motor.

G. Electrical Control Panel

1. All controls and associated control equipment shall be mounted and wired complete, including all necessary fuses, selector switches, and logic control. All wiring required to interface with devices outside the control panel, including electric motors, shall be wired to labeled terminals. Provide like items of equipment specified herein to achieve standardization of appearance, operation, maintenance, and service. All components, assemblies, and wiring shall conform to NEC and JIC standards for electrical control panels.
2. The enclosure shall be of the bolt on type, NEMA 4X, front access only, with continuous hinge full gasketed door. The panel shall be fully factory wired and tested, ready for installation. The panel shall be of Structural Foam Thermoplastic Molded Base and Cover as required to achieve structural integrity. Select panel dimensions to allow free and easy access to all internal components for ease of service. Panel cutouts for instruments, lights, selector switches, and push buttons, shall be cut, punched, or drilled and smoothly finished with round edges.
3. Main power to the control panel shall be 120 volt, single phase, 20 A. (Receptacle by others)
4. Polymer pump shall have a variable speed DC control.
5. The control system shall be designed for fully automatic operation with safety interlocks. Selector switches and pilot lights shall be arranged in the order in which they would be operated for system start-up.
6. All wiring shall be run in PVC wireway and in a neat workmanship manner. Each wire shall be identified with the correct wire number from the schematic drawings, and shall be marked utilizing hot stamped PVC sleeves on each wire. 120 volt control wiring shall be minimum #16 AWG. Wiring to and from door mounted components shall be accomplished through separate terminals for that purpose only. Instrument and potentiometer wiring shall be by shielded cable. Wires shall be neatly grouped within the plastic wireway, and no bundle shall exceed 2" diameter.
7. Provide heavy duty, NEMA 4X, industrial type selector switches with contacts rated for 120 volts. All switches shall be identified by means of either metal (contained) engraved nameplates or engraved phenolic (black letters on white background) nameplates with 3M adhesive backing. Minimum nameplate size shall be ½" x 2" with ¼" engravings.
8. All pilot lights shall be heavy duty, NEMA 4X, industrial type lights rated for 120 volts. Lights to be grouped with associated controls. Lights to have screw on lenses; RED lens for OFF.
9. The polymer system "ON/OFF" switch shall be installed in the polymer preparation control panel.

## 2.3 Lime Post Treatment Module

### A. Requirements:

1. The paddle mixer shall be an industrial dual shaft paddle type continuous mixer.
2. The mixer shall be capable of processing a mixture of sludge and pulverized quicklime at a rate of 12,000 lbs/hr. The bulk density of the lime sludge mixture shall be approximately sixty (65) pounds per cubic foot.
3. The mixer shall be constructed of carbon steel, welded construction. The mixer body shall be hot dip galvanized to a minimum thickness of 5 mils.
4. The mixer shall be equipped with dual shafts connected by gears, chain and sprockets and lubricated by tubes extended to the external surface to allow lubrication while in operation.
5. Shaft bearings shall be flange mounted on the mixer body and tubed to the external surface to allow lubrication while in operation.
6. Paddles shall be 304 stainless steel, wear resistant, and bolted to the shafts to provide pitch adjustment.
7. Mixer body shall be lined with mechanically replaceable synthetic rubber liner.
8. Shafts shall be type 304 stainless steel.
9. The cover section shall consist of: a 304 stainless steel sectional bolted cover.
10. The mixer shall be equipped with a 304 stainless steel discharge chute as required for the installation.
11. The mixer shall be equipped with integral floor mountings.
12. Electrical motor shall be 5.0 HP, 1800 RPM, 3 phase, 60 Hertz, 230/460 VAC, TEFC, rated for continuous chemical service applications and have a 1.15 service factor.
13. Electrical controls and interlocks for the complete system shall be included in the main control panel of the belt filter press.

### B. Sludge Mixer Installation

1. Equipment and materials shall be adequately protected and carefully handled to prevent damage before and during installation. Damaged items shall be replaced by Contractor.
2. The sludge mixing equipment and all appurtenances and accessories shall be installed in accordance with the installation instructions furnished by the manufacturer. The equipment shall be installed by workmen thoroughly experienced in installation of such equipment in accordance with manufacturer's installation instructions.
3. The Contractor shall construct concrete foundations for the sludge mixer in the existing sludge dewatering building.
4. The foundations shall be constructed using 4000 psi concrete and ASTM A-615 grade 60 reinforcing steel.

### C. Lubricants

1. All drive units and special mechanisms shall be delivered with the equipment and lubricated as far as possible. If any point cannot be so serviced, it shall be clearly marked to the effect that it is not lubricated and requires servicing prior to operation. An adequate supply of the proper lubricant, with instructions for its application, shall be supplied with the equipment for each point not lubricated prior to shipment.

### D. Spare Parts

1. The manufacturer shall supply at no additional expense to the Owner five (5) adjustable pitch paddles with nuts, appropriately labeled and properly packaged for long term storage.

- E. Lime Feed System
  - 1. Pulverized quicklime shall be conveyed by a 3" elevator screw and a 3" horizontal feed screw. The elevator screw shall be driven by a variable speed drive with 3/4 HP constant speed AC motor. The horizontal feed screw shall be driven by variable speed drive using a 1 HP AC motor. Speed control of the drives shall be in the lime post treatment or belt press control panel. Lime flow shall be maintained by means of a double agitator driven by a 0.5 HP constant speed AC drive plus an electrical vibrator, channel mounted on the hopper body.
  
- F. Loading Platform
  - 1. Loading platform and steps shall be of carbon steel treadplate. Railings shall protect both sides of the steps and the platform except stair and bag dump access. Platform height and orientation shall allow comfortable access to the bag shelf. All platforms, steps, and railings if required shall comply with OSHA standards.
  
- G. Corrosion Protection
  - 1. The hopper shall be prepared and coated according to ASTM A123, hot dip galvanized to a minimum 5 mils thickness. The hopper shall be drilled and machined, and all bolted connections shall be disassembled prior to galvanizing.
  
- H. Controls
  - 1. Controls, starters, lights and alarms shall be located in the belt filter press control panel.
  
- I. Lime Storage Hopper
  - 1. The lime storage hopper shall be of welded carbon steel construction, leg mounted, square at the bottom, with sides sloped at 60 degrees to the horizontal and complete with bag shelf and self-supporting lid. Minimum capacity shall be 1200 lb. quicklime (approx. 15 bags).
  
- J. Lime Feed System
  - 1. Pulverized quicklime shall be conveyed by a 3" elevator screw and a 3" horizontal feed screw. The elevator screw shall be driven by a variable speed drive with 3/4 HP constant speed AC motor. The horizontal feed screw shall be driven by a variable speed drive using a 1 HP AC motor. Speed control of the drives shall be in the lime post treatment or belt press control panel. Lime flow shall be maintained by means of a double agitator driven by a 0.5 HP constant speed AC drive plus an electrical vibrator, channel mounted on the hopper body.

## 2.4 SOURCE QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Testing, Inspection, and Analysis."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Examination."
- B. Verify that field dimensions are as indicated on Drawings.

#### 3.2 PREPARATION

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Installation Preparation."

#### 3.3 INSTALLATION

- A. The installation of the equipment furnished by the manufacturer shall be the responsibility of the installing contractor in accordance with all requirements of the contract documents.

#### 3.4 FIELD QUALITY CONTROL

- A. Section 014000: "Quality Requirements: Requirements for Inspecting and Testing."
- B. Inspection:
  - 1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Engineer.
  - 2. Repair damaged valve or provide new, undamaged valve.
  - 3. After installation, inspect for proper supports and interferences.

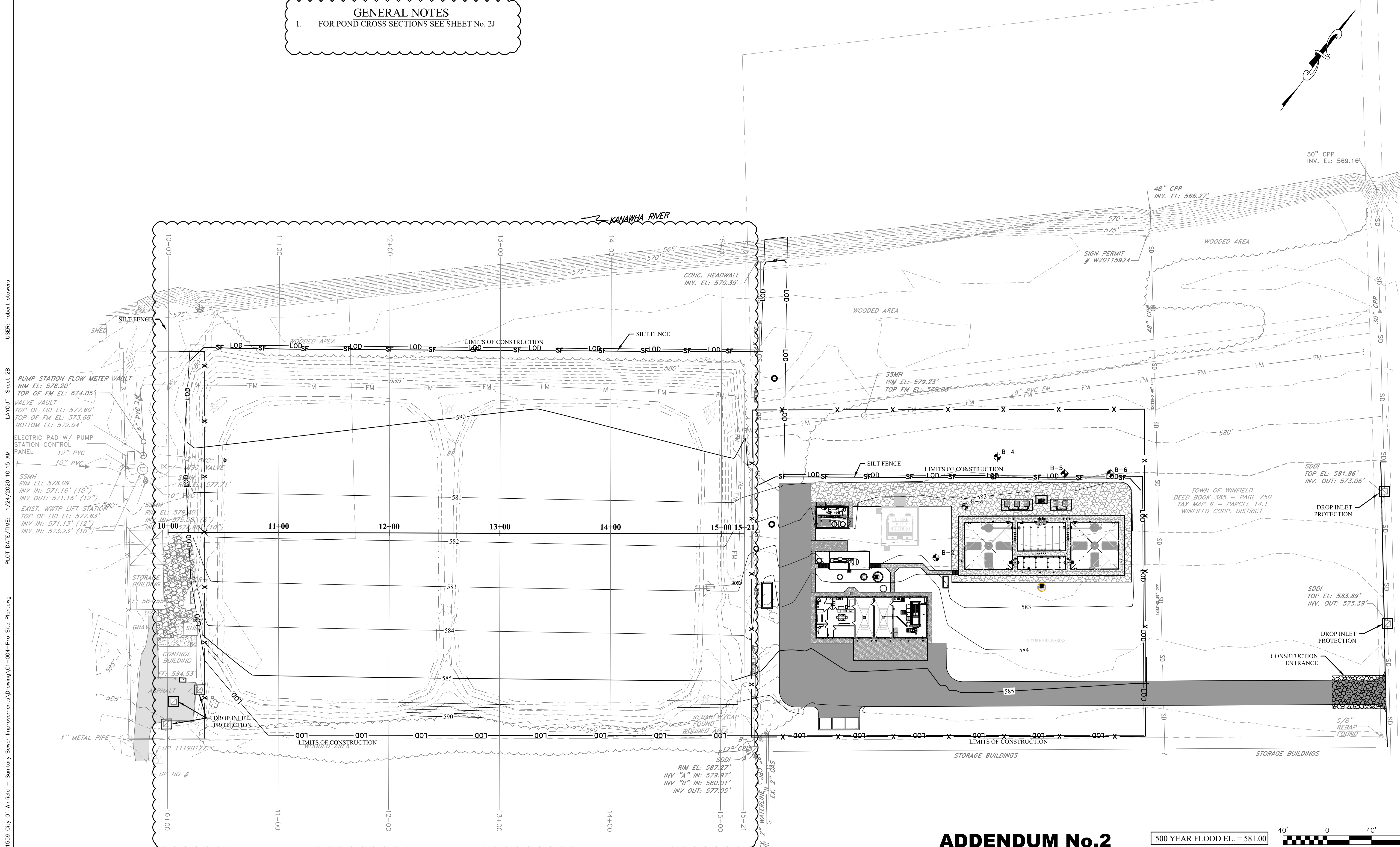
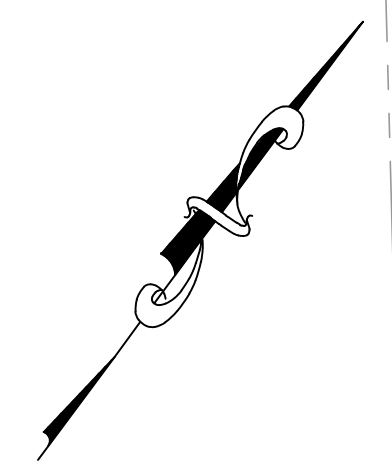
#### 3.5 CLEANING

- A. Section 017000: "Execution and Closeout Requirements: Requirements for Cleaning."

END OF SECTION 467627.00



**GENERAL NOTES**  
 1. FOR POND CROSS SECTIONS SEE SHEET No. 2J



USER: robert stowers  
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 PLOT DATE/TIME: 1/24/2020 10:15 AM  
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**ADDENDUM No.2**

500 YEAR FLOOD EL. = 581.00

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2	RRS	1/23/20	ADDEN. #2 FIXED THE SCALE BAR & ADDED POND CROSS SECTIONS
NO.	BY	DATE	DESCRIPTION

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DRAWN: R. STOWERS	DATE: 8/2019
CHECKED: C. SMITH	DATE: 8/2019
APPROVED: C. SMITH	DATE: 8/2019
SURVEY DATE:	
SURVEY BY:	
FIELD BOOK No.:	

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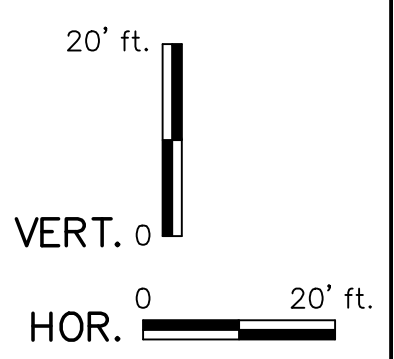
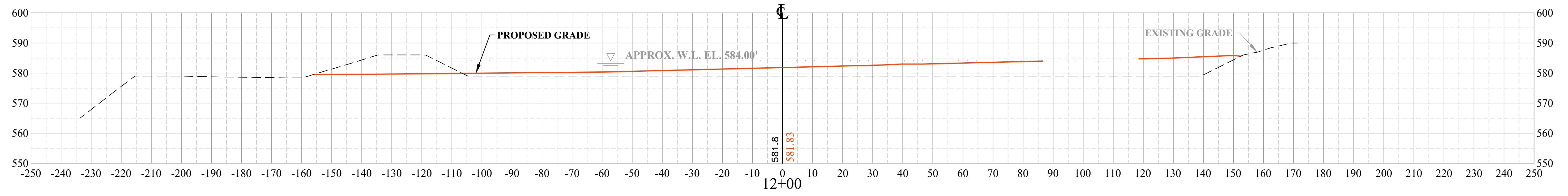
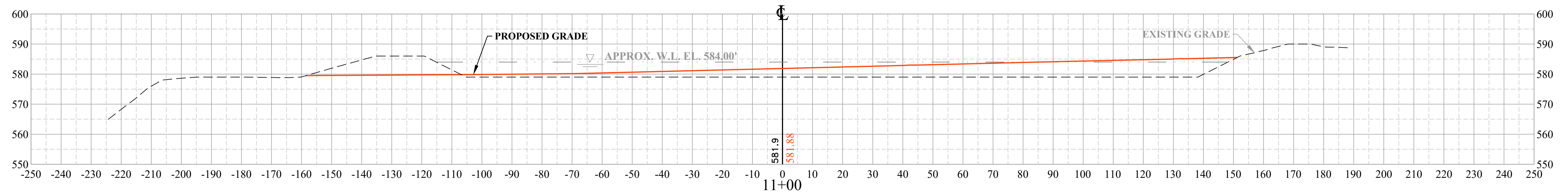
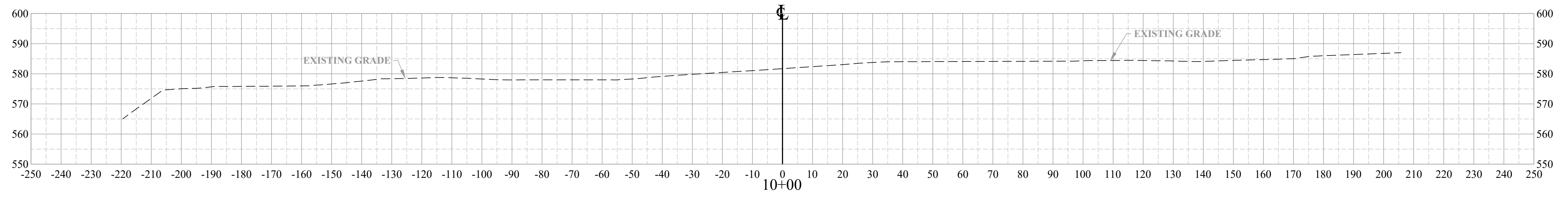
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CONTRACT No.	
PROJECT No.	020-1559

**CITY OF WINFIELD**  
**PUTNAM COUNTY, WEST VIRGINIA**  
**WWTP IMPROVEMENTS**  
**GRADING AND SEDIMENT CONTROL PLAN**

SHEET No.  
**2B**



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 LAYOUT: Sheet 2J  
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### ADDENDUM No.2

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2	RRS	1/23/20	ADDEN. #2 CROSS SECTION SHEET ADDED
NO.	BY	DATE	DESCRIPTION

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DRAWN: R. STOWERS DATE: 1/2020
CHECKED: C. SMITH DATE: 1/2020
APPROVED: C. SMITH DATE: 1/2020
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PROJECT No.
020-1559

CITY OF WINFIELD  
 PUTNAM COUNTY, WEST VIRGINIA  
 WWTP IMPROVEMENTS  
 EXISTING POND CROSS SECTIONS

SHEET No.  
**2J**

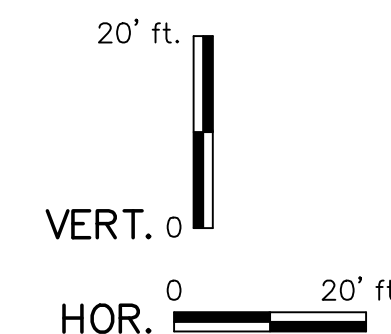
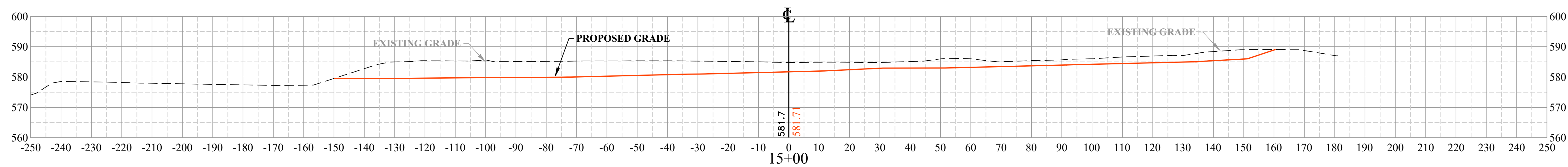
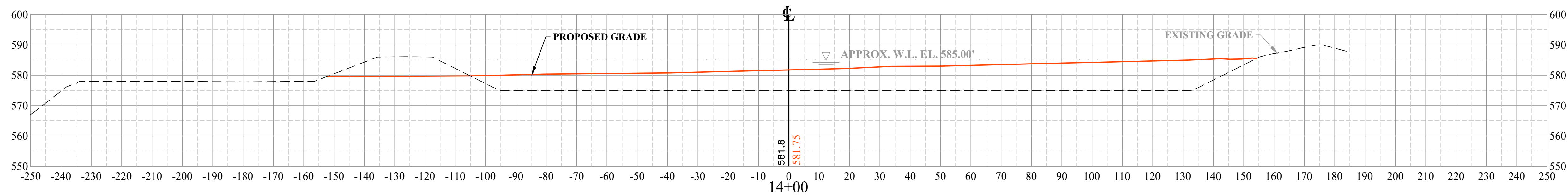
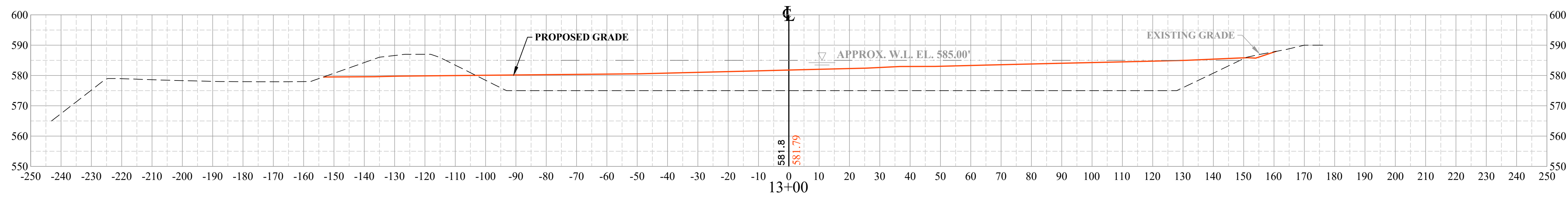
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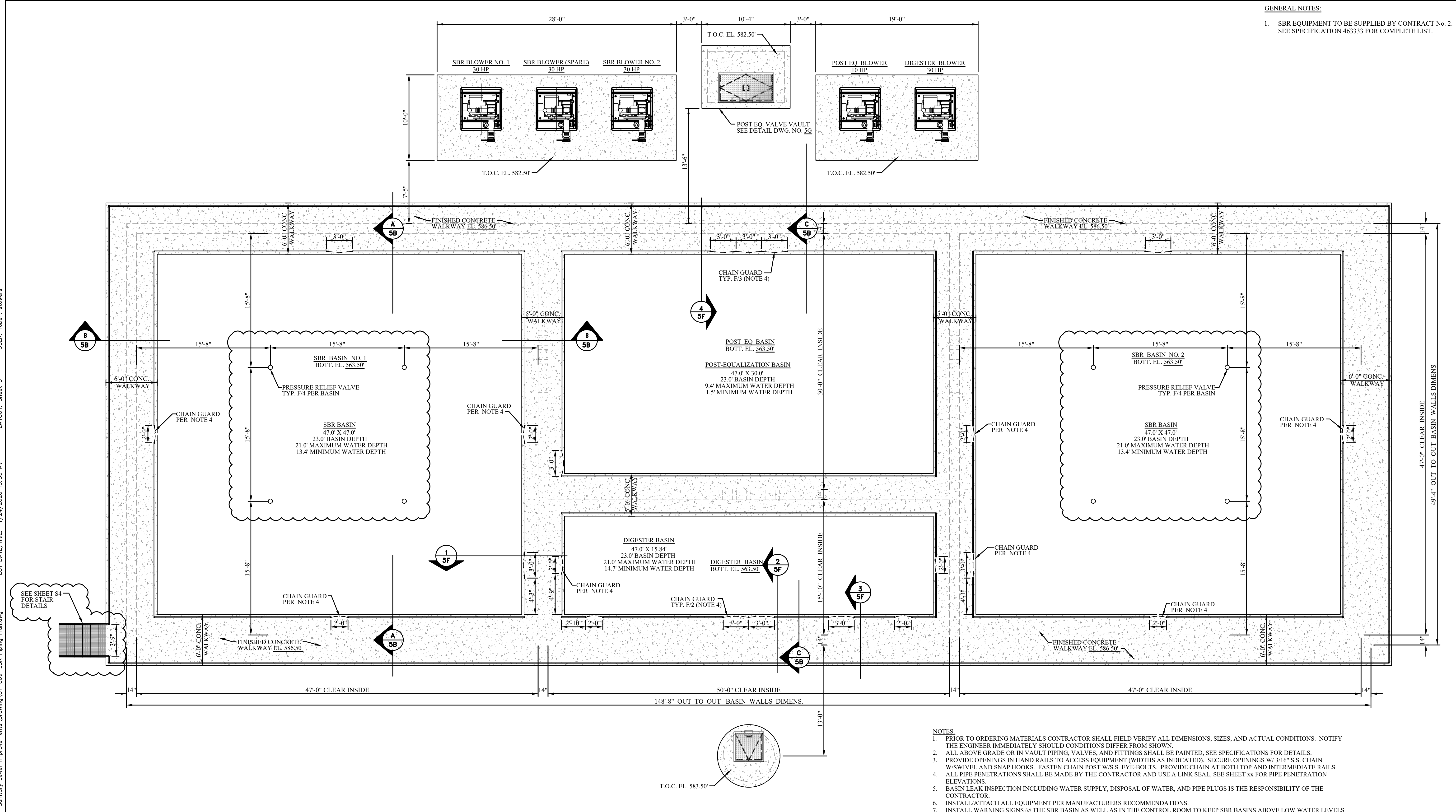
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PHASE No.
CONTRACT No.
1
PROJECT No.
020-1559

CITY OF WINFIELD  
PUTNAM COUNTY, WEST VIRGINIA  
WWTP IMPROVEMENTS  
EXISTING POND CROSS SECTIONS

SHEET No.
2K

GENERAL NOTES:  
 1. SBR EQUIPMENT TO BE SUPPLIED BY CONTRACT No. 2. SEE SPECIFICATION 463333 FOR COMPLETE LIST.



**SBR BASIN LAYOUT PLAN**  
 SCALE: 3/16"=1'-0"

- NOTES:
1. PRIOR TO ORDERING MATERIALS CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, SIZES, AND ACTUAL CONDITIONS. NOTIFY THE ENGINEER IMMEDIATELY SHOULD CONDITIONS DIFFER FROM SHOWN.
  2. ALL ABOVE GRADE OR IN VAULT PIPING, VALVES, AND FITTINGS SHALL BE PAINTED, SEE SPECIFICATIONS FOR DETAILS.
  3. PROVIDE OPENINGS IN HAND RAILS TO ACCESS EQUIPMENT (WIDTHS AS INDICATED). SECURE OPENINGS W/ 3/16" S.S. CHAIN W/SWIVEL AND SNAP HOOKS. FASTEN CHAIN POST W/S. EYE-BOLTS. PROVIDE CHAIN AT BOTH TOP AND INTERMEDIATE RAILS.
  4. ALL PIPE PENETRATIONS SHALL BE MADE BY THE CONTRACTOR AND USE A LINK SEAL. SEE SHEET xx FOR PIPE PENETRATION ELEVATIONS.
  5. BASIN LEAK INSPECTION INCLUDING WATER SUPPLY, DISPOSAL OF WATER, AND PIPE PLUGS IS THE RESPONSIBILITY OF THE CONTRACTOR.
  6. INSTALL/ATTACH ALL EQUIPMENT PER MANUFACTURERS RECOMMENDATIONS.
  7. INSTALL WARNING SIGNS @ THE SBR BASIN AS WELL AS IN THE CONTROL ROOM TO KEEP SBR BASINS ABOVE LOW WATER LEVELS DURING RAIN EVENTS OR DURING TIMES OF ELEVATED GROUND WATER LEVEL.
  8. ALL ITEMS LABELED AS "FUTURE" ARE FOR REFERENCE ONLY AND NOT TO BE INSTALLED/PROVIDED DURING INITIAL CONSTRUCTION.

**ADDENDUM No.2**

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SCALE: 3/16" = 1'-0"	DATE: 11/2017
DRAWN: R. STOWERS	DATE: 8/2019
CHECKED: C. SMITH	DATE: 8/2019
APPROVED: J. CARPENTER	DATE: 8/2019
SURVEY DATE:	
SURVEY BY:	
FIELD BOOK No.:	

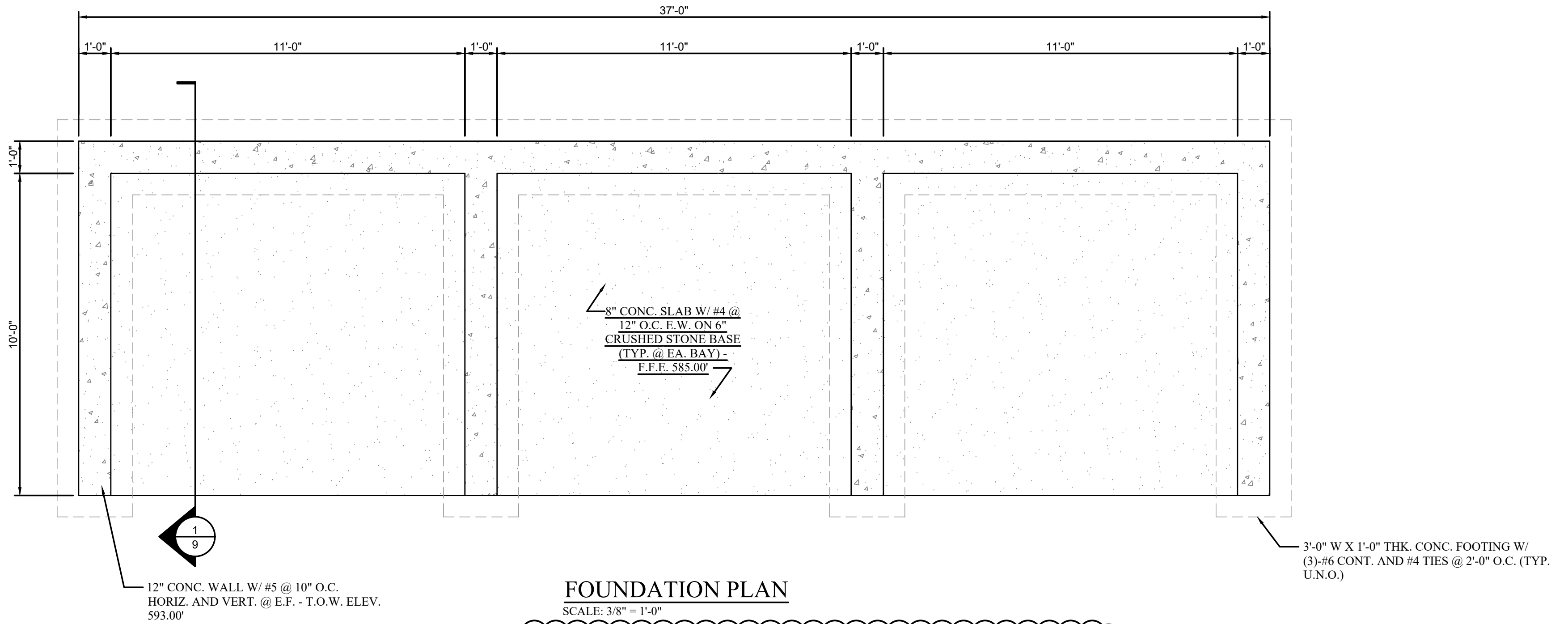
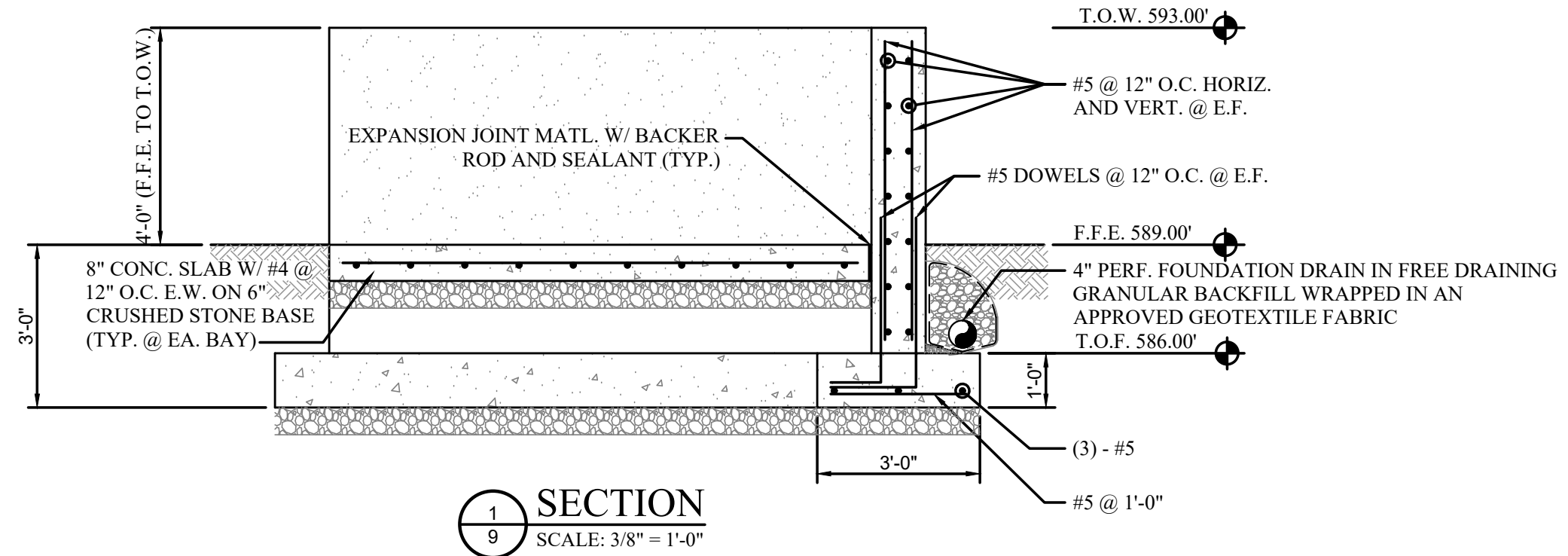
PHONE (304)-343-7601

**THRASHER**  
 300 ASSOCIATION DRIVE  
 CHARLESTON, WV 25311  
 www.thrashergroup.com  
 FAX (304)-343-7604

PHASE No.	
CONTRACT No.	1
PROJECT No.	020-1559

CITY OF WINFIELD  
 PUTNAM COUNTY, WEST VIRGINIA  
 WWP IMPROVEMENTS  
 SBR, POST EQ & DIGESTER PLAN  
 SBR BASIN LAYOUT PLAN

CAD FILE: R:\020-1559 City of Winfield - Sanitary Sewer Improvements\Drawing\CI-013-Storage Bins.dwg  
 PLOT DATE/TIME: 1/23/2020 3:42 PM  
 LAYOUT: Sheet 9  
 USER: robert stowers



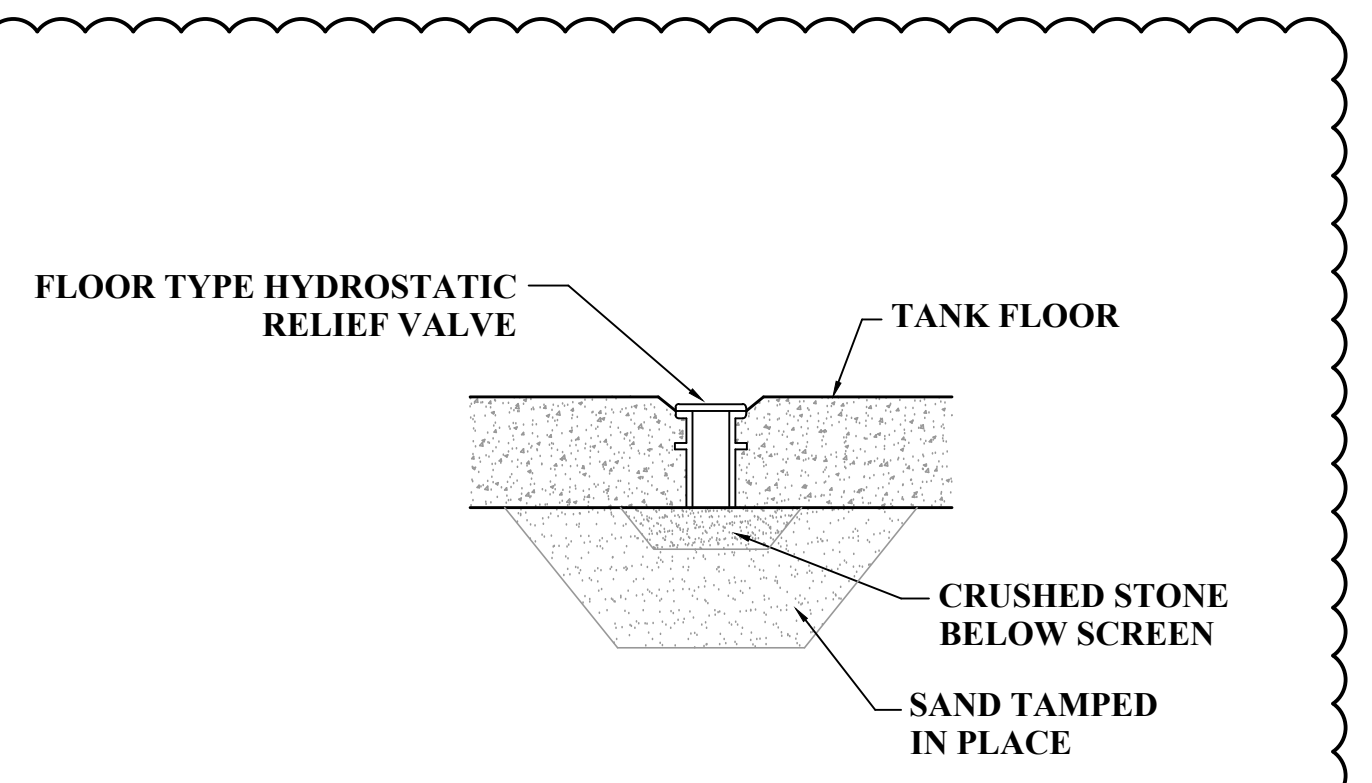
- NOTES:**
1. PROVIDE CORNER BARS SAME SIZE AND SPACING AS HORIZ. REINFORCING IN FOOTINGS AND WALLS.
  2. USE VERT. DOWELS INTO FOOTING SAME SIZE AND SPACING AS VERT. WALL REINFORCING.
  3. SEE SHEET SGI FOR INFORMATION RELATED TO UNDERCUTTING AND PLACEMENT OF STRUCTURAL FILL BENEATH FOOTINGS AND FLOOR SLABS.

**ADDENDUM No.2**

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NO.	BY	DATE	DESCRIPTION										
1	RRS	3/2018	DEP COMMENTS										
2	RRS	1/23/20	ADDEN. #2 REMOVED ORIGINAL NOTE 1										

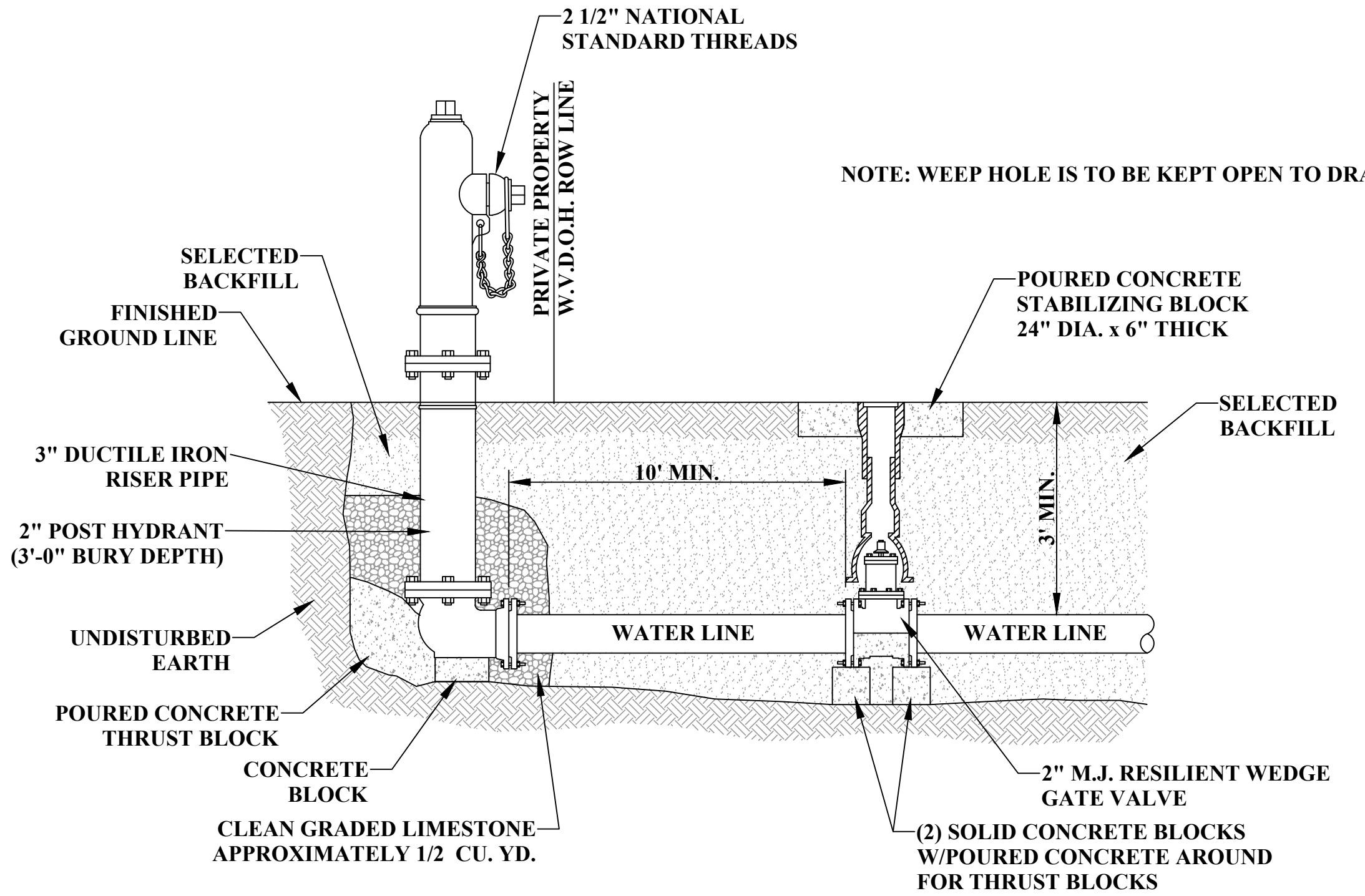


USER: robert stowers  
 LAYOUT: DET-11  
 PLOT DATE/TIME: 1/23/2020 3:44 PM  
 CAD FILE: R:\020-1559 City of Winfield - Sanitary Sewer Improvements\Drawing\CI-016-Standard Details.dwg

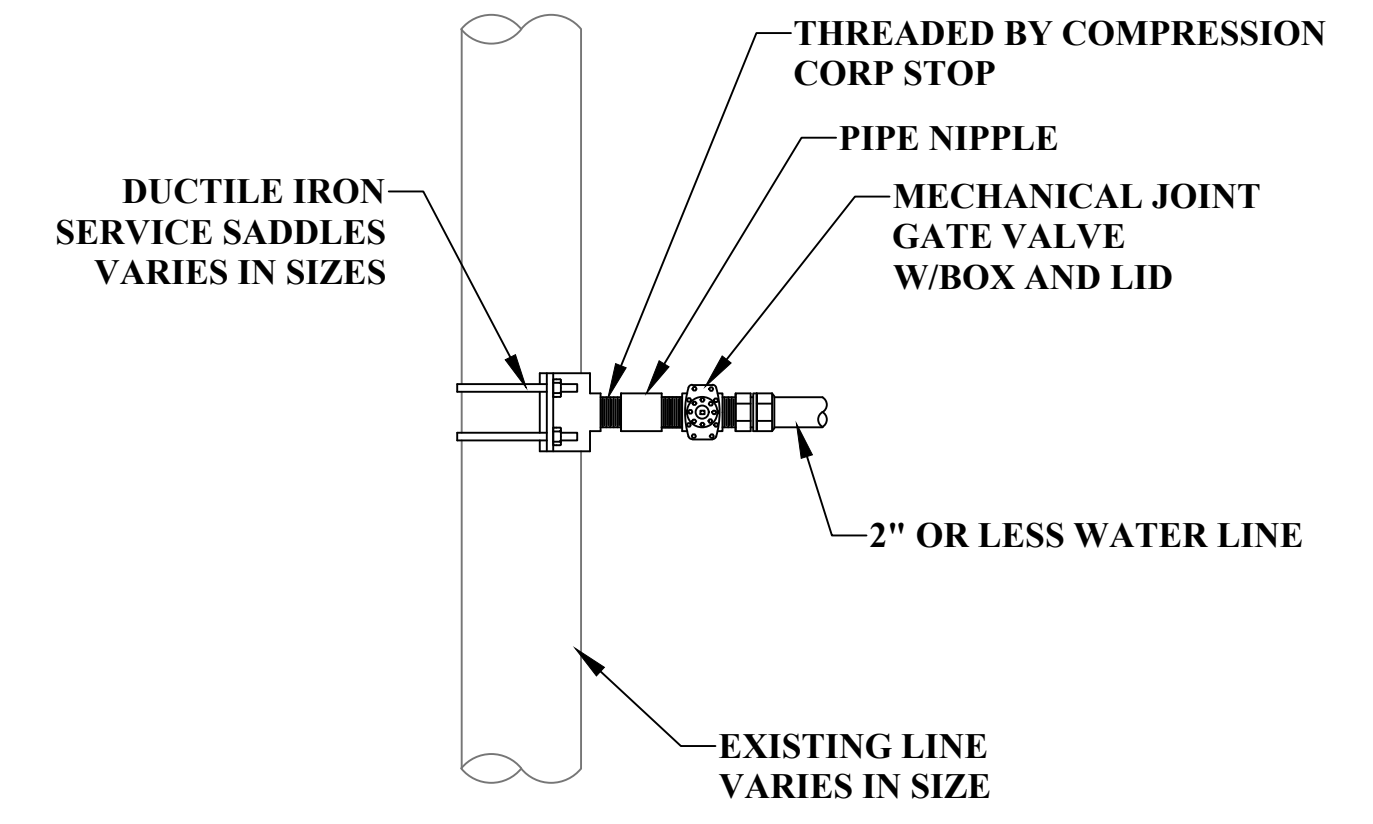


**TYPICAL PRESSURE RELIEF VALVE DETAIL**  
NOT TO SCALE

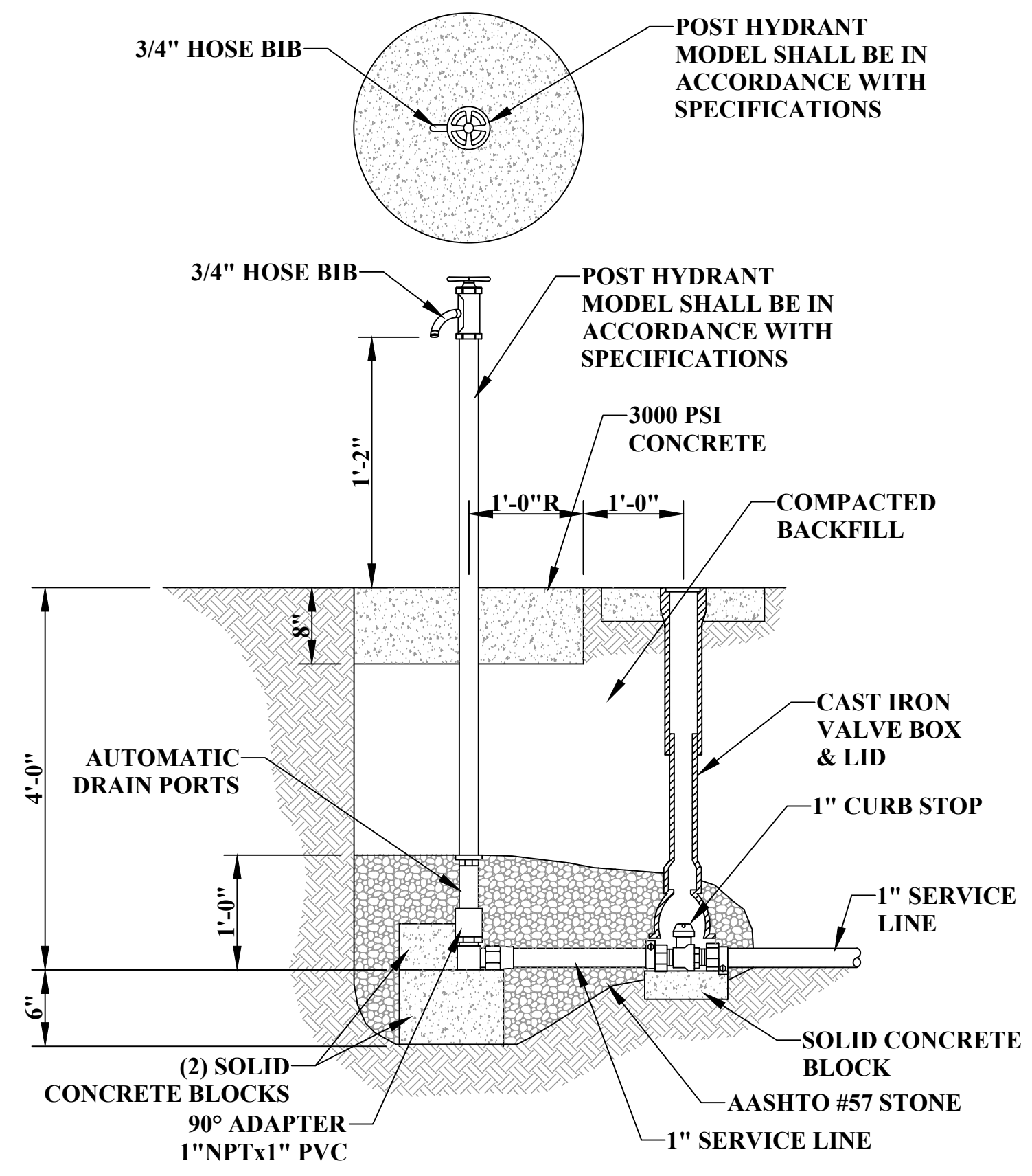
NOTE: VALVES TO OPEN AT 2 PSI



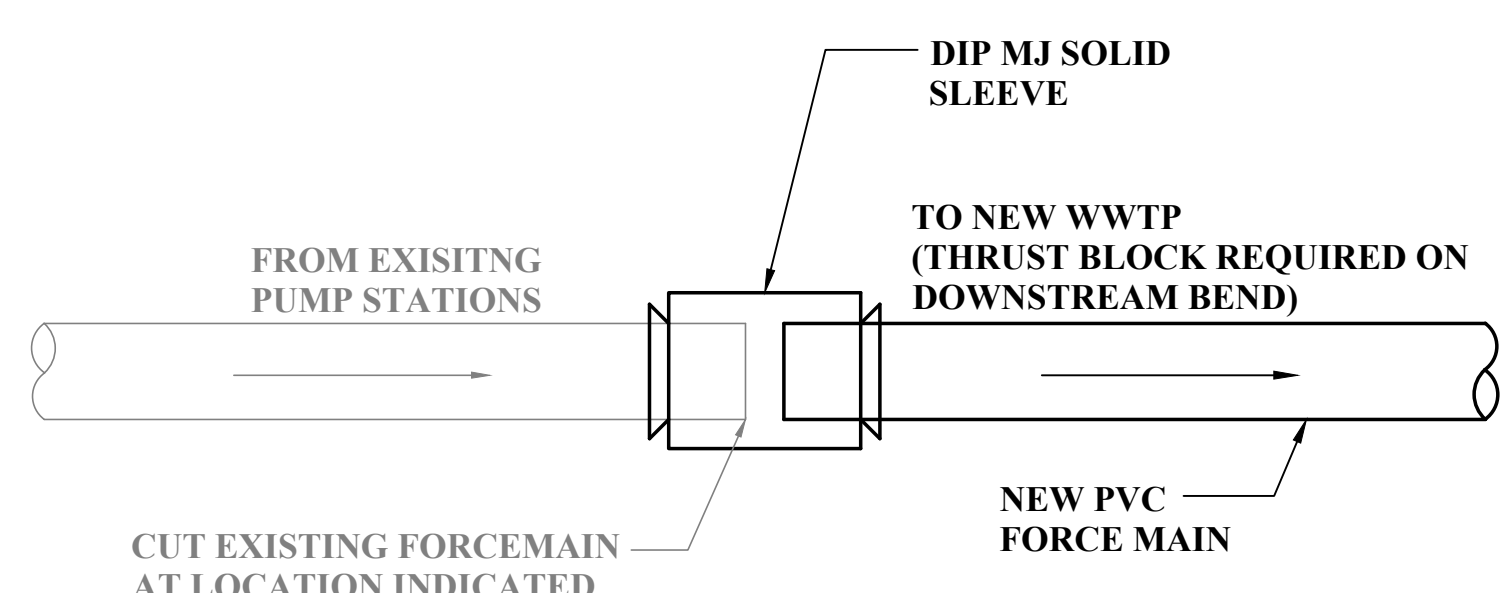
**2" POST FLUSHING HYDRANT**  
NOT TO SCALE



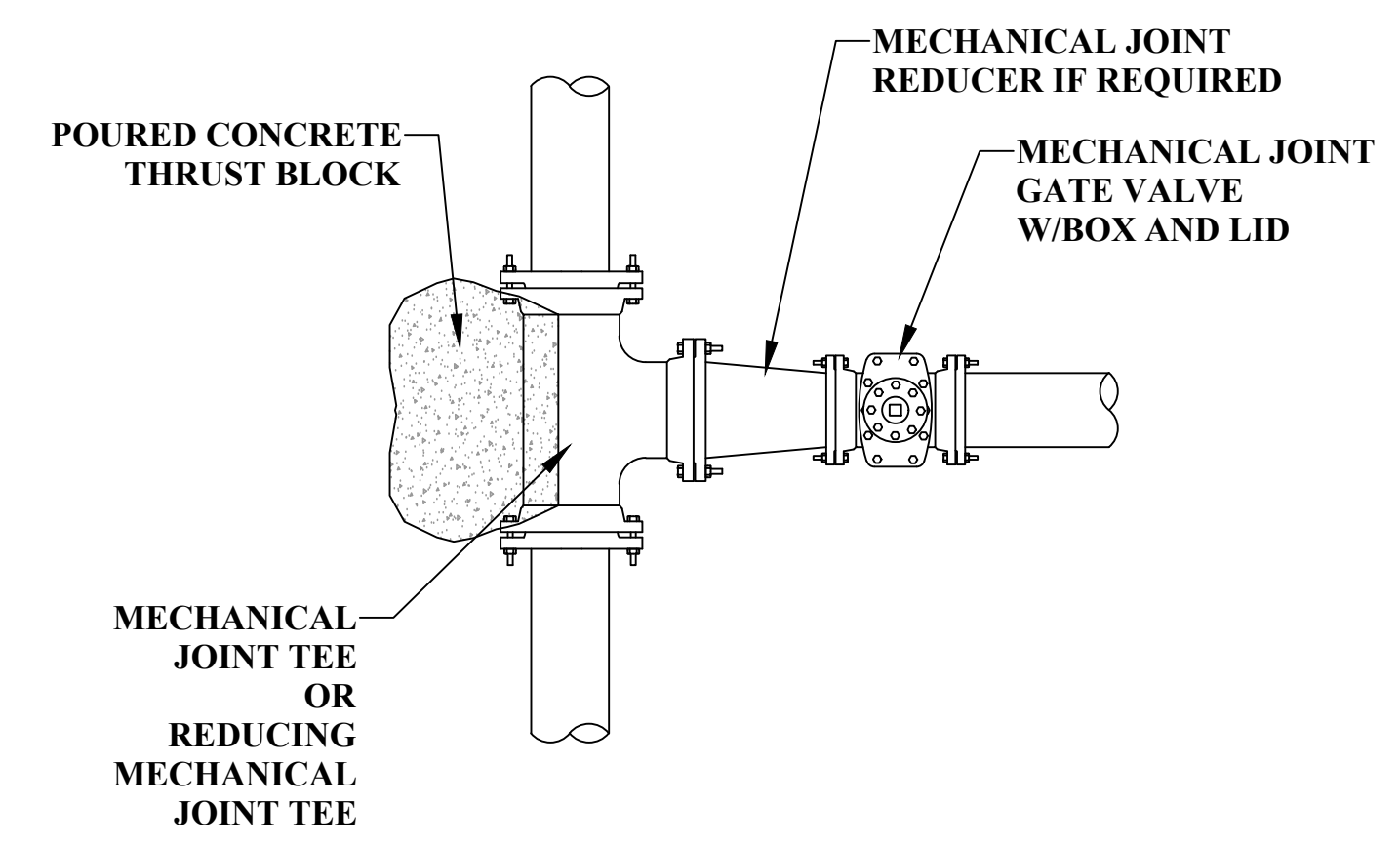
**TYPICAL 2" OR LESS CONNECTION TO EXISTING MAIN LINE**  
NOT TO SCALE



**1" YARD HYDRANT DETAIL**  
NOT TO SCALE



**FORCE MAIN CONNECTION DETAIL**  
SCALE : NONE



**TYPICAL BRANCH CONNECTION**  
NOT TO SCALE

**ADDENDUM No.2**

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NO.	BY	DATE	DESCRIPTION
1	RRS	3/2018	DEP COMMENTS
2	RRS	1/23/20	ADDEN. #2 ADDED PRV DETAIL

SCALE: NOT TO SCALE
DRAWN: R. STOWERS DATE: 12/2017
CHECKED: C. SMITH DATE: 8/2019
APPROVED: J. CARPENTER DATE: 8/2019
SURVEY DATE:
SURVEY BY:
FIELD BOOK No.:

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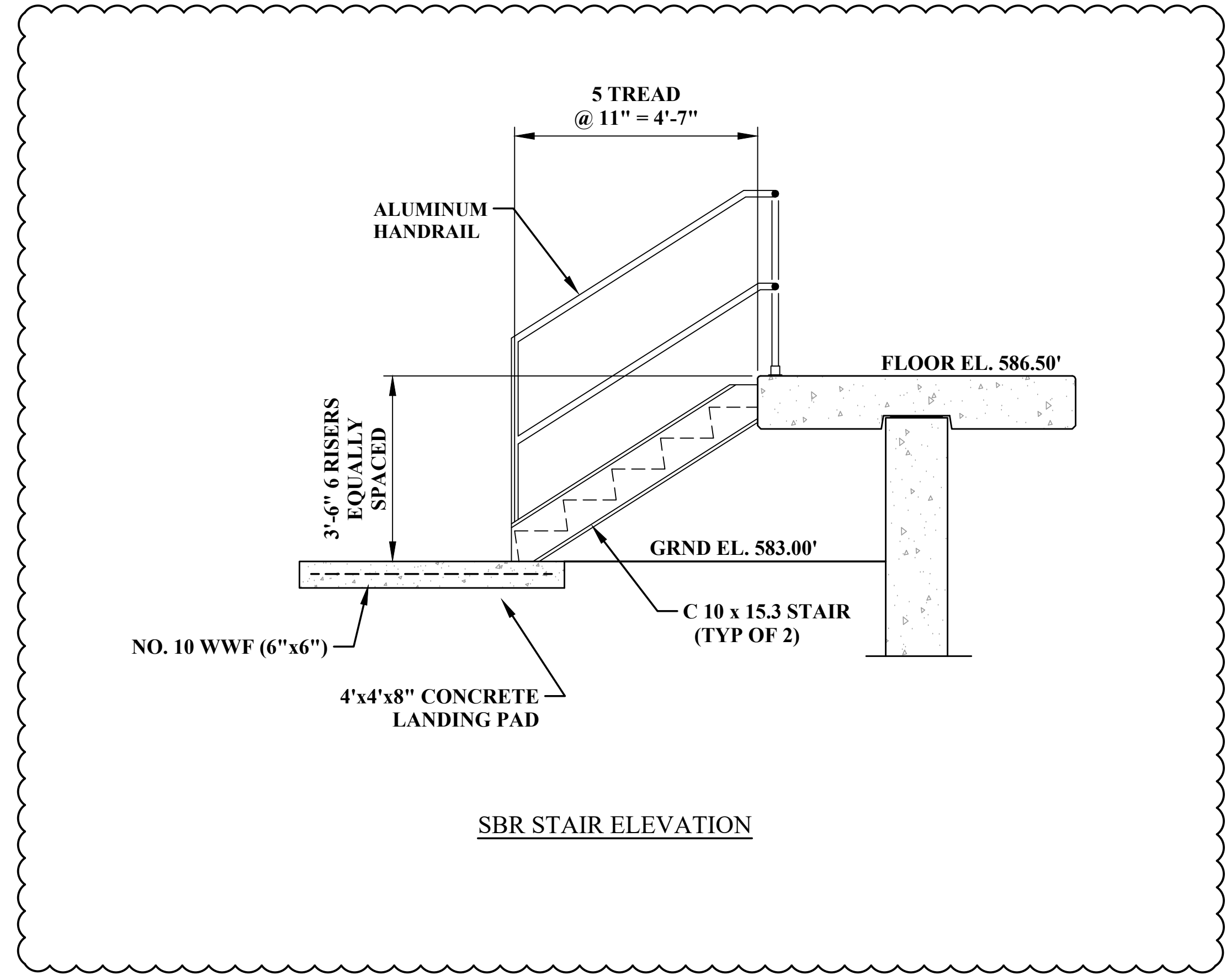
PHONE (304)-343-7601  
 FAX (304)-343-7604

PHASE No.
CONTRACT No.
1
PROJECT No.
020-1559

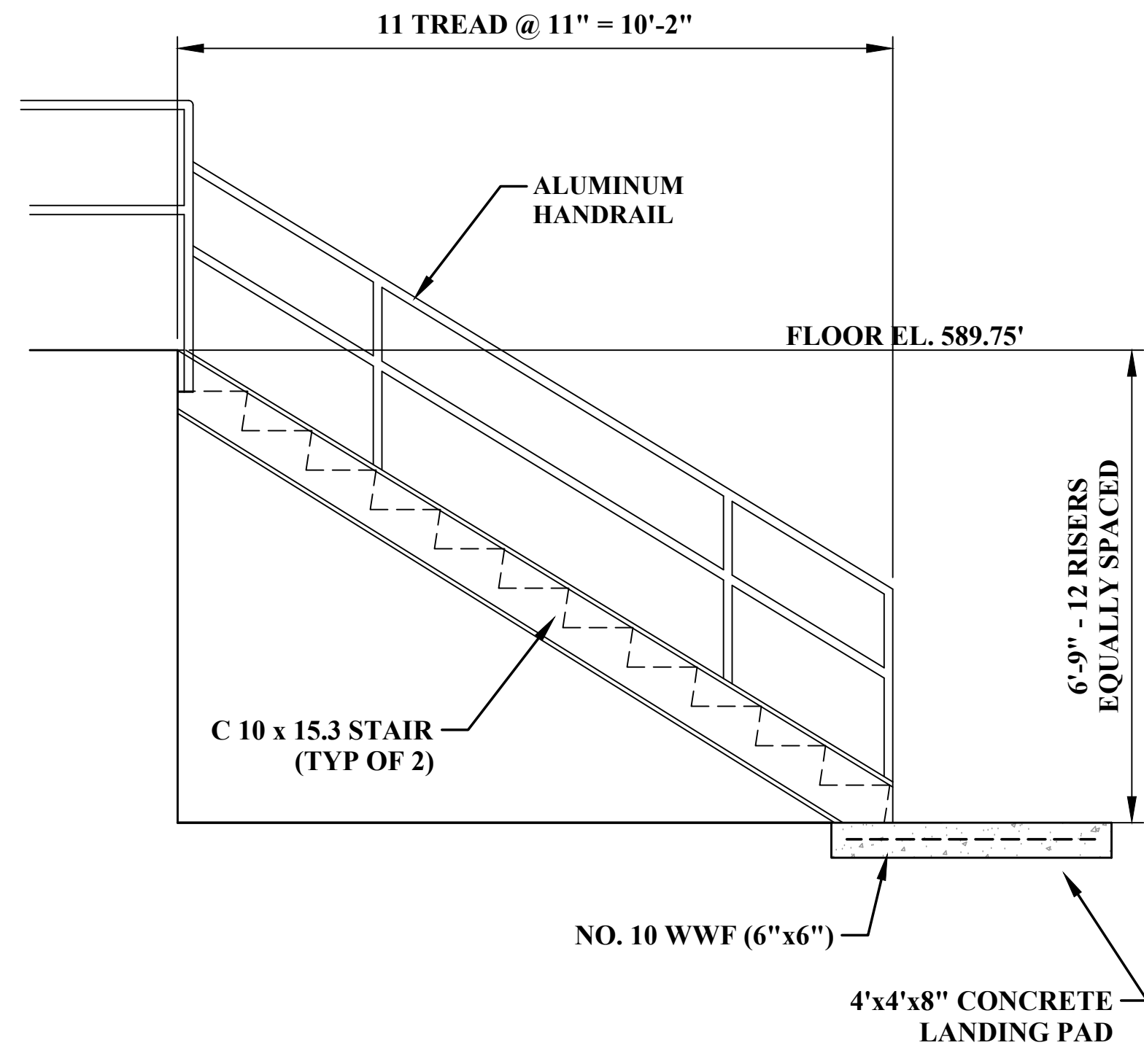
CITY OF WINFIELD  
 PUTNAM COUNTY, WEST VIRGINIA  
 WWTP IMPROVEMENTS  
 STANDARD DETAILS

SHEET No.  
**DET-11**

USER: robert stowers  
 LAYOUT: Sheet S4  
 PLOT DATE/TIME: 1/23/2020 11:34 AM  
 CAD FILE: R:\020-1559 City Of Winfield - Sanitary Sewer Improvements\Drawing\CI-018-Structural Details.dwg



SBR STAIR ELEVATION

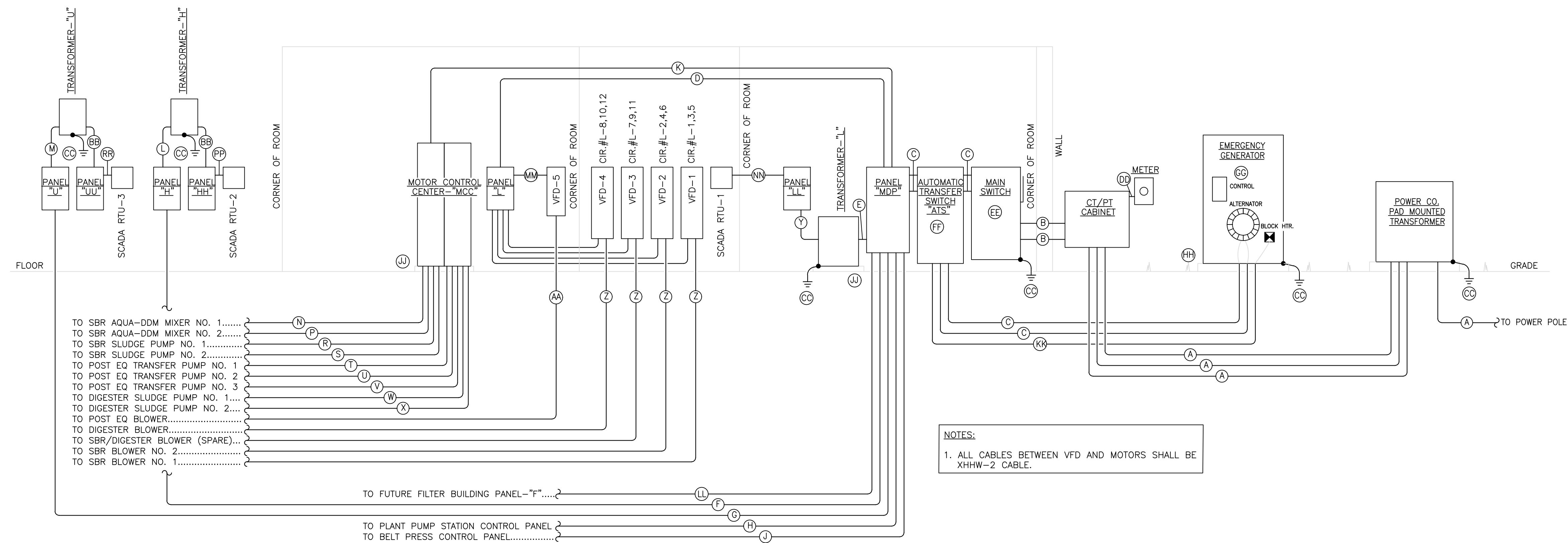


HEADWORKS STAIR ELEVATION  
(TYP. 2 PLACES)

**ADDENDUM No.2**

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NO.	BY	DATE	DESCRIPTION								
1	RRS	3/2018	DEP COMMENTS								
2	RRS	1/23/20	ADDEND. #2 ADDED DETAIL OF THE SBR STAIRS								

CAD FILE: R:\020-1559 City DF Winfield - Sanitary Sewer Improvements\Drawing\CI-089-Sheet E6.7.8.dwg  
 PLOT DATE/TIME: 1/23/2020 11:59 AM  
 LAYOUT: EB  
 USER: robert stowers

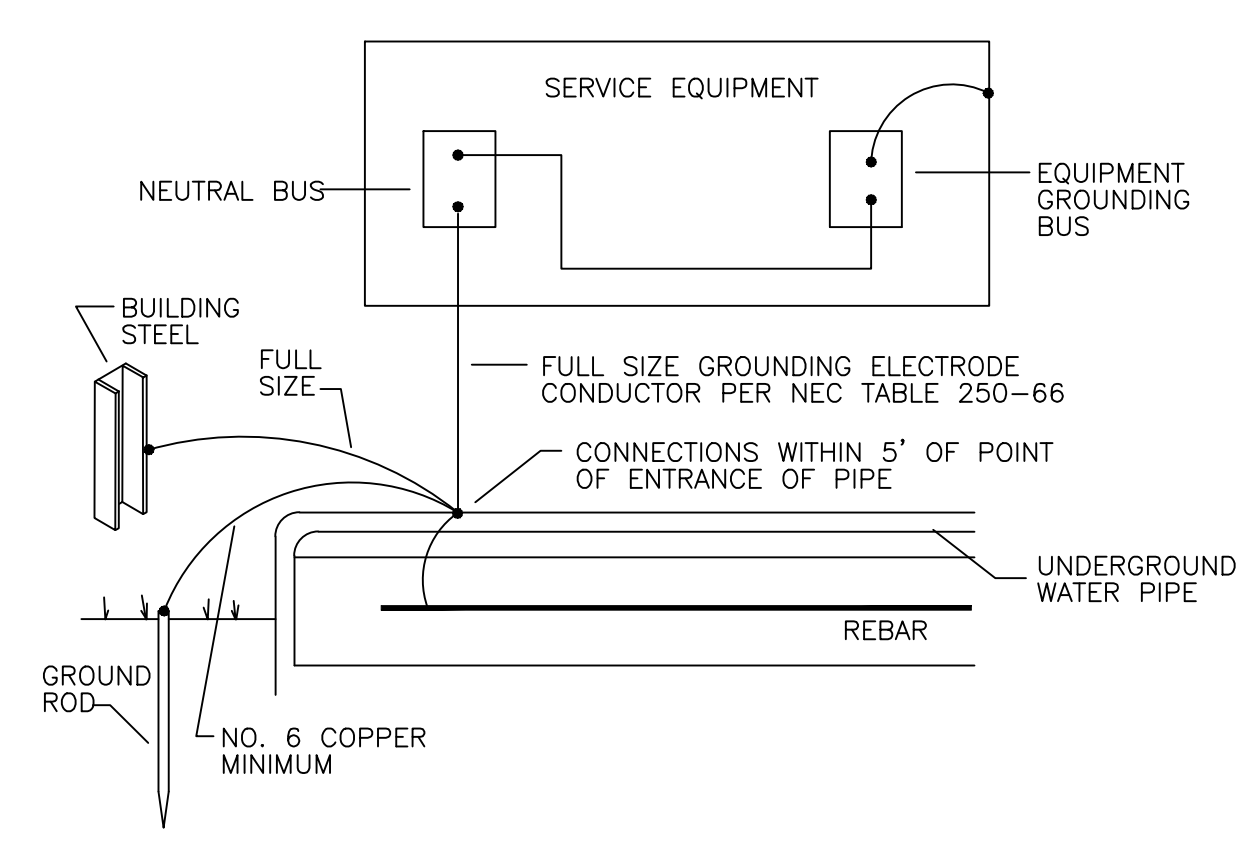


### ELECTRICAL RISER KEY NOTES

- (A) 5" EMPTY CONDUITS WITH PULL STRING TO POWER POLE. CABLES BY POWER CO.
- (B) 4" CONDUIT WITH 4-#600MCM CABLES.
- (C) 4" CONDUIT WITH 4-#600MCM + 1-#2 GROUND.
- (D) CIRCUIT NO. MDP-1,3,5.
- (E) CIRCUIT NO. MDP-2,4,6.
- (F) CIRCUIT NO. MDP-8,10,12.
- (G) CIRCUIT NO. MDP-7,9,11.
- (H) CIRCUIT NO. MDP-13,15,17.
- (J) CIRCUIT NO. MDP-14,16,18.
- (K) CIRCUIT NO. MDP-20,22,24.
- (L) CIRCUIT NO. H-1,3,5.
- (M) CIRCUIT NO. U-1,3,5.
- (N) CIRCUIT NO. MCC-1F.
- (P) CIRCUIT NO. MCC-1H.
- (R) CIRCUIT NO. MCC-1K.
- (S) CIRCUIT NO. MCC-1M.
- (T) CIRCUIT NO. MCC-2B.
- (U) CIRCUIT NO. MCC-2D.
- (V) CIRCUIT NO. MCC-2F.
- (W) CIRCUIT NO. MCC-2H.
- (X) CIRCUIT NO. MCC-2K.
- (Y) 2 1/2" CONDUIT WITH 3-250MCM, 1-#4 GROUND.
- (Z) 1 1/2" CONDUIT WITH 3-#2, 1-#6 GROUND. CABLES TYPE BETWEEN VFD AND MOTOR SHALL BE XHHW-2.
- (AA) 1" CONDUIT WITH 3-#8, 1-#10 GROUND. CABLES TYPE BETWEEN VFD AND MOTOR SHALL BE XHHW-2.
- (BB) 3/4" CONDUIT WITH 4-#8, 1-#10 GROUND.
- (CC) GROUND PER N.E.C.
- (DD) 1 1/4" CONDUIT WITH PULL STRING.
- (EE) MAIN SWITCH: 3P-800A, 277/480V, 3Ø, 4W HEAVY DUTY NEMA-1 SERVICE RATED FUSED SAFETY SWITCH WITH 800A FUSES.
- (FF) AUTOMATIC TRANSFER SWITCH-"ATS": 3P-800A, 277/480A, 3Ø, 4W, NEMA-1 ENCLOSURE WITH CONTROLS AND BATTERY CHARGER.
- (GG) EMERGENCY DIESEL GENERATOR: 600KW, 277/480V, 3Ø, 4W DIESEL GENERATOR WITH 3P-800A MAIN CIRCUIT BREAKER; 1,000 GALLONS DOUBLE WALL BASE MOUNTED FUEL TANK; CONTROLS PANEL; WEATHERPROOF ENCLOSURE; 6.4KW, 480V/1Ø BLOCK HEATER.
- (HH) 6" THICK CONCRETE PAD.
- (JJ) 4" THICK CONCRETE PAD.
- (KK) CIRCUIT NO. L-14,16.
- (LL) 1 1/2" SPARE CONDUIT WITH PULL STRING.
- (MM) CIRCUIT NO. L-13,15,17.
- (NN) CIRCUIT NO. LL-30.
- (PP) CIRCUIT NO. HH-6.
- (RR) CIRCUIT NO. UU-9.

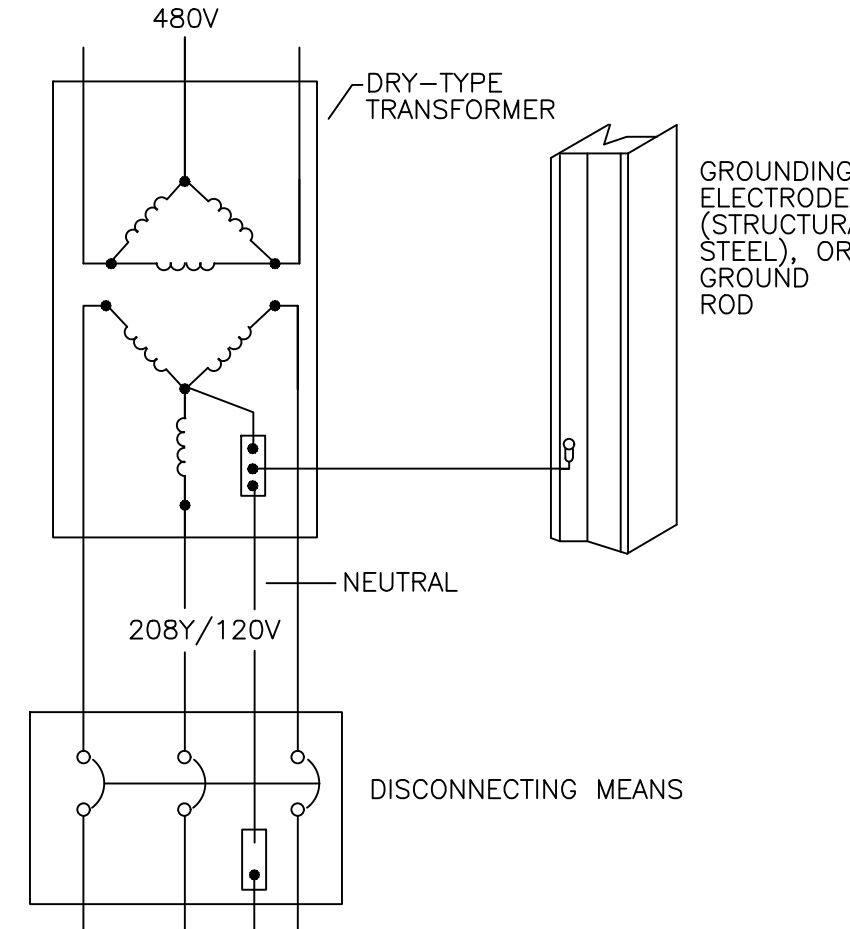
### ELECTRICAL RISER DIAGRAM

SCHEMATIC



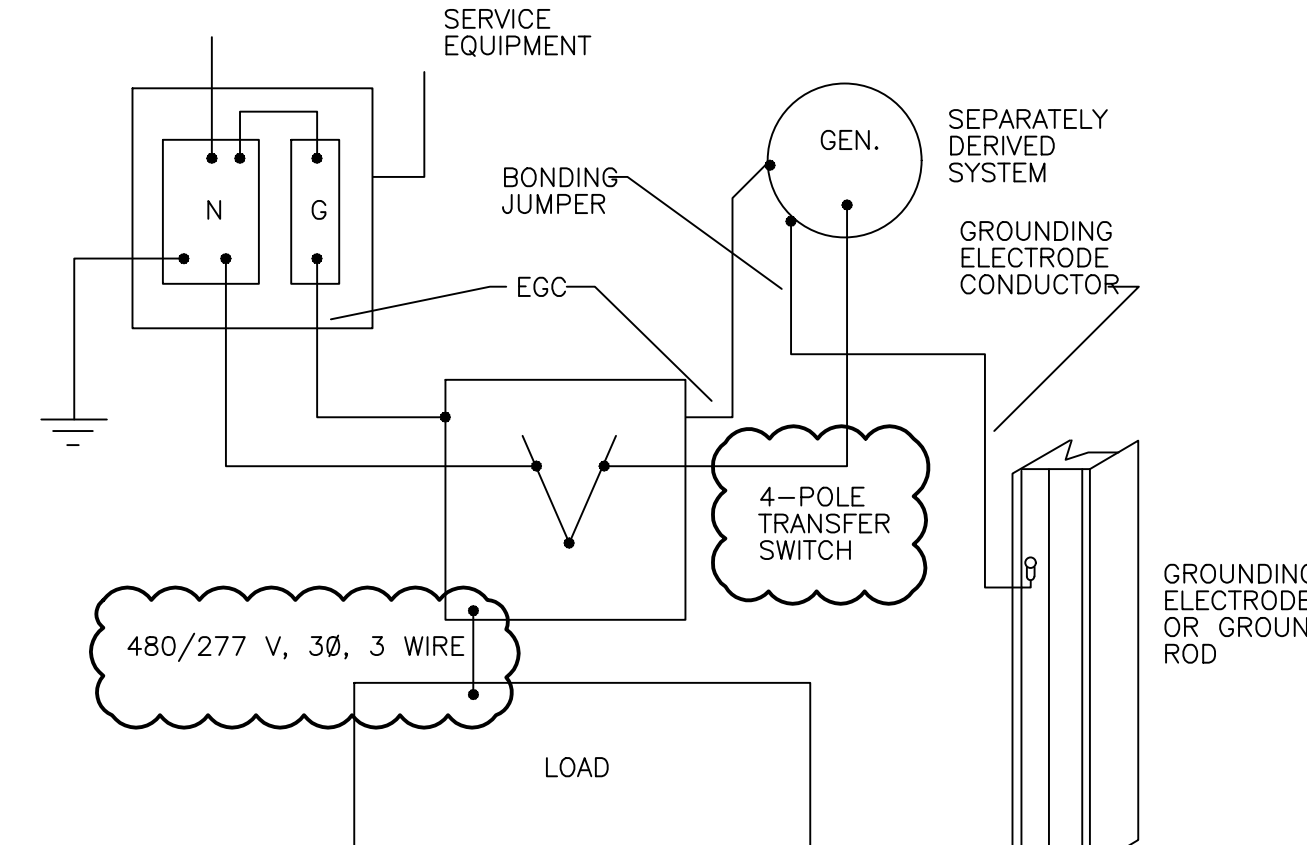
**SERVICE ENTRANCE GROUNDING**

SCHEMATIC



**DRY-TYPE TRANSFORMER GROUND**

SCHEMATIC



**GENERATOR GROUNDING**

SCHEMATIC

### ADDENDUM No.2

1	RRS	3/2018	DEP COMMENTS
2	RRS	1/23/20	ADDEN #2 CHANGED 208/120 TO 480/277 & 4-POLE TO 3-POLE
NO.	BY	DATE	DESCRIPTION

SCALE: NOT TO SCALE
DRAWN: R. STANDISH DATE: 11/2017
CHECKED: C. SMITH DATE: 8/2019
APPROVED: J. CARPENTER DATE: 8/2019
SURVEY DATE: _____
SURVEY BY: _____
FIELD BOOK No: _____

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PHASE No.
CONTRACT No.
1
PROJECT No.
020-1559

CITY OF WINFIELD  
 PUTNAM COUNTY, WEST VIRGINIA  
 WWTW IMPROVEMENTS  
 CONTROL RISER DIAGRAM

SHEET No.
<b>E8</b>