

## ATTACHMENTS

**SECTION 08710**  
**DOOR HARDWARE**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
  - 1. Door hardware for steel (hollow metal) doors.
  - 2. Door hardware for aluminum doors.
  - 3. Door hardware for other doors indicated.
  - 4. Keyed cylinders as indicated.
- B. Intent of Hardware Groups
  - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
  - 2. Where items of hardware aren't definitely or correctly specified and are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Engineer/Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

**1.02 RELATED WORK**

- A. Division 1 – General Provisions.
- B. Division 6 – Wood and Plastics.
- C. Division 8 – Doors and Windows.
- D. Division 16 – Electrical.

**1.03 SUBMITTALS**

- A. Comply with Division 1.
- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- C. Product Data: Manufacturer's specifications and technical data including the following:
  - 1. Detailed specification of construction and fabrication.
  - 2. Manufacturer's installation instructions.
  - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
  - 4. Submit 6 copies of catalog cuts with hardware schedule.

5. Provide 9001 - Quality Management and 14001 - Environmental Management for products listed in Materials Section 2.2
- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
1. List groups and suffixes in proper sequence.
  2. Completely describe door and list architectural door number.
  3. Manufacturer, product name, and catalog number.
  4. Function, type, and style.
  5. Size and finish of each item.
  6. Mounting heights.
  7. Explanation of abbreviations and symbols used within schedule.
  8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples: (If requested by the Engineer/Architect)
1. 1 sample of Lever and Rose/Escutcheon design, (pair).
  2. 3 samples of metal finishes.
- G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
1. Operating and maintenance manuals: Submit 3 sets containing the following.
    - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Name, address, and phone number of local representative for each manufacturer.
    - d. Parts list for each product.
  2. Copy of final hardware schedule, edited to reflect, "As installed".
  3. Copy of final keying schedule
  4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
  5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- 1.04 REFERENCE STANDARDS
- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. ADA - Americans with Disabilities Act of 1990 including Accessibility Guidelines as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).
2. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
3. ANSI/BHMA A156 (.1 through .21)
4. FEMA P-361 – Safe Rooms for Tornadoes and Hurricanes.
5. NFPA 101 – Life Safety Code.
6. NFPA 80 – Fire Doors and Windows.
7. UL10C – Positive Pressure Fire Test of Door Assemblies.
8. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware.
9. IBC - International Building Code, as adopted by public Authority Having Jurisdiction (AHJ).
10. ISO - 9001 - Quality Management and ISO - 14001 - Environmental Management.
11. State and local Rules and Regulations for Barrier Free Facilities, as adopted by AHJ.

#### 1.05 QUALITY ASSURANCE

##### A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
  - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
  - b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
  - a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
  - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

##### B. Review Project for extent of finish hardware required to complete the work. Where there is a conflict between these specifications and the required hardware, notify the Engineer/Architect in writing and furnish hardware in compliance with the specification and applicable codes unless otherwise directed in writing by the Engineer/Architect.

#### 1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.
- C. In the future, all exterior doors on all buildings and openings 802 and 803 will be card reader access. Inform the architect, electrical engineer and the door and frame supplier of the necessity to prepare these opening as required to accomplish this requirement. Card readers and electrified hardware will be supplied under separate contract.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1.
  - 1. Deliver products in original unopened packaging with legible manufacturer's identification.
  - 2. Package hardware to prevent damage during transit and storage.
  - 3. Mark hardware to correspond with "reviewed hardware schedule".
  - 4. Deliver hardware to door and frame manufacturer upon request.
- B. Storage and Protection: Comply with manufacturer's recommendations.

#### 1.08 MAINTENANCE/SPARE PARTS

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
  - 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
  - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
  - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

#### 1.09 WARRANTY/EXTENDED WARRANTY

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
  - 1. Closers: Twenty-Five years.
  - 2. Exit Devices: Five Years.
  - 3. Locksets & Cylinders: Three years.

4. All other Hardware: Two years.

#### 1.10 OWNER'S INSTRUCTION

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

#### PART 2 PRODUCTS

##### 2.01 MANUFACTURERS

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Hager, McKinney
Continuous Hinges	Stanley	Select, ABH
Locksets/Latchsets	Best	Sargent, Schlage, Sargent
Cylinders	Best	None
Exit Devices	Precision	Von Duprin, Sargent
Closers	Stanley QDC100	Dorma 8900, Norton 7500
Non-Corrosive Closers	Dorma STA 8900	Norton SS7500
Access Control System	Future provided by the Security Contractor under separate contract. Note 1.05-C.	
Push/Pull Plates	Trimco	Burns, Rockwood
Push/Pull Bars	Trimco	Burns, Rockwood
Protection Plates	Trimco	Burns, Rockwood
Overhead Stops	ABH	Rixson, Glynn Johnson
Door Stops	Trimco	Burns, Rockwood
Threshold & Gasketing	National Guard	Reese, Pemko

##### 2.02 MATERIALS

- A. Hinges:
1. Template screw hole locations.
  2. Minimum of 2 permanently lubricated non-detachable bearings.
  3. Equip with easily seated, non-rising pins.

4. Sufficient size to allow 180-degree swing of door.
  5. Furnish hinges with five knuckles and flush concealed bearings.
  6. Provide hinge type as listed in schedule.
  7. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
  8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish.
  9. UL10C listed for Fire rated doors.
- B. Geared Continuous Hinges:
1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
  2. Anti-spinning through fastener.
  3. UL10C listed for 3-hour Fire rating.
  4. Non-handed.
  5. Lifetime warranty.
  6. Provide Fire Pins for 3-hour fire ratings.
  7. Sufficient size to permit door to swing 180 degrees.
- C. Locks and Latchsets:
1. Provide locksets tested and approved by BHMA/ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty.
  2. Provide locksets listed by Underwriters Laboratories for use on fire rated single or double swinging doors.
  3. Provide locksets that meet the design and operation of the cylindrical lock to meet the accessible requirements of ANSI A117.1 and ADA–Americans with Disabilities Act.
  4. Provide locksets made in a manufacturing facility to compliant with ISO 9001-Quality Management and ISO 14001-Environmental Management.
  5. Provide locksets that meet or exceed 20 Million cycle test verified by third party testing agency.
  6. Provide locksets with the following mechanical features
    - a. Locksets outside locked lever must withstand minimum 1400 inch-pounds of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
    - b. Locksets shall fit modified ANSI A115.2 door preparation.
    - c. 2-3/4 inch (70 mm) backset, standard.
    - d. Door thickness – Available for 1 3/8" to 2 1/4" doors.
    - e. 9/16 inch (14 mm) throw latchbolt.
    - f. Latch to have single piece tail-piece construction.
    - g. Chassis – Critical latch and chassis components to be brass or corrosion-treated steel.
    - h. Lock shall allow the lever handle to move 45 degrees from parallel to the horizontal plane without engaging the latchbolt assembly.
    - i. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.

- j. Locksets to have anti-rotational studs that are thru-bolted.
  - k. Provide sufficient curved strike lip to protect door trim at single doors. At pairs of doors, provide 7/8" Lip to Center Strike.
  - l. Each lever to have independent spring mechanism.
  - m. Lever springs to be contained in the main lock hub.
  - n. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy.
  - o. Keyed lever to be removable only after core is removed, by authorized control key.
- 7. Locksets to have the capability of supporting manufacturers' conventional core as well as large and small interchangeable cores.
  - 8. Provide core face with the same finish as the lockset.
  - 9. Provide functions and design as indicated in the hardware groups.
  - 10. Non-corrosive and exterior locksets shall be mortise type (BHMA Series 1000) stainless steel (630) finish.
  - 11. Acceptable manufacturers and/or products:
    - a. Dormakaba USA Inc. - Best 9K Series (Best 45H as noted).
    - b. ASSA ABLOY Group - Sargent 11 Line (Sargent 8200 as noted).
    - c. Allegion – Schlage ND Series (Schlage L9000 as noted).
- D. Exit Devices:
- 1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
  - 2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
  - 3. Exit devices chassis to be investment cast steel, zinc dichromate.
  - 4. Exit devices to have stainless steel deadlocking 3/4" through latch bolt.
  - 5. Exit devices to be equipped with sound dampening on touchbar.
  - 6. Non-fire rated exit devices to have cylinder dogging.
  - 7. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
  - 8. Touchbar assembly on wide style exit devices to have a 1/4" clearance to allow for vision frames.
  - 9. All exposed exit device components to be of architectural metals and "true" architectural finishes.
  - 10. Provide strikes as required by application.
  - 11. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
  - 12. The strike is to be black powder coated finish.
  - 13. Exit devices to have field reversible handing.
  - 14. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
  - 15. Provide 9001-Quality Management and 14001-Environmental Management.
  - 16. Vertical Latch Assemblies to have gravity operation, no springs.



- E. Cylinders:
  - 1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
  - 2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
  - 3. Coordinate and provide as required for related sections.
- F. Door Closers shall:
  - 1. Be tested and approved by BHMA for ANSI 156.4, Grade 1.
  - 2. Be UL10C certified.
  - 3. Provide 9001-Quality Management and 14001-Environmental Management.
  - 4. Closer shall have extra-duty arms and knuckles.
  - 5. Conform to ANSI 117.1.
  - 6. Be a maximum 2 7/16-inch case projection with non-ferrous cover.
  - 7. Have separate adjusting valves for closing and latching speed, and backcheck.
  - 8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.
  - 9. Full rack and pinion type closer with 1½" minimum bore.
  - 10. Mount closers on non-public side of door, unless otherwise noted in specification.
  - 11. Closers shall be non-handed, non-sized and multi-sized.
  - 12. Mount all closers to the maximum allowable degree of opening by the closer manufacturer's template. Where closer arms incorporate dead stop features, mount closers to the maximum degree of opening available before conflict with adjacent structures. If not apparent on the contract documents, verify the use of open space with the Architect or Owner's Representative to determine the maximum allowable degree of opening.
- G. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
  - 1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
  - 2. Provide fastener suitable for wall construction.
  - 3. Coordinate reinforcement of walls where wall stop is specified.
  - 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- H. Overhead Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
  - 1. Concealed overhead stops shall be stainless steel.
  - 2. Surface overhead stops shall be stainless steel.
- I. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
- J. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

- K. Push Pull Bars: Provide ANSI J504, 1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- L. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- M. Mop plates: Provide with four beveled edges ANSI J103, 6 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- N. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- O. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
  - 1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
  - 2. UL10C Positive Pressure rated seal set when required.
- P. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
  - 1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
  - 2. UL10C Positive Pressure rated seal set when required.
- Q. Thresholds: Thresholds shall be aluminum beveled type with maximum height of 1/2" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
  - 1. Where there is conflict between scheduled thresholds and details, details shall have precedence. Revise details only if necessary to comply with handicap accessibility requirements. Notify the Architect of such required modifications.
- R. Provide one wall mounted Telkee, series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.
- S. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seal occurs.

## 2.03 FINISH

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

## 2.04 KEYS AND KEYING

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best Standard SFIC 7-pin. Facility standard – no substitutions will be allowed.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
  - 1. 1 each Grand Masterkeys.
  - 2. 4 each Masterkeys.
  - 3. 3 each Change keys each keyed core.
  - 4. 12 each Construction masterkeys.
  - 5. 2 each Control keys.
  - 6. 2 each Construction Control keys.
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Engineer/Architect, Owner, and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
  - 1. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 HARDWARE LOCATIONS

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

### 3.03 INSTALLATION

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
  1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

### 3.04 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
  1. Check and adjust closers to ensure proper operation.
  2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
    - a. Verify levers are free from binding.
    - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
  3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

### 3.05 MAINTENANCE

- A. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
  1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
  2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
  3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
  4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

## 3.06 SCHEDULE OF FINISH HARDWARE

**Manufacturer's Abbreviations**

AB	ABH Manufacturing	Overhead Stops
BE	Best Access Systems	Locks, Cylinders
DM	Dorma USA	Non-Corrosive Closers, Door Position Switches
NA	National Guard	Gaskets, Thresholds
SE	Securitech	Tornado Safe Room Lock
ST	Stanley Commercial	Hinges, Closers
TK	Telkee	Key Storage Cabinet
TR	Trimco	Stops, Flat Goods

**Finish List**

<u>Code</u>	<u>Description</u>
628	Satin Anodized Aluminum
626, 652	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
GREY	Grey

**Option List**

<u>Code</u>	<u>Description</u>
M5	Galvanized Chain (Best Padlocks)
WS/HC	Wind Storm Listing (Best/Precision)
CD	Cylinder Dogging (Precision)
N Mounting	Spanner Through Bolt Mounting (Trimco)
L Mounting	Spanner Back to Back Mounting (Trimco)
CS	Counter Sinking of Kick, Armor and Mop Plates (Trimco)
B4E	Beveled 4 Edges - Kick, Armor and Mop Plates (Trimco)
SSMS/EA	Stainless Steel Machine Screws/Expansion Anchors (NGP)
SMS-TEKS	Self-Drilling Sheet Metal Screws (NGP)

**Miscellaneous Hardware - Provide the following additional hardware**

6	Spare Cores	1CX-7 PATD	626	BE
2	Closers	QDC111 Tri Packed	689	BE
1	Key Cabinet	RWC-75-S		TK

**Hardware Sets****SET #1 - Exterior Single**

Doors: 001, 003, 151, 251, 252, 254, 350, 353, 354, 355, 601, 602, 604, 701, 703, 750, 751, 755, 809, 813

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Exit Device	HC 2308 X VM4908D CD	630	PR
2	Mortise Cylinder	1E-74 STD	626	BE
1	Closer/Stop	QDC119	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR

1	Drip Cap	16 A FHW SMS-TEKS	NA
1	Gasketing	700 NA SMS-TEKS	NA
1	Door Sweep	200 NA SMS-TEKS	NA
1	Threshold	653 SSMS/EA	NA
*1	Door Position Switch	MC4	DM
Prepare door and frame for future electrified hardware and card reader access. Do not cut weatherstrip – template hardware accordingly. Verify threshold application.			

**SET #2 - Exterior Pair**

Doors: 002, 150, 250, 352, 603, 754

8	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Removable Mullion	HC822 9'0"	600	PR
1	Exit Device	HC 2108 X V4908D CD	630	PR
1	Exit Device	HC 2101 CD	630	PR
1	Rim Cylinder	12E-72 STD	626	BE
2	Mortise Cylinders	1E-74 STD	626	BE
2	Closer/Stops	QDC119	689	ST
2	Kick Plates	K0050 10" x 2" LDW B4E CS	630	TR
1	Mullion Seal	5100N		NA
1	Drip Cap	16 A FHW SMS-TEKS		NA
1	Gasketing	700 NA SMS-TEKS		NA
2	Door Sweeps	200 NA SMS-TEKS		NA
1	Threshold	653 SSMS/EA		NA
*2	Door Position Switches	MC4		DM
Prepare doors and frame for future electrified hardware and card reader access (active leaf only). Do not cut weatherstrip - template hardware accordingly. Verify threshold application.				

**SET #3 - Overhead Door**

Doors: 253, 351, 556, 560, 564, 600, 702, 753

1	Padlock	41B-722L STD M5	626	BE
Balance by door manufacturer.				

**SET #4 - Exterior - Non-Corrosive**

Doors: 550, 553, 554, 555, 558, 561, 563

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Exit Device	HC 2308 X VM4908D CD	630	PR
1	Mortise Cylinder	1E-74 STD	626	BE
1	Closer	STA 8916 ARP	630	DM
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Door Stop	1214H	626	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Drip Cap	16 A FHW SMS-TEKS		NA
1	Door Sweep	200 NA SMS-TEKS		NA
1	Threshold	653 SSMS/EA		NA
*1	Door Position Switch	MC4		DM
Prepare door and frame for future electrified hardware and card reader access. Do not cut weatherstrip – template hardware accordingly. Verify threshold application.				

**SET #5 - Interior - Non-Corrosive**

Doors: 551, 557, 559, 562

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Exit Device	FL 2108 X 4908D	630	PR
1	Rim Cylinder	12E-72 STD	626	BE
1	Closer	STA 8916 ARP	630	DM
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

**SET #6 - Exterior Double Door - Non-Corrosive**

Door: 552

8	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Removable Mullion	HC822 9'0"	600	PR
1	Exit Device	HC 2308 X VM4908D CD	630	PR
1	Exit Device	HC 2108 X V4908D CD	630	PR
1	Rim Cylinder	12E-72 STD	626	BE
2	Mortise Cylinders	1E-74 STD	626	BE
2	Closers	STA 8916 ARP	630	DM
2	Kick Plates	K0050 10" x 2" LDW B4E CS	630	TR
2	Door Stops	1214H	626	TR
1	Drip Cap	16 A FHW SMS-TEKS		NA
1	Gasketing	700 NA SMS-TEKS		NA
1	Mullion Seal	5100N		NA
2	Door Sweeps	200 NA SMS-TEKS		NA
1	Threshold	653 SSMS/EA		NA
*2	Door Position Switches	MC4		DM

Prepare doors and frame for future electrified hardware and card reader access (active leaf only). Do not cut weatherstrip - template hardware accordingly. Verify threshold application.

**SET #7 - Interior**

Door: 752

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	652	ST
1	Exit Device	FL 2108 X 4908D	630	PR
1	Rim Cylinder	12E-72 STD	626	BE
1	Door Closer	QDC115	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

**SET #8 – Entry – Double Door**

Door: 801

2	Continuous Hinges	661HD	628	ST
1	Exit Device	2601 CD	630	PR

1	Exit Device	2603 CD	630	PR
1	Rim Cylinder	12E-72 STD	626	BE
2	Mortise Cylinders	1E-74 STD	626	BE
2	Door Pulls	1191-4 Type N Mounting	630	TR
2	Door Closers	QDC115	689	ST
2	Drop Plates	8Q00471	689	ST
2	Door Stops	1214H	626	TR
2	Door Sweeps	200 NA SMS-TEKS		NA
1	Threshold	653 SSMS/EA		NA
*2	Door Position Switches	MC4		DM

Prepare doors and frame for future electrified hardware and card reader access (active leaf only). Gaskets by door manufacturer. Verify threshold application.

#### SET #9 - Future Card Access - Interior

Doors: 802, 803

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7D14D STD	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

Prepare door and frame for future electrified hardware and card reader access.

#### SET #10 - Lab

Door: 804

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7R14D STD	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Door Stop	1215CKU	626	TR
3	Door Silencers	1229A	GREY	TR

#### SET #11 - Storage

Doors: 805, 806

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
1	Lockset	9K3-7D14D STD	626	BE
1	Overhead Stop	4420 Series	630	AB
3	Door Silencers	1229A	GREY	TR

#### SET #12 - Double Door - Conference/Training

Door: 807

2	Continuous Hinges	661HD	628	ST
2	Push/Pull Sets	1738 Type L & N Mounting	630	TR
2	Door Closers	QDC115	689	ST
2	Drop Plates	8Q00471	689	ST



2	Wall Bumpers	1270WV	630	TR
	Gaskets by door manufacturer.			

**SET #13 - Break**

Door: 808

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Passage Set	9K3-0N14D	626	BE
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

**SET #14 - Break/Laundry**

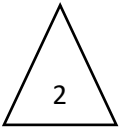
Doors: 810, 811

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Passage Set	9K3-0N14D	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

**SET #15 - Restroom**

Door: 814

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Passage Set	9K3-0N14D	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

**SET #16 - Shower**

Door: 815

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Privacy Set	9K3-0L14D	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

**SET #17 – Double Door - Mechanical**

Door: 816

6	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
2	Flush Bolt	3917-12	626	TR

1	Lockset	45H-7D14H STD WS	630	BE
2	Closer/Stop	QDC119	689	ST
2	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Drip Cap	16 A FHW SMS-TEKS		NA
1	Gasketing	700 NA SMS-TEKS		NA
1	Astragal Gasket	5040 B		NA
2	Door Sweep	200 NA SMS-TEKS		NA
1	Threshold	653 SSMS/EA		NA
*2	Door Position Switch	MC4		DM

Prepare doors and frame for future electrified hardware and card reader access (active leaf only). Do not cut weatherstrip - template hardware accordingly. Astragal on inactive leaf by door manufacturer. Verify threshold application.

### SET #18 - Mechanical

Door: 817

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7D14D STD	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

### SET #19 - Office

Doors: 818, 819, 820

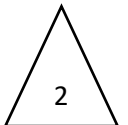
3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7AB14D STD	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Wall Bumper	1270WV	630	TR
1	Coat Hook	3070-1	626	TR
1	Gasketing	5040 B		NA

### SET #20 - Restroom/Tornado Safe Area

Door: 812

4	Hinges	CB168 4 1/2 X 4 1/2	652	ST
1	3-Point Lock	5314-F13E-HM	626	SE
1	Mortise Cylinder	1E-74 STD	626	BE
1	Door Closer	QDC111 RA	689	ST
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

FEMA 361 Tornado safe room. Verify that all components, including door and frame, have been successfully tested.



\* Requires electronic coordination.

END OF SECTION

**SECTION 11210****ON-SITE SODIUM HYPOCHLORITE GENERATION SYSTEM****PART 1 GENERAL****1.01 SCOPE OF WORK**

- A. The Contractor shall furnish an On-site Sodium Hypochlorite Generation (OSHG) System to enable on-site production on a 0.8% (+/- 0.05%) sodium hypochlorite solution through the electrolysis of brine solution. Two (2) hypochlorite generation skids will be installed at the site with a third skid to be installed in the future.
- B. The Generation System includes, but is not limited to the Sodium Hypochlorite Generator Skid with integral piping, valves, system control panels with PLC, Air dilution blowers, air dilution blower control panels, Water Softener, bulk salt/brine tank, hypochlorite solution storage tank, commercial strength hypochlorite dilution panel, piping, valves, ancillary equipment as specified herein, related testing, start-up and training services.
- C. The Generation System shall be furnished and installed with all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not, as required for a complete and fully operations system incorporating the highest standards for this type of service.
- D. The OSHG Supplier shall furnish an entire OSHG consisting of the following major components:
  - 1. Sodium Hypochlorite Generation cells.
  - 2. Control Panels including: PLCs, OITs, VFD's, networking communication components, and associated equipment.
  - 3. Hydrogen Dilution System.
    - a. Blower Control Panels.
    - b. Hydrogen Gas Monitoring Equipment.
  - 4. Water Softeners & Cartridge Filters.
  - 5. Brine Tank and accessories.
    - a. All Tank Instruments.
    - b. Tank Heat Trace.
  - 6. Sodium hypochlorite storage tank and accessories.
    - a. All Tank Instruments.
  - 7. Sodium hypochlorite metering pumps.
    - a. Local Control Panels.
  - 8. Process water chillers.
  - 9. Acid cleaning Cart/System.
  - 10. Booster Pump.
    - a. Booster Pump Control Panels.
  - 11. Miscellaneous Items.
    - a. All instruments shown on the P&ID or required for proper operation of the proposed system.



- b. All electrically operated valves shown on the P&IDs or required for proper operation of the proposed system.

12. Spare parts.

- E. A Price Proposal for the equipment is provided after this Section as Exhibit 11210.1. Contractor shall coordinate with the vendor to ensure the system is complete and operates as intended. Any parts or appurtenances necessary to make the system operational that are not included in the vendor's scope shall be provided by the Contractor at no additional cost.
- F. The Contractor shall be responsible for equipment unloading, storage and installation per directions of the Supplier. The Supplier shall provide the following services to ensure the safe and efficient operation of the system:
  - 1. Skid factory testing.
  - 2. System commissioning and installation inspection.
  - 3. System startup.
  - 4. Operational Readiness Evaluation.
  - 5. System performance test.
  - 6. Operator training.
- G. The Contractor shall furnish all labor, materials, equipment and appurtenances required to install, test, and place into satisfactory operation the system furnished by the Supplier, including, but not limited to:
  - 1. Mechanical installation of system components, piping, piping supports, fittings, valves and appurtenances not specified herein.
  - 2. Electrical installation of external system components, circuit breakers, transformers, raceways, fittings, conduits and cable trays, wires and cables, panel boards, metering devices, grounding systems, power factor correction capacitors and surge protection.
- H. The Supplier shall furnish, test, and put into operation all instrumentation and control equipment necessary for a complete and fully functional system. As a minimum, the instrumentation and control equipment shall include control panel, programmable logic controller (PLC), and Operator Interface Terminal (OIT), appropriate networking devices, indicators, control stations, push buttons, lights, selector switches, power and control as required.
- I. The Supplier shall provide all applications programming and services required to achieve a fully integrated and operational OSHG control system.
- J. The OSHG unit and other major components of the system shall be factory assembled and tested, factory witnessed tested, and shall be shipped in as large an assembly as practical to minimize field assembling effort.
- K. The Supplier shall coordinate with Process Control System Integrator (PCSI) for proper communication with the plant Process Control System (PCS)

- L. The Supplier shall be responsible for providing all hardware, software and firmware including the development of drivers if required for interface with the plant PCS system. The Supplier shall be present for and conduct testing as described herein. The Supplier shall provide on-site support for the PCSI as describe herein.

#### 1.02 RELATED WORK

- A. Division 3 – Concrete.
- B. Division 5 – Metals.
- C. Division 9 – Finishes.
- D. Division 11 – Equipment.
- E. Division 13 – Special Construction.
- F. Division 15 – Mechanical.
- G. Division 16 – Electrical.
- H. Division 17 – Instrumentation.

#### 1.03 SUBMITTALS

- A. Provide submittals in accordance with Section 01300 – Submittal Procedures.
- B. The following product data shall be electronically submitted by the OSHGS Supplier for review and approval by the Engineer that the product provided conforms to the site-specific requirements prior to the fabrication of the systems:
  1. Process and instrumentation diagram for the systems.
  2. Shop drawings and catalog literature showing dimensional information and details of piping, fabrication, and erection of all materials and equipment furnished under this section, including:
    3. Detailed drawings of tank nozzle orientations provided.
    4. Detailed drawings of equipment installations provided.
    5. Scaled drawing of general layout, general arrangements, and major system components, including:
      6. Dimensions, including those for system connections.
      7. Drawings showing fabrication, assembly, installation, and wiring diagram. Wiring diagrams for the electrical control panel and rectifier transformer shall consist of, at a minimum, control schematics, including coordination with other electrical devices operating in conjunction with the OSHGS.
      8. Manufacturer's literature, illustrations including weight and dimensions, specifications, materials of construction, and bill of materials for each component of the system. Data shall include a complete description in sufficient detail to permit comparison with the technical Specifications. Major system components include:
        - a. Water softener.
        - b. Brine pump.

- c. Hydrogen dilution blower.
    - d. Miscellaneous instrumentation, valves, and accessories.
  - 9. Performance data: for each pump and blower furnish a performance certification indicating:
    - a. Pressure.
    - b. Capacity.
    - c. Efficiency.
    - d. Horsepower.
  - 10. Motor data: for each motor furnish a certified motor data sheet for the actual motor or for a previously manufactured electrically duplicate motor which was tested.
  - 11. Control philosophy including I/O list and loop descriptions.
  - 12. The acceptable range of water pressure for proper system operation. If a pressure or flow regulator is required, it shall be provided.
  - 13. A list of all parameters, ratings or other characteristics where the proposed Sodium hypochlorite generator system deviates from the requirements set forth in these Specifications.
  - 14. Installation instructions.
  - 15. Performance testing protocol including a recommended test plan, measurement methods, and sample data sheet showing all pertinent process data to be recorded and the frequency and data readings.
  - 16. Current NSF Standard 61 Certification for the generation skid being offered.
  - 17. References for at least ten similar units that have been installed and have been operational for at least five years of continuous service.
  - 18. Affidavits of compliance with referenced standards and codes.
  - 19. All shop drawings required by Division 16 and 17
- C. Operation and Maintenance Manuals
- 1. Operations and maintenance manual: See Section 01350 – Operations and Maintenance Data.
  - 2. Recommendations for short and long term storage.
  - 3. A copy of the Manufacturer's warranty.
- D. Vendor shall submit a letter certifying that all equipment and processes are compliant with federal, state and local regulations. If federal, state or local inspectors observe equipment that is not compliant, the vendor shall modify the installation as necessary to make the equipment compliant.
- 1.04 REFERENCE STANDARDS
- A. National Electrical Manufacturers Association (NEMA).
  - B. National Fire Protection Association (NFPA).
  - C. American Society for Testing and Materials (ASTM).
  - D. American Welding Society (AWS).

- E. American Water Works Association (AWWA).
- F. National Sanitation Foundation (NSF).
- G. Standard Methods for the Examination of Water and Wastewater.
- H. Institute of Electrical and Electronics Engineers (IEEE).
- I. International Society of Automation (ISA).
- J. International Electrical Testing Association.
- K. Underwriters Laboratories (UL).
- L. US Department of Labor "Occupational Safety and Health Administration Standards" (OSHA).
- M. City of Oklahoma City Utilities Department SCADA Standards included in the Supplemental Special Provisions.

#### 1.05 QUALITY ASSURANCE

- A. Acceptable Manufacturers for the On-site Sodium Hypochlorite Generation System:
  - 1. Microclor® as manufactured and supplied by PSI Water Technologies, Inc.
- B. OSHG System Supplier Requirements
  - 1. All equipment provided under this section shall be obtained from a single Manufacturer, who shall:
    - a. Assume full responsibility for the completeness and proper operation of the OSHG.
    - b. Have experience, be reputable, and be qualified in designing and manufacturing on-site hypochlorite generation equipment.
    - c. Have current NSF Standard 61 Certification for the generation skid being offered.
    - d. Have at least 15 years' experience with on-site sodium hypochlorite generation equipment ranging in capacity from 20 to 2400 pounds per day of 100% chlorine equivalent.
    - e. Supply units containing all necessary appurtenances and components for a complete and operating system conforming to this specification. The OSHG System shall be pre-assembled, piped, and factory-tested to assure compliance with all operational requirements. The OSHG System shall be shipped as a single unit. Loose hypochlorite generation components shall not be acceptable. No field assembly or wiring will be permitted with the exception of external conduits. Equipment footprint as shown on the drawings shall not be exceeded.
    - f. Have at least ten similar OSHG Systems in operation for at least five years.
  - 2. To ensure quality and complete unit responsibility, the OSHG must be assembled and inspected by the OSHG Supplier at its facility. The complete OSHG must be a standard and regularly-marketed product of that Manufacturer. The OSHG Supplier

must have a physical plant, technical and design staff, and fabricating personnel to complete the work specified.

3. The Owner reserves the right to be present at the fabricator's facility for visual inspection of equipment to be supplied.

C. Manufacturer Services

1. Prior to scheduling services by the OSHGS Supplier, the Contractor shall verify the equipment installation and provide the completed installation checklist with photo documentation. Upon receipt of the completed installation checklist with photo documentation, the OSHGS Supplier shall schedule start-up and training to take place no sooner than two (2) weeks. The Contractor shall coordinate testing requirements and scheduling with the Engineer.
2. The OSHGS Supplier shall assist the contractor with the termination of all wiring in equipment supplied by the OSHGS Supplier.
3. The OSHGS Supplier shall be present at jobsite for the following time period after the system is installed, travel time excluded:
  - a. Certification of proper installation, system startup, and functional testing.
    - (i) Installation inspection shall include supervising the correction of any defective or faulty work before acceptance by Owner.
    - (ii) System startup shall include testing, calibrating, and adjustment of all components for optimum performance.
    - (iii) Functional testing shall include inspection of integration of the provided equipment's controls to the Owner's SCADA system, etc.
  - b. Training Owner's personnel and providing detailed instructions in the operation, maintenance, and troubleshooting for the system.
    - (i) Upon request, a training manual will be provided with an outline of the training procedures.
4. Services shall be provided by a technician that is factory-trained by the OSHGS Supplier and has demonstrated ability and experience in the installation and operation of the equipment.

1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS

- A. The sodium hypochlorite generation system shall use vertically-mounted electrolytic cells to convert brine to a sodium hypochlorite solution for disinfection of treated water. The general arrangement of system components is shown on the Contract Drawings. System shall consist of two (2) generator skids with chlorine production capacity as specified herein. A third generator skid will be installed in a future project.
- B. The system shall be shipped as individual self-contained, skid mounted units with all factory piping and wiring complete to input and output, flanged, threaded, etc. connections located at easily accessible points.
- C. All electrical, mechanical, metal, painting, and instrumentation work included herein shall conform to the applicable Sections or Divisions of this project except as otherwise shown or specified.





- D. The Drawings show details of the components and their overall relationships. Not all items incidental to the system are shown or specified. It is the intent of these Contract Documents that the Manufacturer is to provide a complete and workable system whether or not any specific component is shown or specified.

#### 1.07 DELIVERY, HANDLING AND STORAGE

- A. Refer to general requirements under Division 1 – General Provisions and the following specific requirements.
- B. All materials and equipment shall be inspected for size, quality and quantity against approved shop drawings upon delivery.
- C. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment of unit and when installation is complete and the equipment is ready for use.
- D. Equipment shall be handled and stored in accordance with the Manufacturer's instructions. None of the components of the equipment shall be dropped and all the components shall be examined before installation. No items shall be installed which are found to be defective, and must be replaced to the satisfaction of the Engineer and Owner.
- E. Factory assembled parts and components shall not be dismantled for shipment or storage unless recommended by the Manufacturer in writing to the Engineer and Owner.
- F. Delivery schedule of all equipment shall be coordinated with the Contractor. All materials shall be suitably packed for shipment and long term storage. Instructions for the servicing and startup of equipment in long term or prolonged storage shall accompany each item. Equipment ready for shipment prior to the agreed on shipping date shall be stored without cost to the Owner by the Manufacturer.
- G. All equipment and materials shipped that are exposed such as on a flat bed truck shall be protected during transit. The equipment and materials shall be protected from moisture, road salt, dirt and stones or other materials thrown up from other vehicles. Electrical components shall be protected as above, but with special attention to moisture. The method of shipment protection shall be defined in the submittals.
- H. All equipment and materials shall be stored in a covered dry location off of the ground. When required to protect the materials they shall be stored in a temperature-controlled location. For any short term storage at Project site, equipment and materials shall be stored in a covered and dry location off of the ground.
- I. Provide covering and shielding for equipment and materials to protect from damage.
- J. Repair, restore and replace damaged items.
- K. Protect equipment and materials and finishes during handling and installation to prevent damage. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built and securely bolted.

## 1.08 MAINTENANCE/SPARE PARTS (NOT USED)

## 1.09 WARRANTY/EXTENDED WARRANTY

- A. Prior to acceptance of the Sodium hypochlorite generator system, provide written warranty from the OSHG Supplier that includes the following statements:
  - 1. OSHG Supplier has inspected the installation during and after completion and the sodium hypochlorite generator system is free from faults and defects and is in conformance with the Contract Documents.
  - 2. The warranty period shall start in accordance with Section 01750 – Warranties and Bonds.
  - 3. Sodium hypochlorite generator system will remain free of defects for a period of three (3) years from the date of final acceptance.
  - 4. The electrolytic cells including cell body shall have a three (3) year full replacement warranty and a prorated straight-line replacement warranty for years 4-7 from the date of final acceptance.

## 1.10 COORDINATION OF WORK

- A. The Supplier shall design and guarantee the functional performance of the system. The Supplier shall correct any design deficiencies at their own cost.
- B. The Supplier shall submit Shop Drawings required for the fabrication and installation of the equipment. The Shop Drawings shall be submitted for review and approval.
- C. The Contractor shall coordinate with the Supplier and install the system as specified herein, as shown on the drawings, or as otherwise directed by the Supplier. The Contractor shall make all conduit, wire, and pipe connections to provide a complete and fully operational system.
- D. Power shall be connected by the Contractor to the system control panel(s). The Contractor shall be responsible for providing all conduit and wiring necessary for complete electrical service and for all instrumentation. All wiring shall comply with the National Electrical Code, 1996 edition.
- E. The system Supplier shall inspect the installation and the Contractor shall correct any deficiencies at no additional cost to the Owner. Following the correction of all errors, the Supplier shall provide a Certification of Proper Installation to the Owner.
- F. The Supplier shall be responsible for programming the control software.
- G. The Supplier shall perform functional, performance, and start-up testing of the system. The Contractor shall notify the Supplier at least 14 days before the scheduled testing date and shall coordinate testing requirements and scheduling with the Engineer.
- H. The Supplier shall deliver to the Owner all PLC and HMI codes for future reference prior to final acceptance.

- I. The Supplier shall submit an Operation and Maintenance Manual for the system and for all third party components. The O&M Manual shall be reviewed by the Contractor and issued to the Engineer for review and approval.
- J. The Supplier shall train the Owner's personnel and provide detailed instructions in the operation of the system.

## PART 2 PRODUCTS

### 2.01 ON-SITE SODIUM HYPOCHLORITE GENERATION SYSTEM

- A. A transformer rectifier, electrolytic cells, water solenoid valve, brine solenoid valve, brine pump, rectifier cabinet, hydrogen dilution blower, chemical storage tanks, chemical metering pumps, and a PLC-based control panel containing system controls, water softener with flow meter, water chillers, hydrogen vent stacks, and all necessary interconnecting wiring and hardware shall form a complete on-site sodium hypochlorite generation system. Components of the OSHGS shall comply with this specification. All components of the electrolytic cell skid shall be pre-assembled, piped, wired to input and output, flanged, threaded, etc. connections located at easily accessible points on the skid. The installation contractor shall provide all interconnecting piping and conduit, which shall be Sch 80 PVC. The OSHGS shall be factory-tested prior to shipping as one self-contained unit.
- B. All electrical equipment and enclosures will be built and certified to UL 508 standards and will bare the appropriate label.

### 2.02 HYDROGEN SAFETY MANAGEMENT

- A. The generators shall have no waste products associated with its use other than hydrogen gas, which is to be vented to the atmosphere. Hydrogen Dilution blowers will be used to purge all residual hydrogen out of the system and storage tanks and dilute the hydrogen concentration 100 to 1 or below 25% of the LEL.
- B. Any proposed system must meet every operational and material aspect of this specification. Hydrogen management shall be accomplished by the passive venting of each electrolytic cell without potential restrictions. This flow path should not have baffle plates, orifice plates or backpressure valves between the last point of product generation and atmospheric evacuation.
- C. The presence of over-pressure rupture disks is not acceptable as the initiation of disk rupture would render the system inoperable. No hydrogen shall be vented directly to the hypochlorite storage tank where an accumulation could occur.
- D. Under no circumstance will waste hydrogen be allowed to flow from one cell or cell compartment to the next. All hydrogen must immediately be released from each cell pack.
- E. Minimum passive venting capability from each electrolytic cell pack shall be 4.0 square inches for every 100 pounds of chlorine production.

- F. The hydrogen dilution system shall dilute the hydrogen concentration to below 25% of the LEL or 1% by volume.
- G. Generator skid hydrogen dilution shall include passive vents connected to each cell and blower connected to the vent header. Sodium hypochlorite storage tanks shall be evacuated by blower.
- H. Under no circumstance will the Hydrogen Safety Management requirements (Part 2.02) be relaxed or modified as they are critical operator safety features and core to the generator design. NOTE: THIS HYDROGEN SAFETY DESIGN MUST BE MET, REGARDLESS OF ONSITE GENERATOR MANUFACTURER SELECTED, AND WILL BE REQUIRED FOR SUBMITTAL APPROVAL.

## 2.03 ELECTROLYTIC CELL SKID ASSEMBLY

- A. An electrolytic cell skid assembly shall be provided with the following overall dimensions:

WIDTH	DEPTH	HEIGHT
92"	40"	76"

- B. Each electrolytic cell skid assembly shall have the following components and features:
  - 1. 316 Stainless steel brine gear pump, with:
    - a. Magnetic drive.
    - b. Cavity-style design.
    - c. PEEK gear construction.
    - d. Integral speed control.
    - e. Series GJ by MicroPump.
  - 2. Water solenoid valve.
  - 3. Polycarbonate water and brine rotameters.
  - 4. Electrolytic cells
  - 5. Transformer rectifier.
  - 6. Optical level switches.
  - 7. Temperature switches.
  - 8. Temperature sensor.
  - 9. Teflon and Kynar interconnecting tubing.
  - 10. 304 stainless steel frame, electrolytically polished for passivation, corrosion resistance, and chemical compatibility.
    - a. Horizontal and vertical tube sections shall be of .125-inch wall thickness.
    - b. All vertical and horizontal frame connections shall be welded.
    - c. The completed frame with all mounted components shall comply with the UBC structural requirements for seismic zone four.
- C. The generator shall be factory wired, plumbed, and mounted on a self-contained skid assembly.

- D. The generator will be designed and built to allow one of the five electrolytic cells to be removed (replaced with a pipe spool) and still run at 80% production capacity.
- E. Each electrolytic cell shall be arranged so that it can be completely drained in place.
- F. The rack mounted flow control panel will consist of a water rotameter, water sensor, brine rotameter and a positive displacement gear pump with variable speed drive.
- G. The variable speed drive will respond to a 0-5 VDC signal generated by the PLC algorithm in order to maintain constant current relative to variable water temperature or flow rate.
- H. The process shall operate in a batch environment allowing for consistent hypochlorite concentrations and greatest efficiencies.
- I. The generator skid will be supplied with a 4-20 mA electrolyte temperature sensor that will function to return a linear signal proportional to 0-100°C, which will allow continuous operation up to 130°F without interruption. Under no circumstance will bimetallic "snap" switches be permitted as the primary over-temperature sensor.
- J. The generator package shall have the following redundant interlocked safety features:
  - 1. Cell high temperature switch.
  - 2. Low level switch for each cell.
  - 3. Water flow sensor.
  - 4. Transformer high temperature switch.
  - 5. Automatic current regulation.
- K. All electrical equipment and enclosures will be built and certified to UL 508 standards and will possess the appropriate label.
- L. The generation system shall be pre-piped and skid-mounted.
  - 1. The OSHGS skid frame shall be constructed of 316 stainless steel tube for structural strength. Horizontal and vertical tube sections shall be of .125-inch wall thickness and have a depth no greater than twenty four inches by a length not exceeding six feet. The entire skid shall undergo electrolytic polishing for ultimate passivation, chemical compatibility, and corrosion resistance. The completed frame with all mounted components shall comply with the UBC structural requirements for seismic zone four.
  - 2. The skid frame shall be configured to allow easy access to all components, including the electrolytic cells. All vertical and horizontal frame connections shall be welded. Under no circumstances can water/liquids handling and/or cells be located immediately above the power supplies. The skid frame shall support, as a minimum, the following mounted equipment:
    - a. Generator electrolytic cells
    - b. Power supply/rectifier
    - c. Water and brine rotameters
    - d. Control panel
    - e. Interconnect pipes valves and fittings
    - f. Interconnect conduit and wiring

- g. Water flow sensor
- h. Variable-speed, positive-displacement brine pump

## 2.04 ELECTROLYTIC CELLS

- A. Multiple electrolytic cells shall be provided as follows:

CELL QUANTITY	CELL CAPACITY	ACTIVE SURFACE
5	160	12" x 16"

Any system using fewer electrolytic cells than that specified above must demonstrate its ability to achieve 80% production capacity with one of the cells removed from service.

- B. The electrolytic cell bodies shall be constructed of and clear acrylic materials, allowing for front and rear visual inspection of the electrodes from all angles.
- C. Each electrolytic cell will be constructed utilizing DSA coated titanium anodes and titanium cathodes. The cells must be configured in a vertical format with a recirculating loop provided for each cell. This recirculating loop will also allow the passive removal of hydrogen from each cell via the upper hydrogen vent. Under no circumstance will hydrogen be allowed to be driven from one cell or cell loop to the next.
- D. Each cell loop will also incorporate an optical level sensor so as to preclude any possibility of exposing an active electrode surface
- E. The wetted cell components will consist only of the electrodes and acrylic cell body. No internal baffles, spacers, or connecting hardware will be allowed.
- F. Cells shall utilize titanium bolting hardware.

## 2.05 TRANSFORMER RECTIFIER

- A. The 6-pulse D.C. Rectifier will consist of a fully isolated three phase step down transformer and bridge rectifier. D.C. voltage output will be fixed with multiple primary taps for + 5-10% voltage correction. Under no circumstance will switching rectifiers or phase angle fired SCR voltage correction be permitted. D.C. ripple will be less than 4% with a power factor of 99% or better.
- B. The transformer rectifier will be a fixed voltage unit where the current will be allowed to float as a function of electrolyte conductivity.
  - 1. Constant current will be achieved via an active feedback loop where rectifier amperage is measured and reported to the PLC. The control algorithm calculates the appropriate amount of brine to mix with the incoming water so as to maintain constant current.
  - 2. SCR-controlled rectifiers will not be allowed.
- C. Rectifier efficiency will be 97% or greater.

- D. The transformer/rectifier will house a 4-20 mA D.C. current transducer and NEMA 4X digital display of amperage.
- E. The rectifier cabinet and base frame will be constructed of 316 Stainless Steel and will be of a modular design. All internal wiring connections and components will be easily accessible by removing the front access panel.
- F. The transformer enclosure will be removable from the skid assembly as one piece, allowing for unobstructed access to the transformer.
- G. The transformer rectifiers shall be designed for the following operating conditions:

QUANTITY	CAPACITY (kVA)	PRIMARY VOLTAGE	SECONDARY VOLTAGE
3 (1/skid) (2 current plus 1 future installation)	96	480VAC/3PH/175A	300VDC/320A



- H. The stepdown transformer rectifier shall be provided with the following accessories:

## 2.06 MAIN SYSTEM CONTROL PANEL

- A. The OSHGS Supplier shall provide a PLC based control panel per Division 16 and 17. The control panel, which shall include controls for the entire sodium hypochlorite generation and feed system. The panel shall be mounted in the building's electrical room. The control panel shall house the operator interface terminal (OIT), PLC, networking equipment, Interposing Relays, and miscellaneous items as required to produce a fully operational Main Control Panel.
- B. The control panel cabinets will be UL 508 approved and house the operator interface terminal (OIT), PLC, hydrogen blower controls, and terminal strips to fully support the functions of generator operation and tank levels.
- C. All controls and operations logic specified herein and as shown on the instrumentation loop diagrams required for the system shall be programmed in a Programmable Logic Controller (PLC). The control cabinet logic will function at the PLC level where operating parameters will be measured, corrected, scaled, reported, and controlled. Contractor shall coordinate with OSHGS Supplier and instrumentation supplier for proper integration of the system.
- D. The control panel shall display all relevant operating parameters and/or alarm conditions. The OIT will serve as the operator interface, data input screen, and alarm log.
- E. At a minimum, the panel shall have the following features, components, and functionality:

1. The generator shall automatically start and stop based on the high and low levels in the sodium hypochlorite storage tank.
2. The generator shall shut down and alarm for the following conditions:
  - a. Low electrolyte level in cell.
  - b. Hypochlorite temperature exceeds 130°F (55°C).
  - c. Inlet flow falls below a preset value.
  - d. Rectifier high or low amperage.
  - e. Rectifier high temperature.
  - f. Hydrogen dilution blower failure.
3. Low-low level alarm for hypochlorite storage tank.
4. High-high level alarm for hypochlorite storage tank.
5. Touchscreen human-machine interface (HMI) with dedicated screens, including help dialogs covering all basic operations and detailed alarm explanations, for each portion of the process and Ethernet communications for PLC connection.
6. Rectifier controls.
7. Blower controls.
8. Analog inputs from the flow meter and residual analyzer to drive each VFD based on the appropriate flow, residual, or compound loop algorithm.
  - a. Under no circumstances will external controllers be allowed to control the VFD output.
9. Logging and storing alarm history.
10. Security protection.
11. Dedicated 24 VDC power supply for PLC and HMI.
12. Emergency stop pushbutton.
13. Cabinet-mounted electrical disconnect switch.
14. Start-up shall be accomplished without the need for a laptop computer or proprietary software.

- F. The OSHGS Supplier shall be responsible for programming the Generation System package control software. The OSHGS Supplier shall deliver to the Owner all PLC and HMI code for future reference prior to final acceptance.

## 2.07 HYDROGEN DILUTION BLOWER [FOR ALL MC-800 SYSTEMS]

- A. A hydrogen dilution blower shall be designed for the following operating conditions:

SYSTEM	BLOWER QUANTITY	CAPACITY (ACFM)	STATIC PRESSURE (IN WC)	MOTOR HP	ELECTRICAL SERVICE
OSHGS Generators	6 (4 current plus 2 future installations)	812	4	3	480V/3Ph/60Hz



Sodium Hypochlorite Storage Tanks	4	406	4	1	230V/1Ph/60Hz
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- B. The blower shall be AMCA type B spark resistant of cast aluminum construction. The blower shall be cast with commercial grade 319 cast aluminum, having a 3/16" minimum wall thickness. Housing halves should be attached with tapered lugs having a minimum 45 degree taper from centerline for additional strength. Inlets and outlets shall be round.
- C. The blower wheel hub shall be an integral part of the wheel casting. The wheel shall be a radial-type wheel. The blower shall be statically balanced by removal of material only – no additional weights are to be used in the balancing process.
- D. The blower shall be arrangement 4 with a base of 12 gauge steel (minimum).
- E. Hydrogen dilution blower shall be PB Series by Cincinnati Fan.
- F. The hydrogen dilution blower shall be provided with the following accessories:
  - 1. Inlet guard.
  - 2. Teflon shaft seal.
  - 3. Current sensor.
  - 4. Differential pressure switch positioned in the dilution ductwork vent stack.
  - 5. Software controlled safety interlocks to detect control system sequence failure.

## 2.08 WATER FILTERS

- A. A wall-mounted large-capacity cartridge type filter housing holding a 10" cartridge for dirt, rust, and particulate matter from softener's feed water shall be provided. The filter housing shall be feature NPT inlet and outlet connections and a mounting bracket that must be non-metallic construction. A polypropylene cap with Buna-N O-ring shall be supplied.
- B. The filter cartridge shall be a 4-1/2" diameter, 50-micron, disposable cartridge. Cartridge shall be manufactured from a pleated non-woven and reusable polyester fabric with polypropylene core.
- C. Two (2) pressure gauges shall be provided to measure the pressure drop across the filter.
- D. At least 7 Cartridge filters shall be provided for all MC-800 systems.

## 2.09 WATER SOFTENER

- A. A dual-tank automatic water softening system shall be provided to remove hardness in the feed stream to the OSHGS, plus provides brine water makeup. The softener shall be designed for the following operating conditions:

SOFTENER QUANTITY	TANK DIMENSIONS and QUANTITY	EFFICIENCY*	KINETICO MODEL NO.
4	16" ø x 65" H (2)	3,700	CP-216S

\*Expressed as grains exchanged per pound of salt

- B. Softener shall remove hardness to less than ½ gpg. One tank will be on-line during service. A water meter shall automatically initiate system regeneration. The water meter shall measure the processed volume and be adjustable. Water softeners that regenerate on a fixed time will not be acceptable. When the ion exchange capacity of one resin tank is nearly exhausted, the hydraulically-driven, flow-controlled switchover valve will automatically divert flow to the alternate tank while initiating brine backwashing of the first tank for regeneration of the ion exchange resin. During regeneration cycles, one tank shall provide water to service and to the regenerating tank. Regeneration shall use salt solution from the brine tank.
- C. The regeneration control valve shall be top mounted (top of media tank) and manufactured from non-corrosive materials. Control valve shall not weigh more than four pounds. Control valve shall provide service and regeneration control for two media tanks. Inlet and outlet ports shall accept a quick connect, double O-ring sealed adapter. Interconnection between tanks shall be made through the regeneration valve with a quick connect adapter. Control valve shall operate using a minimum inlet pressure of 25 psi. Pressure shall be used to drive all valve functions. No electric hook-up, electric timers, or gear motors shall be required. Control valve shall incorporate four operational cycles including; service, brine draw, slow rinse, and a combined fast rinse and brine refill. The brine cycle shall flow shall be opposite the service flow, providing a countercurrent regeneration. Control valve shall contain a fixed orifice eductor nozzle and self-adjusting backwash flow control. The control valve will prevent the bypass of hard water to service during the regeneration cycle.
- D. The tanks shall be designed for a maximum working pressure of 125 psi and hydrostatically tested at 300 psi. Tanks shall be made of polyethylene and reinforced with fiberglass wrapping. Each tank shall include a 2.5 in. threaded top opening. Upper and lower distribution system shall be of a slot design. Distributors will provide even flow of regeneration water and the collection of processed water.
- E. Each softener shall include a non-solvent, high capacity cation resin having a minimum exchange capacity of 30,000 grains/ft<sup>3</sup> when regenerated with 15.0 lbs/ft<sup>3</sup>. The media shall be solid, of a proper particle size and shall contain no plates, shells, agglomerates or other shapes, which might interfere with the normal function of the water softener.
- F. The water softener shall be provided with the following accessories:
1. 1-1/2-inch inlet and outlet pipe connections.
  2. 1/2-inch HDPE tube with in-line check valve for feeding brine for regeneration.
  3. 1/4-inch wastewater discharge to sewer for backwash waste.

## 2.10 BRINE TANK

- A. Fiberglass-reinforced plastic (FRP) salt/brine storage tanks shall be provided for the following operating conditions:

TANK QUANTITY	DIAMETER	WALL HEIGHT	SALT CAPACITY (TONS)
2	10'-0"	15'-0"	43

B. Design Criteria

- The brine tank vessel shall be designed for pressure service conditions as specified for Type I Grade 1 tanks in ASTM D 3299. Brine tank vessel shall conform to the following structural design criteria:

Working Pressure:	Hydrostatic load of SG 1.2
Wind Load:	100 mph
Maximum Temperature:	140 °F

A 10:1 safety factor shall be used for internal pressure loadings and a 5:1 safety factor shall be used for external and vacuum loadings.

C. Quality Assurance

- Tanks shall be manufactured in an RTP-1 Accredited manufacturing facility.
- Visual defects shall be better than Level II on the inside of the vessel and better than Level III on the outside in accordance with ASTM D 2563 Table 1.
- The Manufacturer shall have been regularly engaged in the design and manufacture of brine make-up and storage systems tanks such as specified herein for at least five years. The Manufacturer's experience shall include at least fifteen installations of equal or larger capacity than specified herein, that have been in operation for at least five years.

D. Materials and Construction

- The brine tank shall be vertical and consist of FRP vessel, salt fill line, water distribution system, outlet plenum, salt and brine level controls, and all internals. The brine tank shall be cylindrical with a flat bottom and domed top. Vessel size and configuration shall be as shown on the drawings. Unit shall be complete with flanges, nozzles, manways, lifting lugs, anchor lugs, and other appurtenances.
- The vessel shell shall be helically filament wound according to ASTM D-3299. Any shell fabrication by hand lay-up shall not be acceptable. Only the tank bottom and dome may be fabricated by hand lay-up. Any tank made of PVC, polypropylene, or any other material shall not be acceptable. Contact molded components and accessories, shall be fabricated in accordance with ASTM D 4097 and NBS PS 15-69. The resin used shall be a premium isophthalic polyester type such as AROPOL 7241 T-15 by Ashland Chemicals. The resin will be exposed continuously to a saturated brine solution.
- All non molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed

with a resin coat prior to the final paraffinated resin coat. All voids to be filled with a resin paste.

4. The laminate shall consist of a single resin rich layer, with either c-veil or Nexus 111-00010 reinforcement followed by two 1-1/2-ounce layers of -1/2-ounce layers of random chopped strand glass, fully wetted out with resin. This interior surface shall yield a minimum 100-mil thick corrosion barrier. Filament wind over this to the required thickness. Exterior surface coat shall be paraffinated. Vessels shall be surface coated on the exterior with gel coat containing ultra violet light such as UV-9. No thixotropic or other additives shall be used.
5. Other than those associated nozzles, couplings, manways, and top and bottom heads, the towers shall be filament wound in one piece with no more than one joint.
6. The minimum properties of filament wound laminate shall be as specified in ASTM D 3299.
7. 24" diameter manways shall be in accordance with ASTM D 3299. As a minimum, two manways (lower side, top) shall be provided for each tank. The top manway cover shall include over-pressurization relief protection.
8. Flanged nozzles, double flanged gusseted nozzles, bottom drain nozzle, and threaded full couplings shall be provided as required. Flanged nozzles with 1/8-inch thick EPDM full-face gaskets of 60 durometer shall be provided by the supplier. Press-molded flanges are not acceptable. Threaded full couplings shall be FRP.
9. The tank shall include salt fill connection, softener water connection, brine outlet connection, drain, overflow, salt level indicator, brine level indicator, and vent.
10. The minimum properties of contact molded laminate shall be as specified in ASTM D 4097.
11. Anchorage: Each tank shall be furnished with concrete anchors and hold down lugs, complete with 304 stainless steel plates, for proper anchoring of the tank as required by the design calculations. A minimum of four (4) hold down lugs shall be provided.
12. Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets, etc. shall be ANSI 316SS.
13. If necessary based on installation location, vessels designed for outdoor use shall have the bottom 6'-0" of straight shell insulated for protection against freezing. Insulation shall be 2" thick polyurethane foam and be covered with a 1/8" thick FRP protective covering and receive a white pigmented gel coat with UV inhibitors. The top of the insulation will be capped to seal out any moisture.

#### E. Accessories

1. The brine tank shall be provided with a full-radiused Sch 40 304 stainless steel salt fill line designed to receive salt pneumatically unloaded from a truck. Long-radius fittings shall be used. One aluminum quick connect adapter and cover shall be provided to connect the truck's hose to the brine tank salt fill line as indicated on the drawings. One gooseneck vent shall be integrally molded into the brine tank dome. A vent dust collector bag shall be furnished and installed. The dust collector shall be properly sized for the salt fill rate and the brine tank capacity. The dust collector shall be polyester cloth material.
2. A water distribution system and a brine collection plenum shall be provided. Each assembly shall be securely installed in the brine/salt storage tank. Each assembly

shall be designed to produce a saturated brine solution as required by the hypochlorite generators.

3. The brine tank shall be provided with a liquid level control assembly, including:
  - a. A pressure sensing-type electronic level transmitter.
  - b. Normally-closed, solenoid pilot-operated diaphragm valve shall have a brass body be ASCO 8210 Series. The solenoid valve shall open when brine solution level in the Brine Storage Tank is low. The solenoid valve shall close when the brine solution level in the Brine Storage Tank is high.
4. For tanks using granular or fine grade (less than 12 mesh) solar salt, a quartz rock filter bed shall be installed in the sump. The filter bed shall consist of a 5" layer of 0.125" x 0.125" on top of a 7" layer of 0.250" x 0.250". The filter bed shall be evenly-distributed over the entire bottom of the vessel. All quartz rock shall be AWWA-washed and NSF-certified.
5. The salt level sensor shall be a cable measurement transmitter. Cable measurement transmitter shall continuously measure salt level in the brine tank with 0.25% accuracy. Measuring cable length shall extend the entire height of the brine tank to measure salt at all levels. The cable shall be constructed of material resistant to saturated brine. Transmitter shall be Bin Master "Emerson 3D Solid Scanner".
6. For tanks with straight shell greater than 12'-0", an OSHA-approved fiberglass ladder with safety cage shall be provided. The ladder shall be mounted to the vessel, but fully supported by concrete or other suitable support base. Attachment fasteners shall be stainless steel.
7. A fiberglass-encapsulated nameplate shall be provided. At a minimum, the nameplate shall include the following information:
  - a. Project name.
  - b. Installation location.
  - c. Service.
  - d. Specific gravity.
  - e. pH.
  - f. Pressure rating.
  - g. Temperature rating.
  - h. Resin.
  - i. Size.
  - j. Capacity.
  - k. Shipping Weight.
  - l. Date of manufacture.
8. Unless otherwise specified, all pipe and fittings shall be Sch 80 PVC and all fasteners stainless steel.

## 2.11 BRINE FILTERS

- A. A wall-mounted cartridge type filter housings holding a 10" cartridge for dirt, rust, and particulate matter from the brine stream shall be provided. The filter housing shall be feature NPT inlet and outlet connections and mounting bracket that must be non-metallic construction. A polypropylene cap with Buna-N O-ring shall be supplied.

- B. The filter cartridge shall be a 50-micron, disposable cartridge.

## 2.12 SODIUM HYPOCHLORITE STORAGE TANK

- A. Two (2) fiberglass-reinforced plastic (FRP) sodium hypochlorite storage tanks shall be provided for the following operating conditions:

TANK QUANTITY	DIAMETER	LENGTH	CAPACITY (GAL)
2	10'-0"	19'-0"	12,000

### B. Design Criteria

- The sodium hypochlorite storage tank vessel shall be designed for pressure service conditions as specified for Type II Grade 1 tanks in ASTM D 3299. Brine tank vessel shall conform to the following structural design criteria:

Working Pressure: Hydrostatic load of SG 1.2  
+4 in WC

Wind Load: 100 mph

Maximum Temperature: 140 °F

A 10:1 safety factor shall be used for internal pressure loadings and a 5:1 safety factor shall be used for external and vacuum loadings.

### C. Quality Assurance

- Tanks shall be manufactured in an RTP-1 Accredited manufacturing facility.
- Visual defects shall be better than Level II on the inside of the vessel and better than Level III on the outside in accordance with ASTM D 2563 Table 1.

### D. Materials and Construction

- The sodium hypochlorite storage tank shall include FRP vessel, fill connection, outlet connection, vent connections, and level controls. The sodium hypochlorite storage tank shall be cylindrical with a flat bottom and domed top. Vessel size and configuration shall be as shown on the drawings. Unit shall be complete with flanges, nozzles, manways, lifting lugs, anchor lugs, and other appurtenances.
- The vessel shell shall be helically filament wound according to ASTM D-3299. Any shell fabrication by hand lay-up shall not be acceptable. Only the tank bottom and dome may be fabricated by hand lay-up. Any tank made of PVC, polypropylene, or any other material shall not be acceptable. Contact molded components and accessories, shall be fabricated in accordance with ASTM D 4097 and NBS PS 15-69. The resin used shall be a premium fire-retardant vinyl ester type such as HETRON FR992 by Ashland Chemicals. The resin will be exposed continuously to a 0.8%  $\pm$  0.05% sodium hypochlorite solution.
- All non molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat. All voids to be filled with a resin paste.

4. The laminate shall consist of a single resin rich layer, with either c-veil or Nexus 111-00010 reinforcement followed by two 1-1/2-ounce layers of random chopped strand glass, fully wetted out with resin. This interior surface shall yield a minimum 100-mil thick corrosion barrier. Filament wind over this to the required thickness. Exterior surface coat shall be paraffinated. Vessel shall undergo a BPO/DMA cure and receive a post cure as recommended by the resin Manufacturer. Vessels shall be surface coated on the exterior with gel coat containing ultra violet light such as UV-9. No thixotropic or other additives shall be used.
5. Other than those associated nozzles, couplings, manways, and top and bottom heads, the towers shall be filament wound in one piece with no more than one joint.
6. The minimum properties of filament wound laminate shall be as specified in ASTM D 3299.
7. 24" diameter manways shall be in accordance with ASTM D 3299. As a minimum, one manway (top) shall be provided for each tank.
8. Flanged nozzles, double flanged gusseted nozzles, bottom drain nozzle, and threaded full couplings shall be provided as required. Flanged nozzles with 1/8-inch thick EPDM full-face gaskets of 60 durometer shall be provided by the supplier. Press-molded flanges are not acceptable. Threaded full couplings shall be FRP.
9. The tank shall include fill connection, outlet connection, drain, overflow, level indicator, air inlet, and outlet vent.
10. The minimum properties of contact molded laminate shall be as specified in ASTM D 4097.
11. Anchorage: Each tank shall be furnished with concrete anchors and hold down lugs, complete with 316 stainless steel plates for proper anchoring of the tank as required by the design calculations. A minimum of four (4) hold down lugs shall be provided.
12. Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets, etc. shall be ANSI 304SS.

E. Accessories

1. The OSHGS Supplier shall provide a pressure sensing-type electronic level transmitter which shall provide a 4-20 mA level signal for proper for operation of the generation equipment and alarm initiation. Level controls for the tank shall be brought to the operator interface.
2. A fiberglass-encapsulated nameplate shall be provided. At a minimum, the nameplate shall include the following information:
  - a. Project name.
  - b. Installation location.
  - c. Service.
  - d. Specific gravity.
  - e. pH.
  - f. Pressure rating.
  - g. Temperature rating.
  - h. Resin.
  - i. Size.
  - j. Capacity.

- k. Shipping Weight.
  - l. Date of manufacture.
3. Unless otherwise specified, all pipe and fittings shall be Sch 80 PVC and all fasteners stainless steel.

#### 2.13 COMMERCIAL STRENGTH HYPOCHLORITE DILUTION PANEL

- A. Under emergency conditions commercially available sodium hypochlorite (10-12 percent solution) can be added if required via a commercial strength hypochlorite dilution panel provided by the OSHGS Supplier as part of the OSHGS.
- B. The commercial strength sodium hypochlorite dilution panel shall include a wall-mounted PVC panel with the following instruments and accessories:
  - 1. Venturi eductor, polypropylene construction.
  - 2. Polysulfone inline potable water rotameter.
  - 3. Polysulfone inline commercial strength sodium hypochlorite rotameter.
  - 4. Two (2) manually-operated flow control valves.
  - 5. Outlet check valve.
  - 6. Sch 80 PVC piping and fitting.
- C. A centrifugal magnetically-driven booster pump shall be provided for the concentrated sodium hypochlorite to ensure pressure interruptions will not disrupt the dilution process. Pump shall be Series 3 by March Pump.

#### 2.14 SODIUM HYPOCHLORITE METERING PUMPS

- A. Under normal operating conditions, site generated sodium hypochlorite (nominally 0.8%  $\pm$  0.05%) will be injected into the process at locations shown on the drawings for disinfection.
- B. A metering pump shall regulate the amount of sodium hypochlorite dosed based on a pre-established set point as follows:

PUMP QUANTITY	CAPACITY (GPH)	DISCHARGE PRESSURE (PSI)	HP	POWER
3	660	45	1.0	480/3/60

- C. The metering pump shall be a diaphragm metering pump with a TEFC inverter-duty motor. Where multiple pumps are provided, all pumps shall be manufactured by a single Manufacturer.
- D. The metering pump shall be suitable to operate 24-hours per day.
- E. The solution metering pump shall be able to operate with a 10 :1 turn down ratio in conjunction with the VFDs.
- F. The metering pump shall be provided with a PVC pump stand.



- G. The following accessories for the sodium hypochlorite meter pump:
  - 1. PVC calibration column.
  - 2. PVC chargeable pulsation dampener.
  - 3. PVC backpressure relief valve.
  - 4. PVC pressure relief valve.
  - 5. Wye strainer.
  - 6. Pressure gauge with PVC isolator using a Teflon membrane.
- H. The OSHG Supplier shall provide a VFD based control panel as part of the metering pump system.
- I. Metering pumps shall be Apex 35 by Bredel or approved equal.

#### 2.15 BOOSTER PUMP

- A. If the incoming feed water to the water softener is less than 50 psi, a booster pump shall be provided.

#### 2.16 CHILLER

- A. A chiller shall be provided or maintain a feed water temperature below 75F.

#### 2.17 HEAT EXCHANGER

- A. A heat exchanger shall be provided to maintain a feed water temperature above 57F.
- B. A titanium and PVC heat exchanger will be provided on the OSHGS rack capable of raising the incoming cold water temperature 8-12°F.
- C. The process will function to bleed waste heat from the product hypochlorite to the incoming cold water.
- D. A bypass valve will be provided for seasonal adjustment. Additionally, a flushing valve and drain will be provided.
- E. All wetted components and fasteners will be titanium and all internal gasketing will be Viton.
- F. The heat exchanger will not require power or control circuitry and will function in a completely passive fashion.

#### 2.18 HYDROGEN DETECTOR

- A. A hydrogen gas monitoring system shall be provided to continuously measure and display gas concentration and provide alarms when preset limits are exceeded. A transmitter will send the signal to the control panel.
- B. The gas monitoring system shall have a NEMA 4X enclosure and two-line, eight-alphanumeric character LCD display with linear 4-20 mA output signal.

- C. The gas detector shall be model CN06 by Conspec Controls.

#### 2.19 ACID CLEANING CART

- A. A pre-assembled, mobile cart including acid cleaning tank and centrifugal pump shall be provided by the OSHG Supplier for periodic washing of the electrolytic cells.
- B. The cart shall be pre-piped and pre-wired prior to shipment. All piping, fittings, and valves shall be Sch 80 PVC. The 120VAC, single-phase plug shall be included for connection to a standard electrical receptacle.
- C. A discharge hose, quick-connect couplings, and appurtenance shall be included to transfer acid to and from the electrolytic cells.

#### 2.20 TOOLS, SPARE PARTS, AND MAINTENANCE MATERIALS

- A. The OSHGS Supplier shall furnish one set of the following spare parts for each onsite sodium hypochlorite generator system:
  1. One (1) electrolytic cell level switch.
  2. One (1) electrolytic cell temperature sensor.
  3. One (1) electrolytic cell temperature switch.
  4. One (1) air flow switch.
  5. One (1) brine pump.
  6. One (1) solenoid valve.
  7. One (1) pump rebuilds kit.
  8. One (1) complete electrolytic cell including cell housing (loose electrodes are not acceptable).
- B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner at the completion of the contract.
- C. The OSHGS Supplier shall furnish an initial supply of all greases and lubricants required to start operations. Supply an amount of these materials necessary for one year of continuous operation.

### PART 3 EXECUTION

#### 3.01 FACTORY ASSEMBLY AND TESTING

- A. The OSHGS shall be pre-assembled at the manufacturing location.
- B. System shall be tested for a minimum of eight hours at the location of assembly to assure it is in full compliance with the requirements of the specific design for the project and this specification.
- C. Factory testing shall include visual inspection of all equipment, complete assembly, and functional testing of equipment including leak testing, piping and instrumentation check,

verification of control panel wiring and operation, and confirmation of proper operating parameters.

- D. Engineer and/or Owner reserve the right to be present at the OSHGS Supplier's manufacturing facility to witness factory testing. Engineer and/or Owner shall provide intent to witness factory testing at the time of the design submittal review and approval, and OSHGS Supplier shall provide notice to Engineer and/or Owner regarding the scheduled time of the factory testing at least five business days in advance of the proposed factory test.
- E. The OSHGS Supplier shall maintain Quality Control documentation that includes system test settings and measured performance.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. The OSHGS shall be packaged and shipped so as not to incur damage to any portion of the equipment through handling and installation of the system itself.
- B. The Contractor shall be responsible for the delivery, storage, and handling of products in accordance with the OSHGS Supplier's recommendations.
- C. The Owner shall inspect all equipment and materials against approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to the OSHGS Supplier for replacement or repair.
- D. Equipment and materials shall be stored in a dry, chemical-free location and protected from the elements according to the OSHGS Supplier's instructions.
- E. Equipment and materials shall be handled in an approved manner according to the OSHGS Supplier's instructions.

### 3.03 INSTALLATION

- A. All equipment units or assemblies shall be installed on concrete bases and secured with anchor bolts in accordance with the OSHGS Supplier's recommendations and as shown. The contractor shall coordinate with OSHGS supplier for skid placement and anchoring.
- B. Contractor shall inspect all concrete pads for proper elevation, dimensions, cutouts, evenness and anchor bolt locations and correct if necessary.
- C. The Contractor shall inspect all equipment before installation, if damaged; notify the Engineer and OSHGS Supplier promptly. Do not install damaged equipment until the OSHGS Supplier makes repairs in accordance with OSHGS Supplier's written instruction and approval.
- D. The Contractor shall, after installation of storage tanks is complete but before piping connections are made, block all outlets and fill each tank with potable water and tested for leakage for a minimum of 24 hours prior to system start-up and commissioning. Any leaks that are observed will be repaired and the tank re-tested.

- E. Contractor shall provide a drain for each piece of equipment, according to the OSHGS Supplier's instructions. Any additional drains required for the system but not shown in the drawings shall be provided by the Contractor at no additional cost.
- F. Power shall be provided by the Contractor to the system control panels as shown on the OSHGS skid drawings. The Contractor shall be responsible for providing all necessary conduit and wiring necessary for a complete electrical service to this location. All wiring shall comply with the National Electrical Code.
- G. Installation shall include furnishing and applying an initial supply of lubricants, as provided by the OSHGS Supplier.
- H. Contractor shall support piping independent of equipment. Equipment shall be free from all loads and stresses induced by the piping.
- I. All equipment including motors, belts, and drives shall be aligned to the best industrial standards. Field check and adjust all equipment alignments in the presence of the Engineer.
- J. The Contractor shall inspect all equipment before installation, if damaged; notify the Engineer and OSHGS Supplier promptly. Do not install damaged equipment until the OSHGS Supplier makes repairs in accordance with OSHGS Supplier's written instruction and approval.
- K. Tie-down lugs for tanks shall be grouted or shimmed to prevent excessive loads being transferred to the tank shell.
- L. The PSHGS Supplier shall assist the contractor in making all required electrical connections to the supplied equipment.

### 3.04 START-UP SERVICES AND FUNCTIONAL TESTING

- A. A factory technician from the OSHGS Supplier shall be present at the jobsite for initial system start-up/commission of equipment as specified in section 1.03 G.
- B. Factory technician will insure that the systems are properly installed, start-up the systems, and train the Owner's personnel.
- C. Contractor and OSHGS Supplier shall make equipment adjustments required to place system in proper operating condition.

### 3.05 IDENTIFICATION AND MARKING

- A. The OSHGS, along with all applicable components, shall be marked and identified for all health, flammability, and reactivity of hazardous materials as required by all applicable jurisdictional building codes, statues, standards, regulations, and laws.

END OF SECTION

**SECTION 11351****FINAL CLARIFIER EQUIPMENT****PART 1 GENERAL****1.01 SCOPE OF WORK.**

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation, two (2) final clarifier mechanisms, each suitable for installation in a concrete basin as shown on the Contract Drawings and specified herein. A third clarifier is to be installed in a future project. All necessary and desirable accessory equipment, whether specifically mentioned in this Section or not, shall be furnished and installed as required for an installation incorporating the highest standards for this type of equipment.
- B. Each clarifier mechanism shall be a center column supported, center feed unit with peripheral effluent collection. A center drive mechanism shall be provided for rotation of the two rake arms with spiral type rake blades, and scum skimming mechanism.
- C. The final clarifier equipment shall be designed to effectively settle mixed liquor suspended solids and scrape the settled solids from the basin floor to the rotating sludge collection drum or stationary sludge ring as shown on the Contract Drawings. The clarified effluent shall be collected uniformly by the peripheral launder. Surface scum shall be collected by the scum skimming equipment and discharged through the scum withdrawal pipe.
- D. The equipment furnished for each clarifier mechanism shall include but not be limited to: walkway with handrails, center drive assembly, center drive platform, center support column with inlet openings, energy dissipating inlet (EDI), feedwell, center cage, sludge collection arms with spiral type rake blades, rotating sludge collection drum or stationary sludge ring if needed, surface scum skimming and collection equipment, effluent weir plates and scum baffle, anchor bolts and assembly fasteners.
- E. Except where specifically indicated otherwise, all plates and structural members shall be designed for the intended use and of adequate strength to withstand all loads during shipping and operations, and have a minimum thickness of 1/4 inch. All submerged steel components shall be constructed of 304 stainless steel structural shapes. All non-submerged structural steel will conform to ASTM A36 requirements. All non-submerged steel plate will conform to ASTM A283C requirements. All anchor bolts and assembly fasteners shall be 316 stainless steel.
- F. The equipment furnished for each clarifier mechanism shall be no conflict with the installation and/or operation of the Launder Cover System as shown on the Contract Drawings and specified in Section 06502 – Launder Cover System.
- G. Electric motors shall be furnished as part of the work of this Section and shall be in accordance with Division 16 – Electrical.



- H. A local control panel shall be provided for each clarifier. The control panel shall contain the starter, indicator lights, and torque overload protection and alarms.
- I. Like items of the final clarifier equipment specified herein shall be the end products of a single clarifier equipment Manufacturer in order to achieve standardization for operation, maintenance, spare parts and Manufacturer's service.

#### 1.02 RELATED WORK

- A. Division 01 – General Provisions.
- B. Division 03 – Concrete.
- C. Division 05 – Metals.
- D. Division 06 – Wood and Plastics.
- E. Division 09 – Finishes.
- F. Division 11 – Equipment.
- G. Division 13 – Special Construction.
- H. Division 16 – Electrical.
- I. Division 17 – Instrumentation.

#### 1.03 SUBMITTALS

- A. The Contractor shall submit to the Engineer, in accordance with Section 01300 – Submittals, copies of all materials required to establish compliance with this Section. Submittals shall include, but not be limited to, the following:
  1. Complete shop drawings of all equipment furnished for this project as covered by these specifications.
  2. A certification that the submitted material describes exactly the equipment to be provided. Substitutions of equipment subsequent to submittal approval will not be accepted.
  3. A copy of the equipment specification Section with all addenda and all referenced specification sections. Each paragraph shall be check-marked to indicate specification compliance or marked to indicate deviations from the specification requirements. Check marks shall indicate complete compliance with the paragraph requirements. Deviations from the specification shall be indicated by underlining the deviation and marking the paragraph or line with a number or letter. The remainder of the paragraph not marked as a deviation shall indicate compliance with the requirements of the paragraph. The Manufacturer shall prepare a detailed justification for each deviation. Failure to include the required specification sections and the justification for deviations will indicate non-compliance and shall be rejected without further consideration.
  4. Complete operating and maintenance instructions shall be furnished in accordance with Section 01350 – Operations and Maintenance Data. The instructions shall be

prepared specifically for this installation and shall include all required drawings, equipment lists, descriptions, and other information required to instruct operating and maintenance personnel with such equipment. The maintenance instructions shall include troubleshooting data and full preventive maintenance schedules.

5. Electrical and Control information as required by Division 16 & 17.

B. The clarifier equipment Manufacturer shall furnish as a minimum the following design and description information to establish compliance with these specifications:

1. Certified general arrangement and tank dimensional drawings.
2. Certificate of design stamped by a Registered Professional Engineer stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications. The certificate shall state the respective loads and design criteria.
3. Drive mechanism rating calculations, stamped by a Registered Professional Engineer, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.
4. Motor data and catalog information. Electrical drawings as applicable to the supply of the clarifier equipment Manufacturer.
5. Catalog cut sheets for purchased sub-components.
6. The clarifier equipment Manufacturer shall provide Operation and Maintenance (O&M) Manuals at least two weeks prior to shipment of all major equipment components. Each manual shall be a bound, indexed binder with drawings and parts lists prepared specifically for this project rather than general instructions that are not designed for this project. As a minimum the O&M Manual shall contain:
7. Certified as-built drawings (general arrangement and general arrangement details).
  - a. Erection drawings.
  - b. A complete bill of materials for the equipment including the weights of all structural steel components.
  - c. Installation and maintenance instructions for the specific equipment including the erection sequence, maintenance and trouble-shooting check points, and complete lubrication procedures with recommended grades of lubricants.
  - d. Cut sheets for all equipment items purchased from sub-vendors.
  - e. A list of the clarifier Manufacturer's recommended spare parts specifically denoting wear items, long delivery items, and all items convenient for stocking as optional replacement items.

#### 1.04 REFERENCE STANDARDS

A. American Society of Testing Materials (ASTM):

1. ASTM 304 – Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements.
2. ASTM A36 – Standard Specification for Carbon Structural Steel.
3. ASTM A48 – Standard Specification for Gray Iron Castings.
4. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings.

5. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  6. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  7. ASTM A283/Grade C – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.
  8. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  9. ASTM A536 – Standard Specification for Ductile Iron Castings.
  10. ASTM A992 – Standard Specification for Structural Steel Shapes.
- B. American Iron and Steel Institute (AISI), AISI 4142 – Heat Treated Steel.
  - C. American Gear Manufacturers' Association (AGMA), – Gear Ratings.
  - D. American Welding Society (AWS), Current Standards.
  - E. Anti-friction Bearing Manufacturers' Association (AFBMA), Bearing Life Specifications.
  - F. National Electrical Manufacturer's Association (NEMA), Motor Design Standards and Standards for Control Enclosures.
  - G. Society for Protective Coatings (SSPC), Current Standards and Specifications for Surface Preparation and Coating.
  - H. National Fire Protection Association (NFPA).
  - I. Institute of Electrical and Electronics Engineers (IEEE).
  - J. International Society of Automation (ISA).
  - K. Underwriters Laboratories (UL).
  - L. International Electrical Testing Association (NETA).
  - M. Occupational Safety and Health Administration (OSHA).
- 1.05 QUALITY ASSURANCE
- A. The clarifier equipment Manufacturer shall modify his standard equipment to meet the minimum values specified for dimensions, design, and the intent of this specification.
  - B. Manufacturers regularly engaged in the manufacture of the clarifier equipment as specified herein and who can demonstrate equipment of this specified design, in actual service for a period of not less than 10 years will be considered as acceptable Manufacturers.
  - C. Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the clarifier equipment herein specified.



This assurance will be met by certification to the quality system requirement of ISO 9001 or equivalent standard as accepted by the engineer.

D. Services of Manufacturer's Representative:

1. The clarifier equipment Manufacturer shall provide a Manufacturer's Service Representative who has been properly trained in inspection and operation of the mechanism to approve the installation, certify that the torque settings of the drive overload protection device are correct, perform the torque test and instruct the Owner's personnel on maintenance and operation. This service shall be a minimum of two (2) separate trips to the job site, and a minimum of total four (4) days, eight (8) hours per day on-site service.
2. If additional field service beyond the trips and days specified above is required due to the mechanisms not being fully operational, at the time of service requested by the Contractor, the additional service days will be at the Contractor's expense.

E. Acceptable Manufacturers:

1. The naming of a Manufacturer in this specification is not an indication that the Manufacturer's standard clarifier equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the experience and capability of engineering and supplying the clarifier equipment as specified.
  - a. Ovivo USA, LLC (Formerly Eimco Water Technologies) of Salt Lake City, UT
  - b. WesTech of Salt Lake City, UT

## 1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS

A. Capacity Requirements

1. Current Improvements
  - a. Design average daily flow.....2.89 MGD per clarifier
  - b. Design maximum daily flow .....7.80 MGD per clarifier
  - c. Design peak hourly flow .....8.67 MGD per clarifier
  - d. Design minimum recycle flow .....1.44 MGD per clarifier
  - e. Design average recycle flow .....2.89 MGD per clarifier
  - f. Design maximum recycle flow.....4.83 MGD per clarifier
2. Ultimate Build-Out (UBO) Conditions
  - a. Design average daily flow.....3.25 MGD per clarifier
  - b. Design peak hourly flow .....9.75 MGD per clarifier
  - c. Design maximum recycle flow.....5.31 MGD per clarifier

B. Design Requirements

1. Number of clarifiers.....Two (2)
2. Basin diameter.....130 ft
3. Side water depth ..... 15 ft
4. Tank freeboard ..... 2 ft
5. Floor slope .....1:12



6. Mixed liquor suspended solids concentration range .....2,000–5,000 mg/L
7. RAS suspended solids concentration range.....8,000–10,000 mg/L
8. Center column diameter .....36 inches
9. Feedwell diameter..... 32 ft
10. Feedwell submerged depth ..... 6 ft
11. Number of feedwell scum ports..... Four (4)
12. EDI diameter ..... 12 ft
13. EDI submerged depth ..... 3 ft
14. Number of baffled EDI openings .....Eight (8)
15. Cage minimum size.....4 ft, square
16. Rake arm size (minimum).....3 ft-10 inch, square
17. Spiral blade height near tank wall.....10 inches
18. Spiral blade height at tank center .....30 inches
19. Rotating sludge collection drum diameter (minimum), if applicable..... 8 ft-4 inch
20. Stationary sludge collection ring diameter (minimum), if applicable ..... 25 ft
21. Scum box width .....6 ft, standard
22. Effluent launder width .....3.5 ft
23. Combined RAS/WAS pipe diameter .....18 inches

C. Torque/Rotational Requirements

1. Drive design continuous running torque (minimum) ..... 40,000 ft-lbs
2. Drive 100% alarm design continuous torque (minimum) ..... 60,000 ft-lbs
3. Drive momentary peak torque (minimum)..... 120,000 ft-lbs
4. Mechanism rotation..... Clockwise
5. Rotation speed, constant (maximum) ..... 0.05 rpm
6. Tip speed, constant (maximum) ..... 20 ft/min

1.07 DELIVERY, HANDLING AND STORAGE

- A. Ship equipment and material complete and ready for installation.
  1. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match-marked for ease of field erection.
  2. Components shall be packaged in separate containers legibly marked to identify contents. Each box or packages shall be legibly marked to show its net weight.
- B. At the time of shipment, the shipping list, original bill of loading, shipping memorandum and invoice shall be delivered in triplicate to the Owner's Field Representative. Each shipping list shall give the description and net weight of each item, and gross weight of the shipment. Shipment will not be accepted until the list has been received. Demurrage or other charges resulting from failure to furnish these lists shall be absorbed by the Contractor.
- C. The Contractor shall erect all components immediately upon receipt from the clarifier Manufacturer or store in strict conformance with storage recommendations provided by the clarifier Manufacturer in the Operations and Maintenance Manual.

- D. The mechanism shall be lubricated by the Contractor in strict accordance with the instructions of the clarifier Manufacturer's field service representative. The required lubricants shall be provided by the Contractor.

#### 1.08 MAINTENANCE/SPARE PARTS

- A. The intent of this specification is to provide uninterrupted operation for a minimum period of two (2) years. To meet this objective the clarifier equipment Manufacturer shall supply any spare parts, excluding lubricants, that are required to meet this time frame.
- B. As a minimum provide the following spare parts shall be furnished:
  1. One (1) set of seals for the center drive assembly.
  2. Two (2) oil sight glass. (Upper and lower housing).
  3. One (1) set of neoprene skimmer wipers.
- C. All spare parts shall be packed in suitable storage containers and legibly marked as to the contents.
- D. Furnish special tools for normal operation and maintenance of the equipment, if required. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

#### 1.09 WARRANTY/EXTENDED WARRANTY

- A. The Warranty shall be in accordance with Section 01750 – Warranties and Bonds.

### PART 2 PRODUCT

#### 2.01 GENERAL

- A. Each clarifier mechanism shall be of the center-drive type, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upward to the inlet openings located at liquid level and dispersed into the tank through the EDI and flocculating feedwell. The clarifier mechanism shall be designed to collect sludge uniformly from the bottom of the tank into a rotating sludge collection drum or sludge ring.

#### 2.02 CENTER DRIVE ASSEMBLY DRIVE – OPTION A

- A. The center drive assembly shall consist of an integral motor and primary speed reducer coupled through roller chain and sprockets to a secondary worm/worm gear reducer driving the main gear through a pinion and shall have an integral overload protection system.
- B. All gears and bearings shall be oil bath lubricated with the main bearing totally submerged in oil and the teeth of the main spur gear submerged at least 70 percent in the oil bath. Oil pumps for lubrication or grease lubricated bearings are not considered appropriate for this application and will not be allowed. The oil reservoir for the main bearing and gear shall have a section of minimum depth 5 inches below

the main bearing to positively prevent contamination of the main bearing and gears with condensate or other contaminants. Gear and bearing housings must also be fitted with oil level sight glasses and condensate drains. Condensate must be allowed to drain from a low point of the housing. Condensate and contaminants will not be allowed to drain through the lower pinion bearing.

- C. Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the completed drive unit shall be accomplished at the clarifier Manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review prior to shipment to the job site.
- D. The complete center drive assembly, including the overload protection device, shall be a regularly manufactured in-house product of the clarifier Manufacturer. Drive assemblies purchased from third party vendors will not be accepted.
- E. The primary gear reducer shall be of either worm/worm gear, helical or cycloidal design and shall be C-face or integrally mounted to the electric motor. The drive motor shall be minimum 1.5 horsepower and shall be totally enclosed, fan cooled, with a 1.15 service factor, and have bearings with a minimum B10 rating of 50,000 hours. Operating electric voltage will be 480 volt, 3 phase, and 60 hertz. Each motor will be NEMA Design B employing Class F insulation designed for an ambient temperature of 40°C.
- F. The motor and primary speed reducer shall drive a secondary worm gear reducer through a #60 roller chain and steel sprockets enclosed in a galvanized 18 gauge steel guard. Sprockets and chain shall be designed for the connected horsepower of the drive with a minimum service factor of 1.4. Provision shall be made for adjustment of chain tension.
- G. The main drive unit shall consist of a worm gear secondary reduction unit, pinion and main spur gear assembly. The secondary reducer shall be a worm gear reducer specifically designed for this application. The worm gear shall be centrifugally cast high strength manganese bronze. The worm shall be hardened alloy steel. A single piece pinion shall be keyed to the worm gear to transmit power from the worm gear to the spur gear. In order to maintain proper alignment between the pinion and the spur gear, the pinion will be supported by bearings both above and below the spur gear. The bearings shall be fitted into precision machined bearing pilots to positively insure bearing and gear alignment.
- H. The main spur gear material shall be high strength ductile iron per ASTM A536 grade 100-70-04. The gear shall have a minimum pitch diameter of 60 inches with a 6-inch face width height or the equivalent spur gear surface area of 1,130 square inches. Spur gear surface area is defined as the spur gear pitch diameter multiplied by the spur gear face height multiplied by 3.14.
- I. The main gear shall rotate and be supported on a ball bearing assembly provided with four replaceable liner strips fitted into the main gear and turntable base. Liner strips shall be special vacuum degassed carbon corrected, alloy steel hardened to a Rockwell

hardness of at least 43 to 46 Rc. The turntable base shall be a minimum 1 inch thick to insure adequate structural rigidity to properly support the drive bearing and gear.

- J. The main gear and bearing shall be completely enclosed in an ASTM A48 Class 40A cast iron housing provided with neoprene dust seals. In order to ensure the maximum possible base rigidity and vibration dampening the gear housing shall be of full sidewall construction, integral with the base. Prior to assembly, the base shall be thoroughly inspected for seep holes or inclusions and given a hydrostatic test to insure no leaks are in the oil containment area. Shop inspection reports must be made available for review.
- K. The main gear shall rotate and be supported on a ball bearing assembly having a four-point contact design and fully contoured raceways. Raceways shall be AISI 4150, hardened to Rc 58 - 63 to an appropriate case depth. Ball bearings shall be manufactured to AFBMA Standards Section 10, Grade 200. The bearing shall be replaceable independent of the main gear.
- L. The drive unit shall be equipped with an electro-mechanical overload control device actuated by thrust from the worm shaft. The pointer shall provide a visual reading of the relative main gear output torque on a 0 to 100 percent graduated scale. The 100 percent reading shall equal the drive 100% design torque as specified in Section 1.06. The control device shall also activate an alarm switch for warning of impending overload, a motor cutout switch for overload protection and a back-up safety motor cutout switch for back up overload protection. In lieu of a back-up safety motor cutout switch a slip clutch assembly will be acceptable upon review by the Engineer. The respective switches in the overload control device shall be factory calibrated and set to the following settings:
  - 1. Alarm ..... 40% of scale
  - 2. Motor cutout ..... 85% of scale
  - 3. Back-up motor cutout or slip clutch ..... 100% of scale
- M. All drive control components shall be mounted in a NEMA 4X enclosure of either epoxy coated aluminum construction or stainless steel with a gasket sealed removable cover. The pointer shall be covered with a clear plexi-glass enclosure and shall be above the walkway/platform surface for visibility from the walkway/platform. Amperage sensing devices, devices with exposed linkage connections, or devices which react to rotational movement to an intermediate reduction unit are not acceptable.
- N. The center drive unit shall be designed for the continuous torque rating as specified in Section 1.06. The continuous torque shall be defined as the minimum torque at which the drive mechanism may operate continuously 24 hours per day, 365 days per year, for 20 years, at the specified sludge collector arm speed. Main gear and pinion calculations shall be based upon ANSI/AGMA 2001-C95 standards for rating the pitting resistance and bending strength of involute spur and helical gear teeth. Calculations shall clearly present the values used for the following design parameters:
  - 1. Number of pinions.
  - 2. Actual face width.
  - 3. Tooth geometry (I and J factors).

4. Load distribution factor.
5. Allowable contact stress.
6. Allowable bending stress.
7. Pinion pitch diameter.
8. Hardness ratio factor.
9. Elastic coefficient.
10. Life factor.

- O. The load distribution factor shall be determined by the empirical method. For parameters which are material dependent, such as allowable contact stress, the calculations shall include a complete description of material and heat treatment used.
- P. Worm gearing shall be designed and rated to equal or exceed the specified continuous torque and life. The basis for rating shall be ANSI/AGMA 6034-B92 standards for durability rating and design of worm gear reducers.
- Q. The continuous torque rating for the drive unit shall be the lowest value determined for the gearing.

## 2.03 CENTER DRIVE ASSEMBLY DRIVE – OPTION B

### A. Design Parameters.

1. The drive unit shall be designed and manufactured by the clarifier equipment supplier to ensure unit responsibility. The drive unit shall be designed for the torque values previously listed. It shall turn the mechanism at the design collector tip speed. The drive main bearing shall be designed for the total rotating mechanism loads with a minimum L-10 life of 50 years or 438,000 hours. The drive unit shall be capable of producing and withstanding the previously listed momentary peak torque while starting. The drive main gear shall be designed to a minimum AGMA 6 rating when rated in accordance with the latest AGMA standard. Gear teeth shall be designed for proper load distribution and sharing. Stub tooth design and surface hardening of the main gear shall not be allowed. The main bearing shall be capable of withstanding the listed overturning moment without the aid of any underwater guides or bearings to ensure correct tooth contact for AGMA rating of the main gear.
  - a. All spur gearing shall be designed to the latest AGMA spur gear standard for strength and surface durability, based on a life of 175,000 hours. The design running torque rating of the drive gearing shall be based on the smaller of the strength and durability values determined from the above AGMA standard. To ensure safety and ease of maintenance, all components of the drive shall be direct coupled.
  - b. No overhung pinions shall be allowed on the speed reducing unit. The lower pinion bearing shall not be located below the turntable base.
  - c. Any and all welding on the drive unit shall be done using E70XX weld rod.

### B. Physical Characteristics.

1. The drive unit shall consist of a solid internal main spur gear, bearing turntable, pinion, secondary speed reducer, support base, and drive unit bearing. The drive

shall be mounted on the center column and support the entire rotating load of the mechanism. The main internal gear shall be forged of alloy hardened steel. The pinion shall be heat treated alloy steel. Support base for the drive shall be of welded steel to assure rigidity. Dust shields shall be provided. The drive bearing shall include a forged steel precision gear/bearing set, with fully contoured raceways hardened to a minimum 58-62 Rc and protected by a neoprene seal. The drive shall be designed so that the balls and nylon spacers can be replaced without removing the access walkway. The main gear to pinion gear mesh shall be oil lubricated. An oil sight glass, fill pipe, and drain shall be provided for the reservoir. Lubrication fittings shall be readily accessible.

C. Overload Protection.

1. An overload device shall be provided in a stainless steel, weatherproof enclosure. The device shall be actuated by torque generated from the main drive, which shall operate two independently adjustable switches (the alarm switch at 100 percent of design running torque and the motor cutout switch at 120 percent of design running torque). Devices that require the worm to float and measure the thrust of the worm gear shall not be acceptable. These two switches shall be factory adjusted to accurately calibrate the alarm torque value and the overload position. A visual torque indicator shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.

D. Turntable.

1. The turntable base shall have an annular bearing raceway upon which the rotating assembly rests. It shall have a maximum allowable deflection in accordance with the bearing specifications. The allowable modulus of elasticity shall be a minimum of  $29 \times 10^6$  psi. The center cage shall be fastened to and supported from the gear casing. Ball bearings shall be of high carbon chrome alloy 52100 steel running in fully contoured races, as part of a precision gear/bearing set. The balls shall be grease lubricated and protected by elastomer seals. Felt seals that allow the entrance of moisture from outside the drive (i.e. rain water, condensate, etc.) will not be allowed.

E. Speed Reducing Unit

1. The speed reducing unit shall consist of cycloidal, helical, or planetary speed reducers directly connected to a motor without the use of chains or v-belts, and shall be keyed to the pinion.
  - a. The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the high-speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The lobes of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low speed shaft. Speed reducer efficiency shall be a minimum of 90% per reduction stage.
  - b. Speed reducer helical or planetary gearing shall be manufactured to AGMA standards and shall provide at least 95% power transmission efficiency per

stage. The speed reducer shall have a minimum service factor of 1.25 based on the output torque rating of the drive.

- c. The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and be grease lubricated. As a safety feature, the speed reducer shall be back drivable to release any stored energy as the result of an over torque condition.

F. Motor.

- 1. The motor shall be a squirrel cage, induction type, TEFC, ball bearing heavy duty unit of ample power for starting and operating the mechanism without overload. The drive motor shall be minimum 0.5 horsepower with a minimum service factor of 1.15.
  - a. Power supply to the equipment shall be 480 volt, 60 hertz, 3 phase.

2.04 CONTROL PANEL

- A. Electrical shall conform to Division 16 & 17.
- B. One (1) control panel shall be provided per clarifier to operate the center drive unit, torque alarms and provide alarm contacts for plant monitoring system.
- C. The enclosure shall be NEMA 4X, 316 Hoffman Sequester stainless steel panel properly sized to dissipate heat generated by the internal components under the specified site environmental conditions.
- D. Panel logic to be relays. Use of a PLC is prohibited.
- E. The control panel will be connected to 480 volt, 3 phase, 60 hertz incoming power. The panel will have at a minimum:
  - 1. Enclosure circuit breaker engage/disengage handle.
  - 2. FVNR Starter with Bi-metallic overload.
  - 3. Phase fail / over / under voltage protection.
  - 4. Hand-Off-Auto switch.
  - 5. Push to start button.
  - 6. Push to stop button.
  - 7. Run light.
  - 8. Alarm horn.
  - 9. Alarm beacon.
  - 10. Alarm silence button.
  - 11. Alarm/overload reset button.
  - 12. Hi torque alarm light.
  - 13. Hi-Hi torque alarm light.
  - 14. 480/120 VAC transformer for control power.
  - 15. General alarm.
  - 16. Hi Torque (approaching high torque warning).
  - 17. Hi-Hi torque (High torque drive shutdown).



- 18. Motor overload.
- 19. Run status.

- F. The following output will be available for connection to the Owner's SCADA system:
  - 1. Clarifier Running.
  - 2. Clarifier High Torque.
  - 3. Clarifier High High Torque.
  - 4. Clarifier Not in Auto.

## 2.05 INTERNAL WALKWAY ACCESS BRIDGE

- A. The clarifier shall be provided with a 36-inch clear open width walkway extending from the tank wall to the center drive platform or the opposite tank wall as shown on the Contract Drawings. The walkway shall be supported at the center by the drive unit and supported on the opposite end(s) by the tank wall. As a minimum the walkway shall be designed to safely withstand all dead loads plus a live load of 150 pounds per linear foot with a maximum deflection of  $L/360$  of the entire span. The walkway shall consist of truss design, sufficiently braced to resist the specified design loads. The contractor shall block out or otherwise modify the tank wall to accommodate the walkway as shown on the clarifier Manufacturer's shop drawings. The walkway decking shall be 1-1/4 inch aluminum I-Bar grating.
- B. A center drive operations platform shall be provided. It shall be a minimum of 8 feet square to provide clearance around the center assembly and drive control for maintenance and service. The drive platform shall be decked with 1/4 inch aluminum checkered floor plate and have sufficient structural steel supports to meet the specified design load conditions.
- C. Handrails with toe plate shall be provided along both sides of the walkway and around the center drive platform. The handrailing with fittings factory assembled to posts shall be in conformance with the requirements specified in Section 05521 – Metal Railings and shall be as shown on the Contract Drawings. Rails are to be shipped to the job site in stock lengths for cutting and fitting. The walkway truss supports may be used in place of handrailing along the walkway if it meets OSHA standards for this application.

## 2.06 EXTERNAL CONNECTING BRIDGES AND STAIRS

- A. The 36-inch clear open width external bridges and stairs shall be provided for accessing two adjacent clarifiers as shown conceptually on the Contract Drawings.
- B. The External Bridge/Stairs System shall be in conformance with the requirements specified in Section 05540 – Metal Ladders, Platforms & Stairs and Section 05521 – Metal Railings. The handrails shall be in conformance with the requirements specified in Section 05521 – Metal Railings.
- C. The design for the External Bridge/Stairs System shall be stamped by an Oklahoma Professional Engineer.

- D. External Bridges/Stairs System – Option A: The External Bridge/Stairs System shall be designed and provided by the Clarifier Equipment Manufacturer. The Clarifier Equipment Manufacturer shall also be responsible for integration of the External Bridges/Stairs Systems into the Internal Walkway Access Bridges in the adjacent clarifiers.
- E. External Bridges/Stairs System – Option B: The External Bridges/Stairs System shall be designed and provided by the Contractor. The Contractor shall be responsible for coordination with the Clarifier Equipment Manufacturer in design of both the External Bridges/Stairs System and Internal Walkway Access Bridges. The Contractor shall also be responsible for integration of the External Bridge/Stairs Systems into the Internal Walkway Access Bridges in the adjacent clarifiers.

#### 2.07 ACCESS LADDER TO WALK-ON LAUNDER COVER SYSTEM

- A. An access ladder to the walk-on launder cover system shall be provided in each clarifier.
- B. Access Ladder Option A: A ladder to the walk-on launder cover system from the internal walkway access bridge shall be designed and provided by the Clarifier Equipment Manufacturer in each clarifier as shown conceptually on the Contract Drawings. The ladder shall be dropped down from and bolted to the internal walkway bridge structure. Removable handrails or safety chains shall be provided at top access of the ladder. The ladder shall be in conformance with the requirements specified in Section 05540 – Metal Ladders, Platforms & Stairs.
- C. Access Ladder Option B: A ladder to the walk-on launder cover system from a platform on top of the tank wall shall be designed and provided by the Contractor in each clarifier. The platform shall be extended and accessed from the external bridge/stairs system. The ladder shall be dropped down from and bolted to the platform. The platform shall be provided with handrails. Removable handrails or safety chains shall be provided at top access of the ladder. The platform and ladder shall be in conformance with the requirements specified in Section 05540 – Metal Ladders, Platforms & Stairs. The handrails shall be in conformance with the requirements specified in Section 05521 – Metal Railings. The Contractor shall also be responsible for coordination with the concrete tank supplier in the tank and/or platform design.

#### 2.08 CENTER CAGE AND RAKE ARMS

- A. The center cage shall be of steel box truss construction. It shall be provided with connection for the sludge removal arms and feedwell supports. The top of the cage shall be bolted to the main gear which shall rotate the cage with the attached arms and feedwell. The minimum angle size used for construction of the cage and rake arms shall be 2 inch x 2 inch x 1/4 inch members.
- B. The clarifier mechanism shall include two (2) full length sludge removal arms and two (2) partial sludge removal arms of stainless steel truss construction, with stainless steel spiral rake blades and adjustable 20-gauge stainless steel squeegees. The rake blades shall provide complete raking of the basin floor twice per revolution.

- C. The rake blades shall consist of a minimum 3/16-inch thick stainless steel plate blade. The blades shall be constructed to a logarithmic spiral curve with a constant 30-degree angle of attack. Blade depth shall vary as specified in Section 1.06. Each rake truss support arm shall be provided with the necessary outrigger bracing and other blade support structures, to ensure that the complete blade can be properly located and adjusted in the field.
- D. The rake blades shall terminate at and directly attach to the rotating sludge collection drum or stationary sludge ring.
- E. The structural calculations for the rake arm shall include an analysis of the torsional loads from the spiral curve blade.
- F. The cage and rake arms shall be designed such that calculated stresses do not exceed the AISC allowable stress at the drive 100% design torque.

#### 2.09 ROTATING SLUDGE COLLECTION DRUM

- A. A rotating sludge collection drum shall be provided to collect settled solids raked to the center by the rotating spiral blades. The collected sludge shall be discharged from the tank by way of the combined RAS/WAS sludge pipe as shown on the Contract Drawings.
- B. The sludge collection drum shall rotate with the center cage and shall be provided with sludge collection ports located directly in front of each rotating spiral rake blade. The ports shall be sized to collect thickened sludge from the bottom most dense sludge layer to maximize underflow solids concentration.
- C. The rotating sludge collection drum shall be constructed of 1/4-inch stainless steel plate. A neoprene seal shall be provided to seal against the center column. A stainless steel seal shall be provided to seal against the tank floor.

#### 2.10 SLUDGE WITHDRAWAL RING

- A. The tank floor slope and sludge withdrawal ring design shall be verified by the clarifier equipment Manufacturer. The sludge withdrawal ring shall be located and sized to prevent short-circuiting of the influent to the underflow. It shall be placed at a point of high sludge concentration. It shall be rectangular in cross section as shown on the drawings and shall remove sludge uniformly around the center of the tank.
- B. The sludge withdrawal ring shall surround the center column and shall include appropriate anchorage to the tank floor. The cross section shall be tapered along its length to assure a constant sludge velocity through the ring. Equally spaced orifices shall be cut into the outer ring wall. The orifices shall be sized to avoid plugging. The outer ring wall shall be at a constant radius. The annulus between the column and the ring shall be filled with grout.
- C. The sludge withdrawal ring shall be constructed from stainless steel.

## 2.11 CENTER COLUMN

- A. A 1/4-inch wall thickness, vertical, stationary center column shall be provided to serve as the influent pipe. The lower end shall have a 1-1/4-inch support flange for bolting to the foundation with a minimum of eight (8) 1-1/4-inch diameter anchor bolts as shown on the clarifier Manufacturer's shop drawings. A similar flange shall be provided at the upper end of the column for supporting and securing the center drive assembly.
- B. Influent openings shall be provided in the upper portion of the column to allow unrestricted passage of the flow into the feedwell. Influent velocity shall be reduced by providing a total inlet port area a minimum of 135 percent of the center column cross sectional area.
- C. The center column shall be constructed from stainless steel.

## 2.12 FEEDWELL

- A. The feedwell shall rotate with the clarifier mechanism and be sufficiently supported by structural members attached to the center rotating cage. The feedwell shall be fabricated from 3/16-inch stainless steel plate with upper and lower reinforcing rim angles and stiffeners as required. A minimum of four (4) scum ports, 4-inch high x 16-inch long, shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level. Scum ports shall be free to allow scum to escape with an adjustable and angled baffle plate to impart a tangential direction of the flow exiting the scum port.

## 2.13 ENERGY DISSIPATING INLET (EDI)

- A. The clarifier mechanism shall be equipped with an energy dissipating inlet (EDI) located inside the rotating feedwell. The dissipating inlet shall be designed to dissipate the energy of the incoming flow thereby inducing flocculation of the feed solids. The energy dissipating inlet shall have a bottom plate extending to within one inch of the center column. The well shall be constructed of 3/16-inch stainless steel plate. Baffled openings equally spaced around the periphery shall be provide for the following functions:
  - 1. energy dissipation,
  - 2. exit flow direction tangent to the inlet wall,
  - 3. prevention of downward flow.

## 2.14 SURFACE SCUM SKIMMING EQUIPMENT

- A. Skimmer Assemblies
  - 1. Two (2) skimmer assemblies shall be furnished as part of each mechanism. The skimmer assemblies shall be arranged to sweep the surface of the settling zone automatically removing scum and floating material into a scum box mounted at the tank perimeter.

2. Each rotating skimmer shall consist of a vertical stainless steel plate supported from the rake arm and extending at a tangent from the feedwell to a recessed adjustable pivoted scum scraper.

B. Scum Scraper

1. The aluminum scum scrapers shall be provided with neoprene wipers on bottom and both sides.
2. Each scum scraper shall maintain contact with the scum baffle as it travels around the tank periphery. Upon approaching the scum box ramp, it shall trap the scum in an enclosure consisting of the scum box ramp as the bottom, and baffle and scum scraper as three sides. The trapped scum shall be carried up the ramp and into the scum trough.

C. Scum Box

1. The 6 feet wide scum box shall be supported from the tank wall and connected to the scum sump through a 8-inch diameter scum pipe. The box shall be made of welded 1/4-inch stainless steel plate, to serve as an integral section of the tank's scum baffle. The assembly shall have a scum trough, vertical sides, sloping ramp, 8-inch diameter straight pipe stub for connection of a flexible connector to interface with scum outlet piping.
2. The outlet piping and flexible connector shall be furnished by the Contractor.

## 2.15 PAINTING AND SURFACE PREPARATION

- A. All non-submerged steel shall be sandblasted to SSPC-SP-6 specifications and given one (1) coat of Tnemec Series N69 epoxy primer 2-3 MDFT.
- B. Prior to assembly of the drive unit, the castings shall have been sandblasted and thoroughly cleaned to remove any foreign particles in the drive base. After assembly, the drive mechanism shall be solvent cleaned and power wire brushed as needed prior to application of the clarifier Manufacturer's standard primer.
- C. The drive unit shall receive a surface preparation in accordance with SSPC-SP-06 specifications and will be finish coated with two (2) coats of Tnemec N69 and one (1) coat of Tnemec Endura-shield series 73.
- D. Gear motors shall be furnished with the clarifier Manufacturer's standard enamel.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The equipment shall be erected in strict accordance with the clarifier Manufacturer's recommendations. A 2-inch layer of grout shall be applied to the tank floor in strict accordance with the clarifier Manufacturer's recommendations. Screed boards shall be supplied by the Contractor.

### 3.02 TORQUE TEST

- A. The clarifier mechanism shall be field torque tested. The purpose of the torque test is to verify the structural integrity of the mechanism structural steel design and center drive unit. The testing shall be carried out under the supervision of the clarifier equipment Manufacturer's Service Representative and as approved by the Engineer before the mechanisms are accepted and placed into operation.
- B. The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the Contractor in the tank floor at locations specified by the clarifier equipment Manufacturer. A load shall be applied to the scraper arm in small increments by means of a ratchet lever and cylinder connected to the cable assembly. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the center line of the mechanism. A reading shall be taken at the drive design torques.
- C. The clarifier equipment Manufacturer's Service Representative shall verify that the alarm, motor cut-out, and backup safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.

END OF SECTION

## SECTION 11375

### EXTENDED AERATION SYSTEM

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install an extended aeration system consisting of an oxidation ditch design including, but not limited to, surface aerators, adjustable effluent weir gates, variable frequency drives, and control instruments and system as shown on the Drawings and specified in here.
- B. This Specification is intended to give a general description of what is required but does not cover all details that will vary in accordance with the design requirements of the equipment application. It is, however, intended to cover the furnishing, delivery, installation assistance, and field testing of all materials, equipment, and all appurtenances required to complete the Work of this Section, whether specifically mentioned in these Specifications or not.



##### 1.02 RELATED WORK

- A. Division 01 – General Provisions.
- B. Division 09 – Finishes.
- C. Section 11000 – Equipment General Provisions.
- D. Section 11280 – Fabricated Slide Gates.
- E. Section 11388 – Hyperbolic Mixer (NOT USED).
- F. Section 15047 – Identification.
- G. Section 15139 – Electric Actuators for Valves and Gates.
- H. Division 16 – Electrical.
- I. Division 17 – Instrumentation.



##### 1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300 – Submittals, copies of all materials required to establish compliance with this Section. Submittals shall include, but not be limited to, the following:
  1. Complete description of all materials.
  2. The weight of each component.
  3. Certified shop and installation drawings showing all important details of construction dimensions, anchor bolt locations, loads on supporting structures, and field connections.

4. Complete data on motors, gear reducers, and required accessories. Data shall include gear reducer calculations and actual service factors. Data shall also include aerator impeller diameter, aerator impeller rotational speed (rpm), aerator impeller tip speed (fps).
  5. Wiring diagrams and electrical schematics for all control equipment to be furnished.
  6. General performance data and performance test reports signed by the Manufacturers test engineer shall be submittal after fabrication but prior to shipment of equipment.
  7. All equipment shop drawings shall contain an Electrical Area Classification Study based on NFPA 820. The equipment Manufacturer shall certify that their equipment is designed for installation within the classified space as defined by NFPA 820.
  8. Shop Drawings as required by Division 16 and Division 17
  9. A written statement that shall guarantee the oxygen transfer efficiency calculations and average channel velocities based on guaranteed performance.
    - a. Oxygen transfer efficiency test reports per 1.03.B.
    - b. Documentation of at least two (2) operating oxidation ditch installations in the United States with 250 HP aerators.
    - c. Shop Drawings shall include written certification from the aerator Manufacturer that the proposed aerators are guaranteed to meet the specified velocity requirements.
    - d. A Biowin or similar model and report for the proposed basins shall be provided by the Manufacturer. The model and results shall be run by a certified individual with relevant training. , sufficient experience at preparing such models for oxidation ditches. Any deviations from model default parameters shall be identified and explained. DO profiles shall be shown at all operating conditions.
  10. Descriptive literature, bulletins, and/or catalogs of all the equipment, materials, etc. Clearly indicate on the submittal cutsheets and catalogs the exact size, type, and/or Manufacturer's model number of the equipment.
  11. Description of the proposed method for ensuring a level installation of all equipment.
  12. Details of any lubrication points for gear reducers or any other equipment requiring lubrication.
  13. Installation, operation, and start-up procedures including lubrication requirements.
  14. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.
  15. A complete bill of materials for all equipment.
  16. A complete list of the Manufacturer's recommended spare parts. List shall include pricing, ordering information, and the name, address, and phone number of the nearest service center from which spare parts will be available.
  17. Affidavits of compliance with referenced standards and specifications.
  18. Written certification from the aerator Manufacturer that the proposed aerators are guaranteed to meet the specified velocity requirements. Shop drawings will not be reviewed without this certification.
  19. Other information necessary for complete review by Engineer.
- B. The Aeration Equipment Manufacturer must submit the following information and meet the experience requirements specified:



1. A test report from a full-scale oxygen transfer test in oxidation ditches.
  - a. Test report shall be from an installation that has an impeller aerator of similar design.
  - b. Test shall be from an oxidation ditch of similar configuration.
  - c. Test report shall be full-scale non steady-state clean water test report from tank equal to or greater than 500,000 gallons, in compliance with ASCE 2-06. Test report must have been witnessed and certified in writing by a third party. Steady-state testing or mixed liquor endogenous test methods are not allowed to meet the requirements of this paragraph. Test report must be a full report including raw data and calculation methods (ASCE non-linear regression) and must be reported as per wire (motor input) HP, per motor output HP, and per gear box output shaft aerator-to-water HP by the third party. The average SOTR value from these reports at max speed and submergence will be used to verify the oxygen transfer efficiency requirement.
  - d. Test results must be in U.S. standard units of 1 atm, 20 C,  $\alpha=1.0$ ,  $\beta=1.0$ ,  $DO=0$ . Temperature shall be corrected with an Arrhenius coefficient of 1.024.
  - e. Minimum standard oxygen transfer efficiency of the surface impeller shall be 3.6 lbs O<sub>2</sub> per motor HP hour. Motor cut sheets shall be included to document efficiency used to convert wire to motor HP.
- C. Complete operating and maintenance instructions shall be furnished in accordance with Section 01350 – Operations and Maintenance Data. The instructions shall be prepared specifically for this installation and shall include all required drawings, equipment lists, descriptions, and other information required to instruct operating and maintenance personnel with such equipment. The maintenance instructions shall include troubleshooting data and full preventive maintenance schedules.

#### 1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM).
- B. American Public Health Association (APHA).
- C. American National Standards Institute (ANSI).
- D. American Society of Mechanical Engineers (ASME).
- E. American Water Works Association (AWWA).
- F. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
- G. American Welding Society (AWS).
- H. National Fire Protection Association (NFPA).
- I. Rubber Manufacturers Association (RMA).
- J. National Electrical Manufacturers Association (NEMA).
- K. Antifriction Bearing Manufacturers Association (AFBMA).

- L. American Gear Manufacturers Association (AGMA).
- M. Federal Specifications (FS).
- N. Manufacturer's published recommendations and specifications.
- O. Institute of Electrical and Electronics Engineers (IEEE).
- P. International Society of Automation (ISA).
- Q. Underwriters Laboratories (UL).
- R. International Electrical Testing Association (NETA).

#### 1.05 QUALITY ASSURANCE

- A. All the equipment shall be of standard materials and construction furnished from a single Manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be supplied. The equipment shall be manufactured and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.
- B. Manufacturer's Qualifications:
  - 1. The equipment Manufacturer shall have not less than ten (10) years of satisfactory service experience in the design, construction, and operation of extended aeration systems with five (5) or more installations of similar size and type.
- C. Services of Manufacturer's Representative:
  - 1. The Manufacturer of the mechanical surface aerators shall furnish the services of a factory representative who has complete knowledge of proper operating and maintenance to inspect the final installation and supervise a test run of the equipment. The Manufacturer shall furnish a minimum of 2 separate trips and a minimum of 4 days total on-site service.
- D. Acceptable Manufacturers:
  - 1. The naming of a Manufacturer in this specification is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the experience and capability of engineering and supplying a system as specified.
    - a. Ovivo.
    - b. WesTech.

#### 1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS

- A. Extended aeration system shall conform to the following and manufacturer shall account for an additional 1.15 safety factor on the loadings:

## 1. Plant Influent Criteria:

	<i>Average Annual Daily Flow (AADF)</i>	<i>Maximum Month Flow (MMF)</i>
Flow Rate	8.66 MGD	13.90 MGD
Biological Oxygen Demand (BOD) Concentration	215 mg/L	190 mg/L
Mixed Liquor Suspended Solids (MLSS) Loading	15,500 lb/d	22,000 lb/d
Ammonia Concentration	29 mg/L	26 mg/L
Ammonia Loading	2,1000 lb/d	3,020 lb/d
Total Kjeldahl Nitrogen (TKN) Concentration	44 mg/L	39 mg/L
TKN Loading	3,180 lb/d	4,520 lb/d

## 2. Plant Effluent Criteria:

	<i>Spring</i>	<i>Summer</i>	<i>Winter</i>
Carbonaceous Biological Oxygen Demand (CBOD) Concentration	6.2 mg/L	5.0 mg/L	15.6 mg/L
Total Suspended Solids (TSS) Concentration	6.2 mg/L		18.7 mg/L
Ammonia as Nitrogen Concentration	0.6 mg/L	0.3 mg/L	2.6 mg/L
Dissolved Oxygen (DO) Concentration	7.0 mg/L	7.5 mg/L	5.0 mg/L

## 3. Unit Design Criteria:

	<i>Average Annual Daily Flow (AADF)</i>	<i>Maximum Month Flow (MMF)</i>
Aeration Hydraulic Retention Time	28 hr	17 hr
Organic Loading Rate	11.6 lb/d*1,000ft <sup>3</sup>	16.5 lb/d*1,000ft <sup>3</sup>
MLSS Concentration	3,300 mg/L	3,700 mg/L
F/M Ratio	0.06 lb BOD/lb MLSS	0.07 lb BOD/lb MLSS
Elevation	1,150 ft above sea level	

## B. System Responsibilities:

1. Furnish low speed, fixed, mechanical surface aerators. The equipment shall include a drive motor, gear reducer, impeller with shaft and coupling, base plate, anchorage studs, and fasteners. The aerators shall be mounted on fixed platforms and shall be designed to both oxygenate and mix the oxidation ditch contents.
2. Furnish adjustable effluent weir gates suitable for installation in the effluent chamber as shown on the Drawings. Each gate shall consist of a manual drive gear

reducer, stand, shaft, actuator, and gate assembly. The weir gate assembly shall include the necessary frame and seals for a complete assembly.

3. Furnish control systems consisting of a dissolved oxygen system for each basin, and any other control equipment as required by the Manufacturer.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall store and temporarily support equipment prior to installation in accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.
- B. Store gear reducers and motors in buildings or trailers which have a concrete or wooden floor, a roof and fully enclosed walls on all sides. Protect the equipment from being contaminated by dust, dirt, vibration, and moisture.
- C. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.
- D. Components shall be packaged in separate containers legibly marked to identify contents. Each box or packages shall be legibly marked to show its net weight.
- E. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and shall be properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.
- F. Ship equipment and material complete and ready for installation.
- G. At the time of shipment, the shipping list, original bill of loading, shipping memorandum and invoice shall be delivered in triplicate to the Owner's Field Representative. Each shipping list shall give the description and net weight of each item, and gross weight of the shipment. Shipment will not be accepted until the list has been received. Demurrage or other charges resulting from failure to furnish these lists shall be absorbed by the Contractor.

#### 1.08 MAINTENANCE/SPARE PARTS

- A. Furnish special tools required for normal operation and maintenance of the equipment. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.
- B. The following spare parts shall be furnished:
  1. One (1) low oil flow cutout switch.
  2. One (1) flexible motor coupling (each size required).
- C. All spare parts shall be packed in suitable storage containers and legibly marked as to the contents.

## 1.09 WARRANTY/EXTENDED WARRANTY

- A. The Warranty shall be in accordance with Section 01750 – Warranties and Bonds.

## PART 2 PRODUCTS

### 2.01 AERATORS

A. Motor

1. Each aerator shall be driven by a single speed 250 HP, totally enclosed fan cooled (TEFC), constant torque, premium efficiency motor wired for 460 volt (V), 60 cycle, 3-phase current and suitable for VFD application. The nominal motor speed shall be 1,800 rpm. The minimum motor bearing life shall be 200,000 hours.
2. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load.
3. The motor shall have a service factor of 1.15 on sine wave power and a 1.0 service factor on VFD supplied power and shall comply with the applicable provision of the Standards of NEMA.
4. Each motor shall be equipped with a suitably sized space heater to keep condensation from forming when the motor is not running. The space heater shall operate on the control voltage.
5. Each motor shall be equipped with a normally closed thermostatic heat protection device to protect the motor from overheating during operation. The unit shall immediately stop the aerator drive motor in the event of excessive heat buildup.
6. Each Aerator shall be supplied with a local E-Stop..
7. Motors shall be suitable for operation in a moisture-laden atmosphere. The conduit boxes shall be gasketed with neoprene or equivalent material, so as to prevent moisture from entering the stator through the conduit box. Stainless steel condensation drains shall be suitably positioned in the lower external surface, so that any accumulation of moisture can drain from the complete motor housing. Ball bearings shall be supplied and shall be grease lubricated. Grease reservoirs shall be ample, and provisions shall be made for re-greasing with a lubrication system where grease is flushed through the bearings. The winding end turns shall be dipped and baked with a non-hygroscopic varnish, the stator bores and rotor cores shall be coated with epoxy paint. The entire enclosure shall be finish painted by the motor Manufacturer at the factory with a corrosion-resistant paint to provide additional protection against moisture and contaminants. The nameplates shall be stainless steel.

B. Gear Reducer

1. Each gear reducer shall be of the helical or spiral-bevel gear type. The gear reducer shall be sized with a minimum service factor of 2.5 times the motor nameplate horsepower rating in accordance with applicable AGMA standards when each unit is operating at full load motor horsepower, 24 hours a day continuous running under moderate shock loads. The efficiency of the gear reducer shall not be less than 94-percent based on the input horsepower. The gear reducers shall be designed for vertical input and output shaft operation. The gear reducer shall be specifically designed for the loading associated with aerators and shall have an independent lower bearing. The bearing shall be external to the gear box housing to

- accommodate an oversized shaft/bearing assembly capable of handling external axial and radial forces associated with the longer overhung loads.
2. The gear reducer housing shall be cast iron construction with provisions for the attachment of suitable lifting devices. The housing shall be constructed of high tensile strength cast-iron conforming to ASTM A48 Class 30, minimum with integral dry well construction to eliminate oil leakage at the output shaft and prevent loss of lubrication in the event of a seal failure. The housing shall be designed to withstand all loads imposed from the operation of the equipment. Cast iron, housing shall be stress relieved prior to machining. The housing shall also be tested to preclude casting porosity or weld defects that could result in oil leakage. Lifting lugs shall be providing on the housing suitably located to enable safe removal of the combined electric motor and gear unit from the supporting platform. Removable inspection cover(s) or inspection port(s) shall be provided. The motor and coupling shall be assembled, painted, and match marked by the gear reducer Manufacturer. The entire gear reducer assembly shall be finish painted by the reducer Manufacturer at the factory with a corrosion-resistant paint to provide additional protection against moisture and contaminants. The nameplate shall be stainless steel.
  3. Each reduction unit shall have gearing of the helical or spiral-bevel gear type. The units shall be designed to AGMA Service Classification III. All shafts shall be supported on tapered roller or double spherical roller bearings. Gears and pinions shall be made of alloy steels. Shafting shall be made out of medium carbon steel. The gear teeth shall be through-hardened or carburized. Flame hardened gears will not be acceptable. All gears shall be made from alloy steels with sufficient hardenability to obtain case and core properties meeting the requirements for grade 2 material in accordance with ANSI/AGMA D04. The steel alloy shall be selected, and the heat treatment shall be controlled, to obtain a microstructure that meets all the requirements for grade 2 material in accordance with ANSI/AGMA D04.
  4. All gears shall meet the accuracy requirements for AGMA quality No. Q12 in accordance with ANSI/AGMA B88. Pitting resistance and bending fatigue resistance shall be rated in accordance with ANSI/AGMA B88.
  5. All bearings incorporated within the gear reduction unit shall have a rating-life expectancy of 100,000 hours rating-life expectancy (B-10), except those bearings attached directly to the output shaft which shall have a rating of 250,000 hours. All bearings shall be of the anti-friction type. Bearing life shall be rated in accordance with ANSI/ABMA Std. 11 based on operating continuously at the rated full load horsepower and speed.
  6. Lubrication shall be accomplished wholly or in part by an integral mechanical oil circulating pump externally accessible and driven directly by one of the gear trains. The lubrication of the speed reducer shall conform to AGMA 9005-E02. The lubrication system shall incorporate a reliable oil flow cutout switch device which will immediately signal the VFD to stop operation and transmit an alarm signal to the Aeration Control System in the event of insufficient lubrication. Each electrical switch shall be wired to its respective aerator VFD. The gear reducer housing shall be provided with an oil sight glass or dip stick and oil flow indicator to observe oil level and effectiveness of the pump while the unit is in operation. Oil fill and drain lines shall be sufficient size to permit efficient functioning and shall be located on the gear unit in a position which is easily accessible from the bridge platform. The

oil drain piping shall be installed so that a container may be placed under the drain discharge.

- a. The Contractor shall be responsible for supplying the initial lubricants required for startup, as well as the first change of oil. The Contractor shall purchase the oil from a local firm selected by the Owner in accordance with the information in the Operation and Maintenance Manual to assure lubricant compatibility.
7. All grease lubricated bearings shall have seals to retain the grease. The low-speed shaft shall have grease lubricated bearings and shall utilize dry-well construction to prevent oil leakage and contamination of the process stream. The dry well shall be 100% maintenance free with no wearing parts. The dry well shall be sealed by a non-contact double labyrinth seal or a v-ring and an oil seal to prevent leakage down the output shaft with a return drain above. Additionally, the output end of the well shall include the upper and lower bearing seals and separate oil seal. All grease lubrication pressure lines shall be fed from fittings accessibly located above the platform supporting the mechanism.
8. Each gear reducer shall be mounted on a support with hot dipped galvanized steel bolts. The support shall be mounted on four (4) zinc plated jack studs inserted in the platform structure and designed to withstand all normal operating loads. The jack studs shall have the capability to provide a total vertical adjustment of six (6) inches. The jack stud nuts shall be drilled and tapped with set screws and vibration isolation pads and stainless steel washers shall be provided.
9. Each gear reducer shall be equipped with a suitable oil immersion-type heater for pre heating the lubrication oil prior to start up after prolonged periods of shut-down in cold weather. The heaters shall have an automatic thermostatic control and shall operate on the control voltage.

C. Impeller, Shaft, and Coupling

1. Each surface impeller shall be a rim-blade type with minimum seven (7) and maximum ten (10) equally spaced blades and constructed of 1/2-inch minimum steel plate. The rim plate shall be submerged at all operating conditions, except during basin draining operations, to reduce the effects of variable loading on the aerator support structure and deck.
2. The impeller blades shall be welded to the plate element. The outer ends of the blades shall be shaped to enable air-intake slots behind the blade-tips.
3. The pipe shaft and impellers shall be constructed so that no field assembly or welding is required.
4. The impeller shall operate with a maximum tip speed and maximum impeller speed selected by the Manufacturer. The impeller shall present a minimum amount of edge perpendicular to the flow to prevent the attachment of solid materials. The gear reducer shall be connected to the impeller by a rigid cast iron type coupling.
5. The surface impeller shall provide oxygenation and propulsion of the mixed liquor in the oxidation ditch.
6. The aerator shaft shall be attached to the gear reducer by a rigid, cast iron flange-type coupling. A retainer plate shall be provided for mounting to the end of the gear reducer output shaft to provide protection against disengagement of the coupling from the gear reducer output shaft. The flanges and flange-type coupling shall be assembled with A325 high strength bolts only. Stainless steel fasteners are not acceptable.

7. All structural steel used in the fabrication of the aerator shall conform to the requirements of "Standard Specifications for Structural Steel" ASTM Specification A36. All shop welding shall conform to the latest standards of AWS. Fabricated assemblies shall be shipped in convenient sections as permitted by carrier installations.

D. Performance

1. The surface impeller shall be capable of delivering an oxygen transfer efficiency of no less than 3.6 lb. O<sub>2</sub>/HP-hr based on motor output power at standard transfer conditions. If the Manufacturer cannot provide full documentation as required in paragraph 1.03 B. to demonstrate compliance with this requirement, the Manufacturer shall perform full-scale tests of oxygen transfer efficiency in the presence of the Engineer.

2.02 RECIRCULATION GATES (NOT USED)

2.03 EFFLUENT WEIR GATES

A. Weir Gate Components

1. Two (2) weir gates shall be furnished per oxidation ditch suitable for installation in the effluent flow structure as shown on the Drawings.
2. The equipment furnished for each weir gate mechanism shall include weir plate, operators as required, side and invert seals, operating stems, plastic stem covers, support frames, guide bearings, fasteners, and anchor bolts.
3. Stainless steel anchor bolts and fasteners with necessary hex nuts and washers shall be provided for all parts of the gate assembly.

B. Weir Gate Assembly

1. Each gate shall be constructed from 1/4-inch steel plate properly stiffened with rib extensions and supports. The gate shall include a pin connection for the dual actuators designed to support both the vertical load and the hydraulic load. The gate assembly will provide for a minimum of 12 inches vertical adjustment. Each gate shall include a revolving shaft assembly fixed between guide bearings mounted to the floor and stand. The floor bearing shall be a thrust type alignment bearing, supporting the entire weight of the unit. The upper guide bearing shall be an integral part of the support stand and shall be mounted just below the worm gear reducer. The center guide bearing, if required by the shaft length, shall be mounted just above the water surface on the lower part of the shaft and shall be field aligned after installation of all other components, assuring proper rotational capability.
2. The unit shall be designed to allow adjustment for concrete tolerances of  $\pm 1/2$ -inch. The unit shall be erected and lubricated in strict accordance with instructions from the Manufacturer.

C. Actuator Assembly

1. The actuator assembly shall include a dual reducer system connected by an actuator-connecting shaft and controlled by a single handwheel. The actuator-connecting shaft shall include the necessary support bearings to prevent binding during operation. The Manufacturer of the actuator shall be in accordance specification section 15139 – Electric Actuators for Valves and Gates.



## D. Gear Reducer

1. The gear reducer shall be of the worm gear type design and have the ability to backdrive without locking of the worm. The worm gear operator shall be of heavy-duty construction, totally enclosed in a cast iron housing and provided with adequate seals to protect the interior of the housing. The housing shall be designed so that all gears and bearings are grease packed and factory sealed to prevent condensate formation. The gear shall be designed to operate under the full load as applied from the rotating gate. The reducer shall be equipped with a 20-inch aluminum hand wheel and require no more than 25 revolutions to rotate the gate a full 112.5 degrees in one direction.
2. The reducer mechanism shall be fitted to the gate shaft with a sleeve and key for ease of assembly and disassembly.
3. The reducer shall be supported on a steel stand that is anchored to the concrete floor or side wall by epoxy type 304 stainless steel anchors. The stand shall be 4-feet off the ground to allow the operator a convenient grip on the handle for clockwise or counterclockwise turning.

## E. Gate Rotating Assembly

1. The revolving shaft shall be supported at each end in such a manner that a slight vertical or horizontal misalignment shall not interfere with the smooth operation of the gate. The shaft shall revolve from the turning of the gear unit.
2. Each gate shall be designed to operate smoothly under the flow conditions existing in the aeration basin. The gate shall include a position lock, lock pin with retention chain and shall be adjustable in 22.5-degree increments over a 112.5-degree range. The gate shall include a wall stop bracket, complete with 304 stainless steel wall anchors.

## 2.04 SYSTEM CONTROL

- A. The primary objective of the control system will be to adjust aerator power input to match the oxygen demand using DO concentration as the primary control parameter. The DO level will be monitored at the location shown on the Drawings. The rotational speed of each aerator, aerator run status, aerator run time, aeration system on status, Normal/Low/High DO status, power on/off, high motor temperature, and low reducer oil pressure/flow shall also be monitored. All monitored parameters shall have separate outputs available for the plant SCADA system.
- B. The control system will use the DO signal to pace the VFD in "auto mode" while the operator will manually control the VFD speed using the operator interface. The entire system shall be designed to restart after power outage if there are no alarm conditions that would normally shut the unit down. Status and alarm lights with an audible alarm shall be included.
- C. The Aeration System Control Panels (one panel per basin) shall be constructed in accordance with Division 16
- D. A single UL 508A control panel will be supplied per Aeration Basin. The control system shall include but not be limited to the following components:
  - a. NEMA 12 enclosure.

- b. PLC (Allen-Bradley) for system operation.
- c. Human-Machine Interface.
- d. Ethernet fiber optic switch for connection to the Plants SCADA System.
- e. Equipment status indications will be displayed on the HMI.
- f. Emergency stop and alarm silence pushbuttons located on panel front.
- g. Alarm Horn on panel exterior.
- h. Relays for control as required.
- i. Interface for all instrumentation shown on the P&IDs and as required for operation of the filters.
- j. No IEC Components allowed.

## 2.05 DISSOLVED OXYGEN MONITORING EQUIPMENT

- A. The dissolved oxygen (D.O.) monitoring system shall consist of a sensor utilizing luminescent sensor technology, analyzer, and auxiliary equipment to facilitate mounting the DO monitoring system. Two (2) probes and one monitoring system per basin shall be furnished. The probes shall be located as shown in the Drawings and be easily accessible for maintenance and removal.
- B. The system shall output a signal proportional to the DO level and the measured temperature. The monitor shall meet NEMA 4X requirements and shall be supplied with adequate length of cable for installation as shown on the Drawings. The system shall be able to display the following parameters:
  - 1. DO Concentration.
  - 2. Temperature (in °F).
  - 3. Selected value for alarm (high and low).

- C. The Manufacturer of the DO monitoring system shall be Hach Equipment.

<i>Manufacturer:</i>	<i>Hach</i>
Sensor Model No:	9020000Stainless (Hatch)
Sensor NEC Classification	Class I, Div 2, Group C & D
Range:	0-20 mg/l
Cleaning System	Mfg. Standard Air Cleaning System
Transmitter Mounting	Float Mount Assembly Hatch 49253100 (Hach)
Controller	Hach SC200 Multi-parameter Universal Controller (DO and Ammonia may share the same controller)
Supply Voltage	120V AC
Signal Output:	4 to 20 mA
Housing:	NEMA 4X

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation of all systems, subsystems, equipment, materials, and other items covered by this Section shall be assembled, installed, and aligned in compliance with the Supplier's instructions and recommendations and in conformance with this Section.

- B. The equipment Manufacturer shall include in their instructions such information as is required to properly install all items covered in this Section, whether manufactured by them or not.
- C. Keep surfaces where metal and concrete come in contact free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.
- D. Finish surfaces to provide a smooth and uniform contact surface where concrete and rubber seals come in contact and where flat frames or plates are installed.

### 3.02 INSPECTION

- A. Furnish a factory representative experienced in the erection, operation, and maintenance of the equipment. The representative shall be present during the initial installation of the aerator equipment to ensure that satisfactory procedures are followed and shall provide periodic supervision and inspection consisting of a number of trips listed previously in this Section. The equipment Manufacturer's representative shall in addition, be present to supervise testing and startup of the extended aeration system and shall provide any other assistance to the Contractor necessary to guarantee satisfactory performance of the equipment.

### 3.03 FIELD TESTING

- A. A certified full-scale oxygen transfer test report in an oxidation ditch configuration of at least 500,000 gallons using the ASCE 2-06 clean water, non-steady state method, meeting the minimum requirements of this specification shall be provided by one of the listed third parties: Stenstorm, Rosso or Redmon. If this is not provided manufacturer/contractor shall perform a full-scale clean water test at no cost to Owner, in one of the basins in accordance with ASCE 2-06 including the cost of chemicals, clean water, disposal of test water, sulfite mixing tank and pumps with one of the above mentioned third party witnessing and certifying the test. Steady state or endogenous mixed liquor tests may not be used and with no modifications to the overall project schedule.
- B. During the start-up of the equipment, if a reference test report of similarly sized equipment is not available, the equipment Manufacturer shall test the equipment to verify that the velocity requirements have been met. Average velocity shall be determined from an arithmetic average 16 points in a cross section of the channel. These points shall be gathered at four equally spaced points across the width of the tank and four equally spaced points from the liquid level to the tank bottom. Average of all values at the full power condition shall not be less than 1 fps. The Contractor shall construct a bridge spanning the middle of the oxidation ditch to allow a suitable platform for testing to be done.
- C. The test runs on the mechanical aerators shall be undertaken with water in the aeration tanks filled up to the High-water elevation shown on the Drawings. The Contractor shall be responsible for providing sufficient water or treated wastewater for filling the tanks for the test runs on the aerators. The test runs on the aerators shall confirm the aerators are providing sufficient velocities and in the correct direction of flow as indicated in the Drawings.

- D. After the aerator is installed and aligned, and the Manufacturer's recommendations for initial start-up have been implemented, the aerator shall be run at full speed and full load for a minimum of two hours after the oil temperature has stabilized. The gear reducer housing and shaft seals shall be checked for leakage of lubricant. Any leaks shall be corrected, and the temperature rise of the lubricant in the oil sump of the gear reducer shall not exceed 100°F above ambient.
- E. In the event of improper installation, the Contractor and the Manufacturer shall be responsible for supervising the correction of the work and subsequent test runs until the defects are corrected.

### 3.04 SCHEDULE

- A. Provide the following equipment for the extended aeration system as shown in the schedule below:

<i>Equipment</i>	<i>Quantity</i>
Oxidation Ditch System	2
Mechanical Surface Aerators	3 per basin; 6 total
Variable Frequency Drives (VFDs)	1 per aerator; 6 total (Supplied under the Electrical Portion of the Project)
Adjustable Weir Gates	Total weir length = 40-feet per basin
DO Probes	2 per basin; 4 total
Control System	1 per basin; 2 total

END OF SECTION

2

**SECTION 11388**  
**HYPERBOLIC MIXER (NOT USED)**



**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and install, complete and ready for operation of hyperbolic mixers in anoxic tanks as shown on the Drawings and as specified herein.
- B. The equipment under this specification shall be provided by a single Supplier. This specification is intended to cover the furnishing, delivery, installation instructions, installation assistance and field testing of all materials, equipment and all appurtenances required to complete the Work of this Section, whether specifically mentioned in these Specifications or not.
- C. The Contractor will be responsible for equipment unloading, storage and installation per directions of the Supplier. The Supplier shall provide shop drawings, field assistance for installation, verification of system installation, start-up and testing of the equipment provided to place into successful operation, as specified herein. The Supplier shall be responsible for conducting acceptance testing, operation and maintenance training of the Owner's personnel and Operation and Maintenance Manuals.

**1.02 RELATED WORK**

- A. Section 09900 – Painting.
- B. Division 16 – Electrical.
- C. Division 17 – Instrumentation.

**1.03 SUBMITTALS**

- A. Submit, in accordance with Section 01300 – Submittal Procedures, shop drawings, catalog sheets showing product data, operational characteristics, dimensions, and the following items:
  - 1. Certificate of compliance or complete list of all deviations from the drawings and specifications.
  - 2. Complete installation and assembly drawings, showing the Manufacturer's dimensions, weights, and loadings, and descriptive information in sufficient detail to show the kind, size, weight, arrangements, operation, component materials and devices, external connections, anchorages and supports required, performance characteristics, and dimensions needed for installation.
  - 3. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment furnished will be submitted for review.

4. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
5. Descriptive literature, bulletins and/or catalogs of the equipment.
6. Manufacturer's installation instruction and certification.
7. Operation and Maintenance Manual.
8. Manufacturer's warranty agreement in compliance with the Contract Documents.
9. Electrical data including control wiring. Electrical/pneumatic requirements, schematic diagrams, and details of components including enclosures.
10. Complete motor and drive data.
11. The total weight of the equipment including the weight of the single largest item.
12. A complete total bill of materials of all equipment.
13. A list of Manufacturer's recommended spare parts to be supplied in addition to those specified in Paragraph 1.08 below with the Manufacturer's current price for each item.
14. Test plan for tests specified in Paragraph 3.02 below.
15. Provide certified test reports that demonstrate compliance with performance requirements. Acceptance test conditions are described in Paragraph 3.02 below.

B. Test Reports

1. Submit certified test reports as specified in this Section.
2. Submit certified motor test data.

C. Submit Manufacturer's installation instructions.

D. Submit operation and maintenance data in accordance with Section 01350 – Operation and Maintenance Data.

E. Submit qualifications of service engineer.

F. Submit a Manufacturer's field report including the following:

1. Report of installation, inspection, testing and observations for each mixer.
2. Letter of Certification.

#### 1.04 REFERENCE STANDARDS

- A. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
- B. ABMA11 – Load Ratings and Fatigue Life for Ball Bearings.
- C. American Society for Testing and Materials (ASTM).
- D. American Public Health Association (APHA).
- E. American National Standards Institute (ANSI).
- F. American Society of Mechanical Engineers (ASME).
- G. American Water Works Association (AWWA).

- H. American Welding Society (AWS).
- I. National Fire Protection Association (NFPA).
- J. National Electrical Manufacturers Association (NEMA).
- K. Antifriction Bearing Manufacturers Association (AFBMA).
- L. American Gear Manufacturers Association (AGMA).
- M. Federal Specifications (FS).
- N. Manufacturer's published recommendations and specifications.
- O. Institute of Electrical and Electronics Engineers (IEEE).
- P. International Society of Automation (ISA).
- Q. Underwriters Laboratories (UL).
- R. International Electrical Testing Association (NETA).
- S. Occupational Safety and Health Administration (OSHA).

#### 1.05 QUALITY ASSURANCE

- A. Submersible mixers shall be provided by a single Manufacturer who is fully experienced for at least 10 years, reputable and qualified in the manufacture of the type and size of mixers to be provided. The mixers shall be designed, constructed, delivered, and installed in compliance with the best practices and methods and shall operate satisfactorily when installed.
- B. Equipment which is a "standard product" with the Manufacturer shall be modified, redesigned from the standard mode, if necessary, or shall be furnished with special features, accessories, special materials, special finishes, etc, as may be necessary to conform to the requirements shown on the Drawings or as specified herein.
- C. Both the mixer and motor Manufacturers shall currently have maintenance and repair facilities established and in operation in the United States. Such facilities shall be fully equipped and staffed with qualified personnel for making repairs to damaged mixers and motors, and shall carry or have direct access to a full line of normal maintenance spare parts.
- D. Certification factory certified engineer or local Field Service Representative as required in Paragraph 1.08.
- E. Mixer unit shall be approved according to UL standards.
- F. Mixer manufacturing shall take place under ISO 9001 certification.

- G. **Manufacturer's Certification:** Provide a letter of certification addressed to the Owner and signed by an authorized representative of the Manufacturer. The letter shall state the following:
  - 1. The equipment will efficiently and thoroughly perform the required functions in accordance with these Specifications and the Drawings, that the materials are best suited for the application, and the Manufacturer accepts joint responsibility with the Contractor for coordination of equipment, including motors, controls, and services required for proper installation and operation of the completely assembled and installed unit.
  - 2. The equipment has been installed in accordance with the Manufacturer's recommendations, and is in proper adjustment and operating condition, the Manufacturer is prepared to warrant the equipment to perform in full compliance with these specifications, and the equipment is ready to be turned over to the Owner for operation.
  - 3. The Manufacturer has inspected the installation and verified training of the Owner's operations and maintenance personnel upon completion of the system installation.
- H. **Services of Manufacturer's Representative**
  - 1. Provide services of mixer Manufacturer's factory service engineer specifically trained in the installation, final field testing and providing instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment in this Section. The services of the Manufacturer's representative shall be made available during the installation period for assistance to the Contractor for adjusting and checking equipment.
- I. **Acceptable Manufacturers:**
  - 1. Invent Environmental Technologies, Inc.

#### 1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS

- A. Mixers shall be designed for continuous-duty operation capable of re-suspending and homogenizing organic biological solids in the tanks over a short period of time.
- B. The mixer shall be designed with no submerged bearings and with a dry installed motor. The entire weight of the mixers shall be supported by concrete bridges/walkway.
- C. The mixer should be designed as a vertical shaft mixer, with a dry installed motor. During operation the mixer should not generate any upward forces on the bridge construction.
- D. The mixers shall be capable of completely mixing each anoxic zone as required to meet the requirements of the performance test outlined below. Each test will be conducted in the presence of the Engineer and the Owner. The performance requirements presented below define the minimum mixing capacity of each mixer.
- E. The equipment furnished shall include four (4) hyperbolic mixers for installation in the anoxic zones of the new Aeration Basins.



- F. The mixers shall conform to the following operating conditions:

1. Wastewater Properties:

	<i>Average Annual Daily Flow (AADF)</i>	<i>Maximum Month Flow (MMF)</i>
Flow Rate	8.66 MGD	13.90 MGD
MLSS Concentration	3,300 mg/L	3,700 mg/L
Organic Loading Rate	9.5 lb/d*1,000ft <sup>3</sup>	13.5 lb/d*1,000ft <sup>3</sup>

- G. The mixers shall perform at an acceptable homogenization range of +/- 10 %.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment unit installation is completed and the equipment is ready for operation.
- B. Equipment shall be handled and stored in accordance with the Manufacturer's instructions. None of the components of the equipment shall be dropped and all the components shall be examined before installation. No items shall be installed which are found to be defective and must be replaced by the Manufacturer.
- C. Factory assembled parts and components shall not be dismantled for shipment or storage unless recommended by the Manufacturer in writing to the Engineer.
- D. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built and securely bolted.
- E. Finished iron or steel surfaces not factory painted shall be properly protected to prevent rust and corrosion.
- F. No shipment shall be made until approved by the Engineer in writing.

1.08 MAINTENANCE/SPARE PARTS

- A. One set of rubber buffers per installed mixer type.
- B. One shaft holder for each shaft diameter supplied.
- C. All lubricating oils required for the first year of operation shall be provided. The products supplied shall be factory prefilled, in accordance with Manufacturer's recommendations.
- D. Spare parts shall be identical to and interchangeable with similar parts installed.

1.09 WARRANTY/EXTENDED WARRANTY

- A. The Warranty shall be in accordance with Section 01750 Warranties and Bonds

- B. The Manufacturer shall provide an all-inclusive two-year warranty from the date of successful startup and Owner acceptance. The warranty shall include normal wear and tear parts. All materials, equipment, and workmanship shall be free from defects in material or workmanship.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Provide all new materials and equipment free from defects.
- B. Where two or more units of the same type of material or equipment are required, provide products of a single Manufacturer.
- C. The mixer Manufacturer shall perform the following inspections and tests on each mixer before shipment:
1. One-second-high potential test.
  2. No load run test.
    - a. No load current
    - b. No load speed
    - c. Phase deviation current
    - d. No-load motor power
  3. Visual inspection of the unit and the tester listens for any abnormal noises
  4. A final inspection of hyperbolic mixer body diameter, motor rating, and electrical connections for compliance with contract requirements and purchase order.
  5. The above inspections and tests shall be executed under ISO 9001 certification.
  6. Certified copies of all test procedures and results shall be provided to the Engineer prior to shipment

### 2.02 MIXER

- A. Mixer Design Data:

<i>Location</i>	<i>Anoxic Zones in Proposed Extended Aeration System</i>
Number of Mixers per Anoxic Zone	1
Number of Anoxic Zones	4
Maximum Water Depth (ft)	17
Area per Anoxic Zone (sf)	4,700
Volume per Anoxic Zone (MG)	0.3
Type of Liquid to be Mixed	Mixed Liquor
Maximum Motor Size (HP)	7.5
Motor Classification	Unclassified (Motor installed 18" above the Top of Wall elevation)
Power Supply, (Phase/Voltage/Hertz)	3/460/60
Maximum propeller speed (rpm)	27
Duty	Continuous, designed for min 10 starts per hour

Propeller Material	FRP
Maximum Mixer Total Weight (lb)	2,000

- B. Each mixer assembly shall consist of a dry installed heavy-duty speed reducer with hollow shaft, electric motor, baseplate, composite FRP shaft, and composite hyperbolic mixer body.
- C. The bottom of the hyperbolic mixing body should not exceed 12 inches above the basin floor.
- D. Mixers shall be capable of handling biological activated sludge with a solids concentration from 0.1 to 0.5 percent solids with a SVI of minimal 80 l/kg., and shall be designed to prevent settlement in the tanks and to re-suspend biological material on the tank bottom.
- E. The mixer should have a steady stationary flow pointed downward parallel to the mixer shaft. The highest speeds and turbulent fluctuations should be produced in the bottom area. On the water surface, no or little surface turbulence should appear.

#### 2.03 GEAR DRIVE AND MOTOR

- A. The gear drive assembly for each mixer shall consist of parallel-shaft helical gear box and motor as designed by SEW Eurodrive.
- B. The gear drive assembly shall have a corrosion protection coating, severe weather protective hood, and thermostat switches for thermal protection of the motor.
- C. The gear box housing shall be cast iron covered with an epoxy coating, having a thickness of at least 6.0 mil. The gear box shall be connected to the mounting base using a flange connection with 316 additional stainless steel nuts and bolts.
- D. The gear box speed shall not exceed 27 rpm. The calculated lifetime L10 of the bearings shall exceed 100,000 hours. The motor shall be manufactured under ISO 9001 certification.
- E. The drive motors shall be a squirrel cage induction motor, 460 V, 3 phase, 60 Hz, 1,800 RPM, Class F insulation.
- F. The motors shall be equipped with a weather protection hood.
- G. The motors shall be equipped with integral thermal overloads mounted in the motor windings.
- H. The hollow shaft shall be covered and sealed with a special hollow shaft cap.

#### 2.04 HYPERBOLOID MIXER BODY

- A. Each hyperboloid mixer body shall be manufactured of FRP with gel coat and be a streamlined stress-free body.
- B. The transport ribs which accelerate the flow are integrated into the mixer body.

- C. No mixer body designs with welded ribs or fins are acceptable.

## 2.05 SHAFT

- A. The drive shaft of the mixer shall be made from FRP.
- B. At the top end of the mixer shaft, there shall be a tappet for the connection to the gear hollow shaft.
- C. At the lower end there, shall be a flange for the connection to the mixer body itself.
- D. All bolted connections shall utilize 316 stainless steel hardware.

## 2.06 MOUNTING BASE

- A. The mounting base of each mixer shall consist of a gear base plate mounted in rubber buffers connected permanently to the bridge/supports by bolted connection. The plate shall be able to be leveled using the threaded bolts, which can be adjusted in height.
- B. The rubber buffers shall absorb start-up torque, prevent any transfer of vibrations to the bridge and constitute the galvanic separation of the mixer from its surroundings.
- C. The mounting base shall be a fastening set for the concrete bridge/walkway with threaded rods and chemical anchors which are permanently anchored to the concrete.

## 2.07 FASTENERS

- A. All fasteners shall be of ANSI 316 stainless steel.

# PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install the hyperbolic mixers as shown on the Drawings and in accordance with Manufacturer's instruction and recommendations and approved shop drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the Manufacturer's recommendations.
- B. Submit a certificate from the Manufacturer stating that the installed equipment has been examined and found to be in complete accordance with the Manufacturer's requirements, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the equipment.

## 3.02 FIELD TESTING

- A. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing and Manufacturer's certificate is submitted.

- B. Functional Test. Prior to plant start-up, the equipment shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance. The equipment shall be operated for 48 hours without vibration, jamming, or overheating, and perform the specified function.
- C. In the event of improper installation or failure of the equipment to meet the specified performance, the Contractor shall be responsible for making all corrections of the work and subsequent test runs until the defects are corrected. If the system remains unable to meet the test requirements, the defective equipment shall be removed and replaced at the Contractor's expense.

END OF SECTION

**SECTION 17910****INPUT/OUTPUT LIST****PART 1 GENERAL****1.01 SCOPE OF WORK**

- A. Provide and install the required hardware to monitor and control the input/output subsystem. The preliminary input/output lists are attached at the end of this section. The Contractor shall coordinate with the Owner and the Engineer to verify all I/O physically at each site. The Contractor shall identify and document at the minimum the following:
  - 1. All existing cable termination points at the existing panel (ensure the length is adequate without excessive butt splices for the new control panel).
  - 2. Functionality as well as electrical characteristic of each cable.
  - 3. Label each cable in preparation for the final panel transfer with understanding that any given site cannot be down for more than an 8 hour period.
- B. Based on the information above Contractor shall design the control panel per specification section 17400 – Instrument Panels, and with minimal transfer time between the new and old control panels in mind.
- C. Provide 30% spare IOs or one spare each type of IO modules for each PLC. All spare IOs shall be wired to panel field terminal blocks and labeled as spare IO in the PLC panel drawing.
- D. **City of Oklahoma City Utilities Department SCADA Standards included in the Supplemental Special Provisions. Refer to Section 4.2.3 Hardware Standards to provide the City with the required PLC hardware including CPU modules, PLC rack, IO and communication modules.**
- E. **Refer to City of Oklahoma City Utilities Department SCADA Standards Appendices included in the Supplemental Special Provisions to provide PLC IO List.**

**1.02 RELATED WORK (NOT USED)****1.03 SUBMITTALS**

- A. Contractor shall submit an Input/Output list in Excel format, that includes PLC panel number, card and point location, configuration information, point description, point function and tag name.
- B. Literature and Drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the Specifications.

**1.04 REFERENCE STANDARDS (NOT USED)****1.05 QUALITY ASSURANCE (NOT USED)**

1.06 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS (NOT USED)

1.07 DELIVERY, HANDLING AND STORAGE (NOT USED)

1.08 MAINTENANCE/SPARE PARTS (NOT USED)

1.09 WARRANTY/EXTENDED WARRANTY (NOT USED)

## PART 2 PRODUCT

### 2.01 GENERAL

- A. The Input/Output list shall contain all items to be configuration items of the point and shall be capable of being imported and exported into the system via an Excel spread sheet.
- B. Provide a complete PLC and HMI database in spread sheet format submittal for City review. The tag listed in the PLC IO list might have discrepancy between City's latest naming standards. Contractor shall follow the City's latest standard and adjust tag name accordingly without asking for a change order.

## PART 3 EXECUTION

### 3.01 INPUT/OUTPUT LISTS



- A. Refer to the Input/Output sheets at the end of the specification.
  - 1. Future equipment are listed as following. Label future equipment IO as "FUTURE" in all PLC/HMI design documents.
  - 2. Refer to Control Narratives specification for future equipment program requirements.
  - 3. Provide future equipment IO check and test from PLC terminals.
  - 4. Future equipment list:
    - a. SCRA38PMP12503
    - b. SCRA38FIT20003
    - c. SCRA38FIT20004
    - d. SCRA38TSV20503
    - e. SCRA38TSV20504
    - f. SCAB30SLG11505
    - g. SCAB30SLG11506
    - h. SCRA38LIT20001
    - i. SCCL35PV11503
    - j. SCCL35CLR12003
    - k. SCCL35LSHH12521
    - l. SCCL35PMP14021
    - m. SCCL35PMP14022
    - n. CL3511WG11005
    - o. CL3511WG11006

**Admin Building PLC-050 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCAN00PLC05001.oTEMP	AI	Admin Building Ethernet IO Unit Temp	050
2	SCAN00TIT10101.oTEMP	AI	Admin Building SCADA Server Room Temperature	101
1	SCAN00PLC05001.oPWR_FAIL	DI	Admin Building Ethernet IO Unit 24Vdc Power Supply Fail	050
2	SCAN00PLC05001.oUPS_FAIL	DI	Admin Building Ethernet IO Unit UPS Fail	050
3	SCAN00PLC05001.oUPS_BATT_FAIL	DI	Admin Building Ethernet IO Unit UPS Battery Fail	050
4	SCAN00PLC05001.oINT_SW	DI	Admin Building Ethernet IO Unit Intrusion Switch	050
5	SCAN00ESW10201.oSW	DI	Admin Building Lab EyeWash	102



**Headworks and Influent Pump Station PLC-100 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCHW05PLC10001.oTEMP	AI	Headworks Influent PLC Temp	100
2	SCIP10PMP11501.oSPEED	AI	Influent Pump Station Wet Well Pump 1 Speed	115
3	SCIP10PMP11502.oSPEED	AI	Influent Pump Station Wet Well Pump 2 Speed	115
4	SCIP10PMP11503.oSPEED	AI	Influent Pump Station Wet Well Pump 3 Speed	115
5	SCIP10PMP11504.oSPEED	AI	Influent Pump Station Wet Well Pump 4 Speed	115
6	SCIP10PMP11505.oSPEED	AI	Influent Pump Station Wet Well Pump 5 Speed	115
7	SCIP10LIT13001.oFEET	AI	Influent Pump Station Level	130
8	SCPP15LIT12501.oFEET	AI	Peak Flow Pump Station Level	125
9	SCIP10FIT14001.oMGD	AI	Influent Pump Station Plant Drain Flow	140
10	SCIP10TIT71001.oTEMP	AI	Influent Pump Station Elect Room Temperature	710
11	SCPB18PV15001.oPOSITION	AI	FEB Valve Position	150
12	SCPP15LIT13501.oFEET	AI	FEB Pump Station Level	135
13	SCPB18FIT14201.oMGD	AI	FEB Flow	142
14	SCPB18FIT11001.oMGD	AI	FEB Basin 1 Influent Flow	110
15	SCPB18PIT11501.oPSI	AI	FEB Basin 1 Influent Press	115
16	SCPB18LIT12501.oFEET	AI	FEB Basin 1 Level	125
17	SCPB18LIT12502.oFEET	AI	FEB Basin 2 Level	125
1	SCIP10PMP11501.oSPD_STPT	AO	Influent Pump Station Wet Well Pump 1 Speed Setpoint	115
2	SCIP10PMP11502.oSPD_STPT	AO	Influent Pump Station Wet Well Pump 2 Speed Setpoint	115
3	SCIP10PMP11503.oSPD_STPT	AO	Influent Pump Station Wet Well Pump 3 Speed Setpoint	115
4	SCIP10PMP11504.oSPD_STPT	AO	Influent Pump Station Wet Well Pump 4 Speed Setpoint	115
5	SCIP10PMP11505.oSPD_STPT	AO	Influent Pump Station Wet Well Pump 5 Speed Setpoint	115
6	SCPB18PV15001.oPOS_STPT	AO	FEB Valve Position SetPoint	150
1	SCHW05PLC10001.oPWR_FAIL	DI	Headworks Influent PLC 24Vdc Power Supply Fail	100
2	SCHW05PLC10001.oUPS_FAIL	DI	Headworks Influent PLC UPS Fail	100
3	SCHW05PLC10001.oUPS_BATT_FAIL	DI	Headworks Influent PLC UPS Battery Fail	100
4	SCHW05PLC10001.oINT_SW	DI	Headworks Influent PLC Intrusion Switch	100
5	SCHW05SLG11001.oREMOTE	DI	Headworks Influent Overflow Channel Gate Remote	110
6	SCHW05SLG11001.oOPEN	DI	Headworks Influent Overflow Channel Gate Open	110
7	SCHW05SLG11001.oCLOSED	DI	Headworks Influent Overflow Channel Gate Closed	110
8	SCHW05SLG11001.oFAULT	DI	Headworks Influent Overflow Channel Gate Fault	110
9	SCHW05SLG12001.oREMOTE	DI	Headworks Influent Channel Gate 1 Remote	120
10	SCHW05SLG12001.oOPEN	DI	Headworks Influent Channel Gate 1 Open	120
11	SCHW05SLG12001.oCLOSED	DI	Headworks Influent Channel Gate 1 Closed	120
12	SCHW05SLG12001.oFAULT	DI	Headworks Influent Channel Gate 1 Fault	120
13	SCHW05SLG12002.oREMOTE	DI	Headworks Influent Channel Gate 2 Remote	120
14	SCHW05SLG12002.oOPEN	DI	Headworks Influent Channel Gate 2 Open	120
15	SCHW05SLG12002.oCLOSED	DI	Headworks Influent Channel Gate 2 Closed	120
16	SCHW05SLG12002.oFAULT	DI	Headworks Influent Channel Gate 2 Fault	120
17	SCHW05SLG14001.oREMOTE	DI	Headworks Effluent Channel Gate 1 Remote	140
18	SCHW05SLG14001.oOPEN	DI	Headworks Effluent Channel Gate 1 Open	140
19	SCHW05SLG14001.oCLOSED	DI	Headworks Effluent Channel Gate 1 Closed	140
20	SCHW05SLG14001.oFAULT	DI	Headworks Effluent Channel Gate 1 Fault	140
21	SCHW05SLG14002.oREMOTE	DI	Headworks Effluent Channel Gate 2 Remote	140
22	SCHW05SLG14002.oOPEN	DI	Headworks Effluent Channel Gate 2 Open	140
23	SCHW05SLG14002.oCLOSED	DI	Headworks Effluent Channel Gate 2 Closed	140
24	SCHW05SLG14002.oFAULT	DI	Headworks Effluent Channel Gate 2 Fault	140
25	SCHW05ODU70501.oLEL_ALARM	DI	Headworks Odor Control Unit LCP-130 LEL Alarm	705
26	SCHW05ODU70501.oFIRE_ALARM	DI	Headworks Odor Control Unit LCP-130 Fire Alarm	705
27	SCHW05ODU70501.oFAULT	DI	Headworks Odor Control Unit LCP-130 Common Fault	705

28	SCIP10ODU70501.oLEL_ALARM	DI	Influent Pump Station Odor Control Unit LCP-131 LEL Alarm	705
29	SCIP10ODU70501.oFIRE_ALARM	DI	Influent Pump Station Odor Control Unit LCP-131 Fire Alarm	705
30	SCIP10ODU70501.oFAULT	DI	Influent Pump Station Odor Control Unit LCP-131 Common Fault	705
31	SCIP10LSL12501.oON	DI	LCP180 Influent Pump Station Level Low	125
32	SCPP15LSH11501.oON	DI	LCP180 Peak Flow Pump Station Level High	115
33	SCPP15LSL12001.oON	DI	LCP180 Peak Flow Pump Station Level Low	120
34	SCIP10LSH12001.oON	DI	LCP180 Influent Pump Station Level High	120
35	SCIP10PMP11501.oREMOTE	DI	Influent Pump Station Wet Well Pump 1 Remote Mode	115
36	SCIP10PMP11501.oRUNNING	DI	Influent Pump Station Wet Well Pump 1 Running	115
37	SCIP10PMP11501.oFAULT	DI	Influent Pump Station Wet Well Pump 1 Fault	115
38	SCIP10PMP11501.oVFD_FAULT	DI	Influent Pump Station Wet Well Pump 1 VFD Fault	115
39	SCIP10PMP11501.oTEMP_HI	DI	Influent Pump Station Wet Well Pump 1 Temp Hi	115
40	SCIP10PMP11501.oLEAK	DI	Influent Pump Station Wet Well Pump 1 Leak	115
41	SCIP10PMP11501.oLEVEL_LOCKOUT	DI	Influent Pump Station Wet Well Pump 1 Level Lockout	115
42	SCIP10PMP11502.oREMOTE	DI	Influent Pump Station Wet Well Pump 2 Remote Mode	115
43	SCIP10PMP11502.oRUNNING	DI	Influent Pump Station Wet Well Pump 2 Running	115
44	SCIP10PMP11502.oFAULT	DI	Influent Pump Station Wet Well Pump 2 Fault	115
45	SCIP10PMP11502.oVFD_FAULT	DI	Influent Pump Station Wet Well Pump 2 VFD Fault	115
46	SCIP10PMP11502.oTEMP_HI	DI	Influent Pump Station Wet Well Pump 2 Temp Hi	115
47	SCIP10PMP11502.oLEAK	DI	Influent Pump Station Wet Well Pump 2 Leak	115
48	SCIP10PMP11502.oLEVEL_LOCKOUT	DI	Influent Pump Station Wet Well Pump 2 Level Lockout	115
49	SCIP10PMP11503.oREMOTE	DI	Influent Pump Station Wet Well Pump 3 Remote Mode	115
50	SCIP10PMP11503.oRUNNING	DI	Influent Pump Station Wet Well Pump 3 Running	115
51	SCIP10PMP11503.oFAULT	DI	Influent Pump Station Wet Well Pump 3 Fault	115
52	SCIP10PMP11503.oVFD_FAULT	DI	Influent Pump Station Wet Well Pump 3 VFD Fault	115
53	SCIP10PMP11503.oTEMP_HI	DI	Influent Pump Station Wet Well Pump 3 Temp Hi	115
54	SCIP10PMP11503.oLEAK	DI	Influent Pump Station Wet Well Pump 3 Leak	115
55	SCIP10PMP11503.oLEVEL_LOCKOUT	DI	Influent Pump Station Wet Well Pump 3 Level Lockout	115
56	SCIP10PMP11504.oREMOTE	DI	Influent Pump Station Wet Well Pump 4 Remote Mode	115
57	SCIP10PMP11504.oRUNNING	DI	Influent Pump Station Wet Well Pump 4 Running	115
58	SCIP10PMP11504.oFAULT	DI	Influent Pump Station Wet Well Pump 4 Fault	115
59	SCIP10PMP11504.oVFD_FAULT	DI	Influent Pump Station Wet Well Pump 4 VFD Fault	115
60	SCIP10PMP11504.oTEMP_HI	DI	Influent Pump Station Wet Well Pump 4 Temp Hi	115
61	SCIP10PMP11504.oLEAK	DI	Influent Pump Station Wet Well Pump 4 Leak	115
62	SCIP10PMP11504.oLEVEL_LOCKOUT	DI	Influent Pump Station Wet Well Pump 4 Level Lockout	115
63	SCIP10PMP11505.oREMOTE	DI	Influent Pump Station Wet Well Pump 5 Remote Mode	115
64	SCIP10PMP11505.oRUNNING	DI	Influent Pump Station Wet Well Pump 5 Running	115
65	SCIP10PMP11505.oFAULT	DI	Influent Pump Station Wet Well Pump 5 Fault	115
66	SCIP10PMP11505.oVFD_FAULT	DI	Influent Pump Station Wet Well Pump 5 VFD Fault	115
67	SCIP10PMP11505.oTEMP_HI	DI	Influent Pump Station Wet Well Pump 5 Temp Hi	115
68	SCIP10PMP11505.oLEAK	DI	Influent Pump Station Wet Well Pump 5 Leak	115
69	SCIP10PMP11505.oLEVEL_LOCKOUT	DI	Influent Pump Station Wet Well Pump 5 Level Lockout	115
70	SCPP15PMP11001.oREMOTE	DI	Peak Flow Pump Station Pump 1 Remote Mode	110
71	SCPP15PMP11001.oRUNNING	DI	Peak Flow Pump Station Pump 1 Running	110
72	SCPP15PMP11001.oFAULT	DI	Peak Flow Pump Station Pump 1 Fault	110
73	SCPP15PMP11001.oRVSS_FAULT	DI	Peak Flow Pump Station Pump 1 RVSS Fault	110
74	SCPP15PMP11001.oTEMP_HI	DI	Peak Flow Pump Station Pump 1 Temp Hi	110
75	SCPP15PMP11001.oLEAK	DI	Peak Flow Pump Station Pump 1 Leak	110
76	SCPP15PMP11001.oLEVEL_LOCKOUT	DI	Peak Flow Pump Station Pump 1 Level Lockout	110
77	SCPP15PMP11002.oREMOTE	DI	Peak Flow Pump Station Pump 2 Remote Mode	110
78	SCPP15PMP11002.oRUNNING	DI	Peak Flow Pump Station Pump 2 Running	110
79	SCPP15PMP11002.oFAULT	DI	Peak Flow Pump Station Pump 2 Fault	110
80	SCPP15PMP11002.oRVSS_FAULT	DI	Peak Flow Pump Station Pump 2 RVSS Fault	110
81	SCPP15PMP11002.oTEMP_HI	DI	Peak Flow Pump Station Pump 2 Temp Hi	110
82	SCPP15PMP11002.oLEAK	DI	Peak Flow Pump Station Pump 2 Leak	110

83	SCPP15PMP11002.oLEVEL_LOCKOUT	DI	Peak Flow Pump Station Pump 2 Level Lockout	110
84	SCPB18LCP19201.oLEVEL_HIHI	DI	LCP192 FEB Pump Station Sump Panel Level HighHigh	192
85	SCPB18LCP19201.oFAULT	DI	LCP192 FEB Pump Station Sump Panel Fault	192
86	SCIP10HCP17001.oPWR_ON	DI	Influent Pump Station Elect Room HVAC Control Panel Power On	170
87	SCIP10HCP17001.oALARM	DI	Influent Pump Station Elect Room HVAC Control Panel General Alarm	170
88	SCIP10AFU17501.oSW	DI	Influent Pump Station Elect Room Air Filter Unit Alarm	175
89	SCPP15ODU70501.oLEL_ALARM	DI	FEB Pump Station Odor Control Unit LCP-131 LEL Alarm	705
90	SCPP15ODU70501.oFIRE_ALARM	DI	FEB Pump Station Odor Control Unit LCP-131 Fire Alarm	705
91	SCPP15ODU70501.oFAULT	DI	FEB Pump Station Odor Control Unit LCP-131 Common Fault	705
92	SCPB18LCP19301.oLEVEL_HIHI	DI	LCP193 FEB Pump Station Sump Panel Level HighHigh	193
93	SCPB18LCP19301.oFAULT	DI	LCP193 FEB Pump Station Sump Panel Fault	193
94	SCPB18PV15001.oOPEN	DI	FEB Valve Open	150
95	SCPB18PV15001.oCLOSED	DI	FEB Valve Closed	150
96	SCPB18PV15001.oREMOTE	DI	FEB Valve Remote	150
97	SCPB18PV15001.oFAULT	DI	FEB Valve Fault	150
98	SCPP15LSH14501.oON	DI	LCP180 FEB Pump Station Level High	145
99	SCPP15LSL14001.oON	DI	LCP180 FEB Pump Station Level Low	140
100	SCPP15PMP13001.oREMOTE	DI	FEB Pump Station Wet Well Pump 1 Remote Mode	130
101	SCPP15PMP13001.oRUNNING	DI	FEB Pump Station Wet Well Pump 1 Running	130
102	SCPP15PMP13001.oFAULT	DI	FEB Pump Station Wet Well Pump 1 Fault	130
103	SCPP15PMP13001.oRVSS_FAULT	DI	FEB Pump Station Wet Well Pump 1 RVSS Fault	130
104	SCPP15PMP13001.oTEMP_HI	DI	FEB Pump Station Wet Well Pump 1 Temp Hi	130
105	SCPP15PMP13001.oLEAK	DI	FEB Pump Station Wet Well Pump 1 Leak	130
106	SCPP15PMP13001.oLEVEL_LOCKOUT	DI	FEB Pump Station Wet Well Pump 1 Level Lockout	130
107	SCPP15PMP13002.oREMOTE	DI	FEB Pump Station Wet Well Pump 2 Remote Mode	130
108	SCPP15PMP13002.oRUNNING	DI	FEB Pump Station Wet Well Pump 2 Running	130
109	SCPP15PMP13002.oFAULT	DI	FEB Pump Station Wet Well Pump 2 Fault	130
110	SCPP15PMP13002.oRVSS_FAULT	DI	FEB Pump Station Wet Well Pump 2 RVSS Fault	130
111	SCPP15PMP13002.oTEMP_HI	DI	FEB Pump Station Wet Well Pump 2 Temp Hi	130
112	SCPP15PMP13002.oLEAK	DI	FEB Pump Station Wet Well Pump 2 Leak	130
113	SCPP15PMP13002.oLEVEL_LOCKOUT	DI	FEB Pump Station Wet Well Pump 2 Level Lockout	130
114	SCPP15PMP13003.oREMOTE	DI	FEB Pump Station Wet Well Pump 3 Remote Mode	130
115	SCPP15PMP13003.oRUNNING	DI	FEB Pump Station Wet Well Pump 3 Running	130
116	SCPP15PMP13003.oFAULT	DI	FEB Pump Station Wet Well Pump 3 Fault	130
117	SCPP15PMP13003.oRVSS_FAULT	DI	FEB Pump Station Wet Well Pump 3 RVSS Fault	130
118	SCPP15PMP13003.oTEMP_HI	DI	FEB Pump Station Wet Well Pump 3 Temp Hi	130
119	SCPP15PMP13003.oLEAK	DI	FEB Pump Station Wet Well Pump 3 Leak	130
120	SCPP15PMP13003.oLEVEL_LOCKOUT	DI	FEB Pump Station Wet Well Pump 3 Level Lockout	130
121	SCPP15PMP13004.oREMOTE	DI	FEB Pump Station Wet Well Pump 4 Remote Mode	130
122	SCPP15PMP13004.oRUNNING	DI	FEB Pump Station Wet Well Pump 4 Running	130
123	SCPP15PMP13004.oFAULT	DI	FEB Pump Station Wet Well Pump 4 Fault	130
124	SCPP15PMP13004.oRVSS_FAULT	DI	FEB Pump Station Wet Well Pump 4 RVSS Fault	130
125	SCPP15PMP13004.oTEMP_HI	DI	FEB Pump Station Wet Well Pump 4 Temp Hi	130
126	SCPP15PMP13004.oLEAK	DI	FEB Pump Station Wet Well Pump 4 Leak	130
127	SCPP15PMP13004.oLEVEL_LOCKOUT	DI	FEB Pump Station Wet Well Pump 4 Level Lockout	130
128	SCPB18LCP19401.oLEVEL_HIHI	DI	LCP194 FEB Flow Meter Vault Sump Panel Level HighHigh	194
129	SCPB18LCP19401.oFAULT	DI	LCP194 FEB Flow Meter Vault Sump Panel Fault	194
130	SCPB18SLG14501.oREMOTE	DI	FEB Effluent Gate 1 Remote	145
131	SCPB18SLG14501.oOPEN	DI	FEB Effluent Gate 1 Open	145
132	SCPB18SLG14501.oCLOSED	DI	FEB Effluent Gate 1 Closed	145
133	SCPB18SLG14501.oFAULT	DI	FEB Effluent Gate 1 Fault	145
134	SCPB18SLG14502.oREMOTE	DI	FEB Effluent Gate 2 Remote	145
135	SCPB18SLG14502.oOPEN	DI	FEB Effluent Gate 2 Open	145
136	SCPB18SLG14502.oCLOSED	DI	FEB Effluent Gate 2 Closed	145

137	SCPB18SLG14502.oFAULT	DI	FEB Effluent Gate 2 Fault	145
138	SCPB18LSH13001.oON	DI	FEB Basin 1 Level High	130
139	SCPB18LSH13002.oON	DI	FEB Basin 2 Level High	130
140	SCPB18LSL13511.oON	DI	FEB Basin 1 Level Low	135
141	SCPB18LSL13521.oON	DI	FEB Basin 2 Level Low	135
142	SCPB18LSL13512.oON	DI	FEB Basin 1 Level Low	135
143	SCPB18LSL13522.oON	DI	FEB Basin 2 Level Low	135
144	SCPB18MX14001.oRUNNING	DI	FEB Mixer 1 Running	140
145	SCPB18MX14001.oFAULT	DI	FEB Mixer 1 Fault	140
146	SCPB18MX14002.oRUNNING	DI	FEB Mixer 2 Running	140
147	SCPB18MX14002.oFAULT	DI	FEB Mixer 2 Fault	140
148	SCPB18MX14003.oRUNNING	DI	FEB Mixer 3 Running	140
149	SCPB18MX14003.oFAULT	DI	FEB Mixer 3 Fault	140
150	SCPB18MX14004.oRUNNING	DI	FEB Mixer 4 Running	140
151	SCPB18MX14004.oFAULT	DI	FEB Mixer 4 Fault	140
152	SCPB18MX14005.oRUNNING	DI	FEB Mixer 5 Running	140
153	SCPB18MX14005.oFAULT	DI	FEB Mixer 5 Fault	140
154	SCPB18MX14006.oRUNNING	DI	FEB Mixer 6 Running	140
155	SCPB18MX14006.oFAULT	DI	FEB Mixer 6 Fault	140
156	SCPB18MX14007.oRUNNING	DI	FEB Mixer 7 Running	140
157	SCPB18MX14007.oFAULT	DI	FEB Mixer 7 Fault	140
158	SCPB18MX14008.oRUNNING	DI	FEB Mixer 8 Running	140
159	SCPB18MX14008.oFAULT	DI	FEB Mixer 8 Fault	140
160	SCPB18MX14009.oRUNNING	DI	FEB Mixer 9 Running	140
161	SCPB18MX14009.oFAULT	DI	FEB Mixer 9 Fault	140
1	SCHW05SLG11001.oOPEN_CMD	DO	Headworks Influent Overflow Channel Gate Open Cmd	110
2	SCHW05SLG11001.oCLOSE_CMD	DO	Headworks Influent Overflow Channel Gate Close Cmd	110
3	SCHW05SLG12001.oOPEN_CMD	DO	Headworks Influent Channel Gate 1 Open Cmd	120
4	SCHW05SLG12001.oCLOSE_CMD	DO	Headworks Influent Channel Gate 1 Close Cmd	120
5	SCHW05SLG12002.oOPEN_CMD	DO	Headworks Influent Channel Gate 2 Open Cmd	120
6	SCHW05SLG12002.oCLOSE_CMD	DO	Headworks Influent Channel Gate 2 Close Cmd	120
7	SCHW05SLG14001.oOPEN_CMD	DO	Headworks Effluent Channel Gate 1 Open Cmd	140
8	SCHW05SLG14001.oCLOSE_CMD	DO	Headworks Effluent Channel Gate 1 Close Cmd	140
9	SCHW05SLG14002.oOPEN_CMD	DO	Headworks Effluent Channel Gate 2 Open Cmd	140
10	SCHW05SLG14002.oCLOSE_CMD	DO	Headworks Effluent Channel Gate 2 Close Cmd	140
11	SCIP10PMP11501.oSTART_CMD	DO	Influent Pump Station Wet Well Pump 1 Start Cmd	115
12	SCIP10PMP11501.oSTOP_CMD	DO	Influent Pump Station Wet Well Pump 1 Stop Cmd	115
13	SCIP10PMP11502.oSTART_CMD	DO	Influent Pump Station Wet Well Pump 2 Start Cmd	115
14	SCIP10PMP11502.oSTOP_CMD	DO	Influent Pump Station Wet Well Pump 2 Stop Cmd	115
15	SCIP10PMP11503.oSTART_CMD	DO	Influent Pump Station Wet Well Pump 3 Start Cmd	115
16	SCIP10PMP11503.oSTOP_CMD	DO	Influent Pump Station Wet Well Pump 3 Stop Cmd	115
17	SCIP10PMP11504.oSTART_CMD	DO	Influent Pump Station Wet Well Pump 4 Start Cmd	115
18	SCIP10PMP11504.oSTOP_CMD	DO	Influent Pump Station Wet Well Pump 4 Stop Cmd	115
19	SCIP10PMP11505.oSTART_CMD	DO	Influent Pump Station Wet Well Pump 5 Start Cmd	115
20	SCIP10PMP11505.oSTOP_CMD	DO	Influent Pump Station Wet Well Pump 5 Stop Cmd	115
21	SCPP15PMP11001.oSTART_CMD	DO	Peak Flow Pump Station Pump 1 Start Cmd	110
22	SCPP15PMP11001.oSTOP_CMD	DO	Peak Flow Pump Station Pump 1 Stop Cmd	110
23	SCPP15PMP11002.oSTART_CMD	DO	Peak Flow Pump Station Pump 2 Start Cmd	110
24	SCPP15PMP11002.oSTOP_CMD	DO	Peak Flow Pump Station Pump 2 Stop Cmd	110
25	SCPB18PV15001.oOPEN_CMD	DO	FEB Valve Open Cmd	150
26	SCPB18PV15001.oCLOSE_CMD	DO	FEB Valve Close Cmd	150
27	SCPP15PMP13001.oSTART_CMD	DO	FEB Pump Station Wet Well Pump 1 Start Cmd	130
28	SCPP15PMP13001.oSTOP_CMD	DO	FEB Pump Station Wet Well Pump 1 Stop Cmd	130
29	SCPP15PMP13002.oSTART_CMD	DO	FEB Pump Station Wet Well Pump 2 Start Cmd	130
30	SCPP15PMP13002.oSTOP_CMD	DO	FEB Pump Station Wet Well Pump 2 Stop Cmd	130

31	SCPP15PMP13003.oSTART_CMD	DO	FEB Pump Station Wet Well Pump 3 Start Cmd	130
32	SCPP15PMP13003.oSTOP_CMD	DO	FEB Pump Station Wet Well Pump 3 Stop Cmd	130
33	SCPP15PMP13004.oSTART_CMD	DO	FEB Pump Station Wet Well Pump 4 Start Cmd	130
34	SCPP15PMP13004.oSTOP_CMD	DO	FEB Pump Station Wet Well Pump 4 Stop Cmd	130
35	SCPB18SLG14501.oOPEN_CMD	DO	FEB Effluent Gate 1 Open Cmd	145
36	SCPB18SLG14501.oCLOSE_CMD	DO	FEB Effluent Gate 1 Close Cmd	145
37	SCPB18SLG14502.oOPEN_CMD	DO	FEB Effluent Gate 2 Open Cmd	145
38	SCPB18SLG14502.oCLOSE_CMD	DO	FEB Effluent Gate 2 Close Cmd	145

**Grit Removal Facility PLC-200 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCDG20PLC10001.oTEMP	AI	Grit Facility PLC Temp	100
2	SCIP10FIT13501.oMGD	AI	Influent Pump Station Effluent Flow	135
3	SCDG20TIT71001.oTEMP	AI	Grit Facility Grit Electrical Room Temperature	710
4	SCDG20TIT71002.oTEMP	AI	Grit Facility Grit Removal Room Temperature	710
5	SCDG20AIT60101.oH2S	AI	Grit Facility H2S Monitor 1 H2S	601
6	SCDG20AIT60102.oH2S	AI	Grit Facility H2S Monitor 2 H2S	601
7	SCAB30LIT11001.oFEET	AI	RAS Splitter Box Level	110
8	SCAB30WG11201.oPOSITION	AI	RAS Splitter Box Weir Gate 1 Position	112
9	SCAB30WG11202.oPOSITION	AI	RAS Splitter Box Weir Gate 2 Position	112
10	SCAB30WG11203.oPOSITION	AI	RAS Splitter Box Weir Gate 3 Position	112
1	SCAB30WG11201.oPOS_STPT	AO	RAS Splitter Box Weir Gate 1 Position SetPoint	112
2	SCAB30WG11202.oPOS_STPT	AO	RAS Splitter Box Weir Gate 2 Position SetPoint	112
3	SCAB30WG11203.oPOS_STPT	AO	RAS Splitter Box Weir Gate 3 Position SetPoint	112
1	SCDG20PLC10001.oPWR_FAIL	DI	Grit Facility PLC 24Vdc Power Supply Fail	100
2	SCDG20PLC10001.oUPS_FAIL	DI	Grit Facility PLC UPS Fail	100
3	SCDG20PLC10001.oUPS_BATT_FAIL	DI	Grit Facility PLC UPS Battery Fail	100
4	SCDG20PLC10001.oINT_SW	DI	Grit Facility PLC Intrusion Switch	100
5	SCPB18LCP19101.oLEVEL_HIHI	DI	LCP191 Influent Pump Station Sump Panel Level HighHigh	191
6	SCPB18LCP19101.oFAULT	DI	LCP191 Influent Pump Station Sump Panel Fault	191
7	SCDG20ODU70501.oLEL_ALARM	DI	Grit Basin Odor Control Unit LEL Alarm	705
8	SCDG20ODU70501.oFIRE_ALARM	DI	Grit Basin Odor Control Unit Fire Alarm	705
9	SCDG20ODU70501.oFAULT	DI	Grit Basin Odor Control Unit Common Fault	705
10	SCDG20LSH11201.oON	DI	Grit Facility Influent Box Level High	112
11	SCDG20SLG11501.oREMOTE	DI	Grit Facility Channel 1 Influent Gate Remote	115
12	SCDG20SLG11501.oOPEN	DI	Grit Facility Channel 1 Influent Gate Open	115
13	SCDG20SLG11501.oCLOSED	DI	Grit Facility Channel 1 Influent Gate Closed	115
14	SCDG20SLG11501.oFAULT	DI	Grit Facility Channel 1 Influent Gate Fault	115
15	SCDG20SLG11502.oREMOTE	DI	Grit Facility Channel 2 Influent Gate Remote	115
16	SCDG20SLG11502.oOPEN	DI	Grit Facility Channel 2 Influent Gate Open	115
17	SCDG20SLG11502.oCLOSED	DI	Grit Facility Channel 2 Influent Gate Closed	115
18	SCDG20SLG11502.oFAULT	DI	Grit Facility Channel 2 Influent Gate Fault	115
19	SCDG20SLG13001.oREMOTE	DI	Grit Facility Channel 1 Effluent Gate Remote	130
20	SCDG20SLG13001.oOPEN	DI	Grit Facility Channel 1 Effluent Gate Open	130
21	SCDG20SLG13001.oCLOSED	DI	Grit Facility Channel 1 Effluent Gate Closed	130
22	SCDG20SLG13001.oFAULT	DI	Grit Facility Channel 1 Effluent Gate Fault	130
23	SCDG20SLG13002.oREMOTE	DI	Grit Facility Channel 2 Effluent Gate Remote	130
24	SCDG20SLG13002.oOPEN	DI	Grit Facility Channel 2 Effluent Gate Open	130
25	SCDG20SLG13002.oCLOSED	DI	Grit Facility Channel 2 Effluent Gate Closed	130
26	SCDG20SLG13002.oFAULT	DI	Grit Facility Channel 2 Effluent Gate Fault	130
27	SCDG20SLG16001.oREMOTE	DI	Grit Facility Bypass Channel Influent Gate Remote	160
28	SCDG20SLG16001.oOPEN	DI	Grit Facility Bypass Channel Influent Gate Open	160
29	SCDG20SLG16001.oCLOSED	DI	Grit Facility Bypass Channel Influent Gate Closed	160
30	SCDG20SLG16001.oFAULT	DI	Grit Facility Bypass Channel Influent Gate Fault	160
31	SCDS18LCP22001.oLEVEL_HIHI	DI	LCP220 Grit Effluent Box Sump Panel Level HighHigh	220
32	SCDS18LCP22001.oFAULT	DI	LCP220 Grit Effluent Box Sump Panel Fault	220
33	SCDG20ODU70502.oLEL_ALARM	DI	Grit Washer Facility Odor Control Unit LEL Alarm	705
34	SCDG20ODU70502.oFIRE_ALARM	DI	Grit Washer Facility Odor Control Unit Fire Alarm	705
35	SCDG20ODU70502.oFAULT	DI	Grit Washer Facility Odor Control Unit Common Fault	705
36	SCDG20HCP27001.oPWR_ON	DI	Grit Facility Electrical Room HVAC Control Panel Power On	270
37	SCDG20HCP27001.oALARM	DI	Grit Facility Electrical Room HVAC Control Panel General Alarm	270

38	SCDG20AFU27501.oSW	DI	Grit Facility Electrical Room HVAC Filter Unit Alarm	275
39	SCDG20AIT60101.oH2S_HI	DI	Grit Facility H2S Monitor 1 H2S High	601
40	SCDG20AIT60102.oH2S_HI	DI	Grit Facility H2S Monitor 2 H2S High	601
41	SCDG20VCP28001.oPWR_ON	DI	Grit Facility Grit Washer Room Vent. Control Panel Power On	280
42	SCDG20VCP28001.oALARM	DI	Grit Facility Grit Washer Room Vent. Control Panel General Alarm	280
43	SCAB30WG11201.oOPEN	DI	RAS Splitter Box Weir Gate 1 Open	112
44	SCAB30WG11201.oCLOSED	DI	RAS Splitter Box Weir Gate 1 Closed	112
45	SCAB30WG11201.oREMOTE	DI	RAS Splitter Box Weir Gate 1 Remote	112
46	SCAB30WG11201.oFAULT	DI	RAS Splitter Box Weir Gate 1 Fault	112
47	SCAB30WG11202.oOPEN	DI	RAS Splitter Box Weir Gate 2 Open	112
48	SCAB30WG11202.oCLOSED	DI	RAS Splitter Box Weir Gate 2 Closed	112
49	SCAB30WG11202.oREMOTE	DI	RAS Splitter Box Weir Gate 2 Remote	112
50	SCAB30WG11202.oFAULT	DI	RAS Splitter Box Weir Gate 2 Fault	112
51	SCAB30WG11203.oOPEN	DI	RAS Splitter Box Weir Gate 3 Open	112
52	SCAB30WG11203.oCLOSED	DI	RAS Splitter Box Weir Gate 3 Closed	112
53	SCAB30WG11203.oREMOTE	DI	RAS Splitter Box Weir Gate 3 Remote	112
54	SCAB30WG11203.oFAULT	DI	RAS Splitter Box Weir Gate 3 Fault	112
1	SCDG20SLG11501.oOPEN_CMD	DO	Grit Facility Channel 1 Influent Gate Open Cmd	115
2	SCDG20SLG11501.oCLOSE_CMD	DO	Grit Facility Channel 1 Influent Gate Close Cmd	115
3	SCDG20SLG11502.oOPEN_CMD	DO	Grit Facility Channel 2 Influent Gate Open Cmd	115
4	SCDG20SLG11502.oCLOSE_CMD	DO	Grit Facility Channel 2 Influent Gate Close Cmd	115
5	SCDG20SLG13001.oOPEN_CMD	DO	Grit Facility Channel 1 Effluent Gate Open Cmd	130
6	SCDG20SLG13001.oCLOSE_CMD	DO	Grit Facility Channel 1 Effluent Gate Close Cmd	130
7	SCDG20SLG13002.oOPEN_CMD	DO	Grit Facility Channel 2 Effluent Gate Open Cmd	130
8	SCDG20SLG13002.oCLOSE_CMD	DO	Grit Facility Channel 2 Effluent Gate Close Cmd	130
9	SCDG20SLG16001.oOPEN_CMD	DO	Grit Facility Bypass Channel Influent Gate Open Cmd	160
10	SCDG20SLG16001.oCLOSE_CMD	DO	Grit Facility Bypass Channel Influent Gate Close Cmd	160
11	SCAB30WG11201.oOPEN_CMD	DO	RAS Splitter Box Weir Gate 1 Open Cmd	112
12	SCAB30WG11201.oCLOSE_CMD	DO	RAS Splitter Box Weir Gate 1 Close Cmd	112
13	SCAB30WG11202.oOPEN_CMD	DO	RAS Splitter Box Weir Gate 2 Open Cmd	112
14	SCAB30WG11202.oCLOSE_CMD	DO	RAS Splitter Box Weir Gate 2 Close Cmd	112
15	SCAB30WG11203.oOPEN_CMD	DO	RAS Splitter Box Weir Gate 3 Open Cmd	112
16	SCAB30WG11203.oCLOSE_CMD	DO	RAS Splitter Box Weir Gate 3 Close Cmd	112

**Aeration Basin Facility PLC-300 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCAB30PLC10001.oTEMP	AI	Aeration Basin PLC Temp	100
2	SCAB30TIT71001.oTEMP	AI	Aeration Basin Elect Room Temperature	710
1	SCAB30PLC10001.oPWR_FAIL	DI	Aeration Basin PLC 24Vdc Power Supply Fail	100
2	SCAB30PLC10001.oUPS_FAIL	DI	Aeration Basin PLC UPS Fail	100
3	SCAB30PLC10001.oUPS_BATT_FAIL	DI	Aeration Basin PLC UPS Battery Fail	100
4	SCAB30PLC10001.oINT_SW	DI	Aeration Basin PLC Intrusion Switch	100
5	SCAB30SLG11501.oREMOTE	DI	Aeration Basin 1 Influent Gate Remote	115
6	SCAB30SLG11501.oOPEN	DI	Aeration Basin 1 Influent Gate Open	115
7	SCAB30SLG11501.oCLOSED	DI	Aeration Basin 1 Influent Gate Closed	115
8	SCAB30SLG11501.oFAULT	DI	Aeration Basin 1 Influent Gate Fault	115
9	SCAB30SLG11502.oREMOTE	DI	Aeration Basin 2 Influent Gate Remote	115
10	SCAB30SLG11502.oOPEN	DI	Aeration Basin 2 Influent Gate Open	115
11	SCAB30SLG11502.oCLOSED	DI	Aeration Basin 2 Influent Gate Closed	115
12	SCAB30SLG11502.oFAULT	DI	Aeration Basin 2 Influent Gate Fault	115
13	SCAB30SLG11503.oREMOTE	DI	Aeration Basin 3 Influent Gate Remote	115
14	SCAB30SLG11503.oOPEN	DI	Aeration Basin 3 Influent Gate Open	115
15	SCAB30SLG11503.oCLOSED	DI	Aeration Basin 3 Influent Gate Closed	115
16	SCAB30SLG11503.oFAULT	DI	Aeration Basin 3 Influent Gate Fault	115
17	SCAB30SLG11504.oREMOTE	DI	Aeration Basin 4 Influent Gate Remote	115
18	SCAB30SLG11504.oOPEN	DI	Aeration Basin 4 Influent Gate Open	115
19	SCAB30SLG11504.oCLOSED	DI	Aeration Basin 4 Influent Gate Closed	115
20	SCAB30SLG11504.oFAULT	DI	Aeration Basin 4 Influent Gate Fault	115
21	SCAB30SLG11505.oREMOTE	DI	Aeration Basin 5 Influent Gate Remote	115
22	SCAB30SLG11505.oOPEN	DI	Aeration Basin 5 Influent Gate Open	115
23	SCAB30SLG11505.oCLOSED	DI	Aeration Basin 5 Influent Gate Closed	115
24	SCAB30SLG11505.oFAULT	DI	Aeration Basin 5 Influent Gate Fault	115
25	SCAB30SLG11506.oREMOTE	DI	Aeration Basin 6 Influent Gate Remote	115
26	SCAB30SLG11506.oOPEN	DI	Aeration Basin 6 Influent Gate Open	115
27	SCAB30SLG11506.oCLOSED	DI	Aeration Basin 6 Influent Gate Closed	115
28	SCAB30SLG11506.oFAULT	DI	Aeration Basin 6 Influent Gate Fault	115
29	SCAB30HCP37001.oPWR_ON	DI	Aeration Basin Elect Room HVAC Control Panel Power On	370
30	SCAB30HCP37001.oALARM	DI	Aeration Basin Elect Room HVAC Control Panel General Alarm	370
31	SCAB30AFU37501.oSW	DI	Aeration Basin Elect Room Air Filter Unit Alarm	375
1	SCAB30SLG11501.oOPEN_CMD	DO	Aeration Basin 1 Influent Gate Open Cmd	115
2	SCAB30SLG11501.oCLOSE_CMD	DO	Aeration Basin 1 Influent Gate Close Cmd	115
3	SCAB30SLG11502.oOPEN_CMD	DO	Aeration Basin 2 Influent Gate Open Cmd	115
4	SCAB30SLG11502.oCLOSE_CMD	DO	Aeration Basin 2 Influent Gate Close Cmd	115
5	SCAB30SLG11503.oOPEN_CMD	DO	Aeration Basin 3 Influent Gate Open Cmd	115
6	SCAB30SLG11503.oCLOSE_CMD	DO	Aeration Basin 3 Influent Gate Close Cmd	115
7	SCAB30SLG11504.oOPEN_CMD	DO	Aeration Basin 4 Influent Gate Open Cmd	115
8	SCAB30SLG11504.oCLOSE_CMD	DO	Aeration Basin 4 Influent Gate Close Cmd	115
9	SCAB30SLG11505.oOPEN_CMD	DO	Aeration Basin 5 Influent Gate Open Cmd	115
10	SCAB30SLG11505.oCLOSE_CMD	DO	Aeration Basin 5 Influent Gate Close Cmd	115
11	SCAB30SLG11506.oOPEN_CMD	DO	Aeration Basin 6 Influent Gate Open Cmd	115
12	SCAB30SLG11506.oCLOSE_CMD	DO	Aeration Basin 6 Influent Gate Close Cmd	115



**RAS/WAS Pump Station PLC-380 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCRA38PLC10001.oTEMP	AI	RAS/WAS Pump Station PLC Temp	100
2	SCCL35WG11001.oPOSITION	AI	Clarifier Splitter Weir Gate 1 Position	110
3	SCCL35WG11002.oPOSITION	AI	Clarifier Splitter Weir Gate 2 Position	110
4	SCCL35WG11003.oPOSITION	AI	Clarifier Splitter Weir Gate 3 Position	110
5	SCCL35WG11004.oPOSITION	AI	Clarifier Splitter Weir Gate 4 Position	110
6	SCCL35WG11005.oPOSITION	AI	Clarifier Splitter Weir Gate 5 Position	110
7	SCCL35WG11006.oPOSITION	AI	Clarifier Splitter Weir Gate 6 Position	110
8	SCCL35WG11007.oPOSITION	AI	Clarifier Splitter Weir Gate 7 Position	110
9	SCCL35WG11008.oPOSITION	AI	Clarifier Splitter Weir Gate 8 Position	110
10	SCRA38PMP12501.oSPEED	AI	RAS/WAS Pump 1 Speed	125
11	SCRA38PMP12502.oSPEED	AI	RAS/WAS Pump 2 Speed	125
12	SCRA38PMP12503.oSPEED	AI	RAS/WAS Pump 3 Speed	125
13	SCRA38PMP12504.oSPEED	AI	RAS/WAS Pump 4 Speed	125
14	SCRA38PMP12505.oSPEED	AI	RAS/WAS Pump 5 Speed	125
15	SCRA38FIT20001.oMGD	AI	RAS/WAS Pump Station Influent 1 Flow	200
16	SCRA38FIT20002.oMGD	AI	RAS/WAS Pump Station Influent 2 Flow	200
17	SCRA38FIT20003.oMGD	AI	RAS/WAS Pump Station Influent 3 Flow	200
18	SCRA38FIT20004.oMGD	AI	RAS/WAS Pump Station Influent 4 Flow	200
19	SCRA38TSV20501.oPOSITION	AI	RAS/WAS Pump Station 1 Telescopic Valve Position	205
20	SCRA38TSV20502.oPOSITION	AI	RAS/WAS Pump Station 2 Telescopic Valve Position	205
21	SCRA38TSV20503.oPOSITION	AI	RAS/WAS Pump Station 3 Telescopic Valve Position	205
22	SCRA38TSV20504.oPOSITION	AI	RAS/WAS Pump Station 4 Telescopic Valve Position	205
23	SCRA38LIT21001.oFEET	AI	RAS/WAS Pump Station Influent Box Level	210
24	SCRA38FIT22001.oMGD	AI	RAS/WAS Pump Station Eff. to RAS Splitter Box Flow	220
25	SCRA38BAV22501.oPOSITION	AI	RAS/WAS Pump Station Eff. Ball Valve Position	225
26	SCRA38FIT23001.oMGD	AI	RAS/WAS Pump Station Eff. to Digester Flow	230
27	SCRA38AIT60101.oH2S	AI	RAS/WAS Pump Station H2S Monitor 1 H2S	601
28	SCRA38AIT60102.oH2S	AI	RAS/WAS Pump Station H2S Monitor 2 H2S	601
29	SCRA38AIT60103.oH2S	AI	RAS/WAS Pump Station H2S Monitor 3 H2S	601
30	SCRA38AIT60104.oH2S	AI	RAS/WAS Pump Station H2S Monitor 4 H2S	601
31	SCRA38TIT71001.oTEMP	AI	RAS/WAS Pump Station Elect Room Temperature	710
32	SCRA38TIT71002.oTEMP	AI	RAS/WAS Pump Station Pump Room Temperature	710
1	SCCL35WG11001.oPOS_STPT	AO	Clarifier Splitter Weir Gate 1 Position SetPoint	110
2	SCCL35WG11002.oPOS_STPT	AO	Clarifier Splitter Weir Gate 2 Position SetPoint	110
3	SCCL35WG11003.oPOS_STPT	AO	Clarifier Splitter Weir Gate 3 Position SetPoint	110
4	SCCL35WG11004.oPOS_STPT	AO	Clarifier Splitter Weir Gate 4 Position SetPoint	110
5	SCCL35WG11005.oPOS_STPT	AO	Clarifier Splitter Weir Gate 5 Position SetPoint	110
6	SCCL35WG11006.oPOS_STPT	AO	Clarifier Splitter Weir Gate 6 Position SetPoint	110
7	SCCL35WG11007.oPOS_STPT	AO	Clarifier Splitter Weir Gate 7 Position SetPoint	110
8	SCCL35WG11008.oPOS_STPT	AO	Clarifier Splitter Weir Gate 8 Position SetPoint	110
9	SCRA38PMP12501.oSPD_STPT	AO	RAS/WAS Pump 1 Speed Setpoint	125
10	SCRA38PMP12502.oSPD_STPT	AO	RAS/WAS Pump 2 Speed Setpoint	125
11	SCRA38PMP12503.oSPD_STPT	AO	RAS/WAS Pump 3 Speed Setpoint	125
12	SCRA38PMP12504.oSPD_STPT	AO	RAS/WAS Pump 4 Speed Setpoint	125
13	SCRA38PMP12505.oSPD_STPT	AO	RAS/WAS Pump 5 Speed Setpoint	125
14	SCRA38TSV20501.oPOS_STPT	AO	RAS/WAS Pump Station 1 Telescopic Valve Position Setpoint	205
15	SCRA38TSV20502.oPOS_STPT	AO	RAS/WAS Pump Station 2 Telescopic Valve Position Setpoint	205
16	SCRA38TSV20503.oPOS_STPT	AO	RAS/WAS Pump Station 3 Telescopic Valve Position Setpoint	205
17	SCRA38TSV20504.oPOS_STPT	AO	RAS/WAS Pump Station 4 Telescopic Valve Position Setpoint	205
18	SCRA38BAV22501.oPOS_STPT	AO	RAS/WAS Pump Station Eff. Ball Valve Position Setpoint	225
1	SCRA38PLC10001.oPWR_FAIL	DI	RAS/WAS Pump Station PLC 24Vdc Power Supply Fail	100
2	SCRA38PLC10001.oUPS_FAIL	DI	RAS/WAS Pump Station PLC UPS Fail	100
3	SCRA38PLC10001.oUPS_BATT_FAIL	DI	RAS/WAS Pump Station PLC UPS Battery Fail	100

4	SCRA38PLC10001.oINT_SW	DI	RAS/WAS Pump Station PLC Intrusion Switch	100
5	SCCL35WG11001.oOPEN	DI	Clarifier Splitter Weir Gate 1 Open	110
6	SCCL35WG11001.oCLOSED	DI	Clarifier Splitter Weir Gate 1 Closed	110
7	SCCL35WG11001.oREMOTE	DI	Clarifier Splitter Weir Gate 1 Remote	110
8	SCCL35WG11001.oFAULT	DI	Clarifier Splitter Weir Gate 1 Fault	110
9	SCCL35WG11002.oOPEN	DI	Clarifier Splitter Weir Gate 2 Open	110
10	SCCL35WG11002.oCLOSED	DI	Clarifier Splitter Weir Gate 2 Closed	110
11	SCCL35WG11002.oREMOTE	DI	Clarifier Splitter Weir Gate 2 Remote	110
12	SCCL35WG11002.oFAULT	DI	Clarifier Splitter Weir Gate 2 Fault	110
13	SCCL35WG11003.oOPEN	DI	Clarifier Splitter Weir Gate 3 Open	110
14	SCCL35WG11003.oCLOSED	DI	Clarifier Splitter Weir Gate 3 Closed	110
15	SCCL35WG11003.oREMOTE	DI	Clarifier Splitter Weir Gate 3 Remote	110
16	SCCL35WG11003.oFAULT	DI	Clarifier Splitter Weir Gate 3 Fault	110
17	SCCL35WG11004.oOPEN	DI	Clarifier Splitter Weir Gate 4 Open	110
18	SCCL35WG11004.oCLOSED	DI	Clarifier Splitter Weir Gate 4 Closed	110
19	SCCL35WG11004.oREMOTE	DI	Clarifier Splitter Weir Gate 4 Remote	110
20	SCCL35WG11004.oFAULT	DI	Clarifier Splitter Weir Gate 4 Fault	110
21	SCCL35WG11005.oOPEN	DI	Clarifier Splitter Weir Gate 5 Open	110
22	SCCL35WG11005.oCLOSED	DI	Clarifier Splitter Weir Gate 5 Closed	110
23	SCCL35WG11005.oREMOTE	DI	Clarifier Splitter Weir Gate 5 Remote	110
24	SCCL35WG11005.oFAULT	DI	Clarifier Splitter Weir Gate 5 Fault	110
25	SCCL35WG11006.oOPEN	DI	Clarifier Splitter Weir Gate 6 Open	110
26	SCCL35WG11006.oCLOSED	DI	Clarifier Splitter Weir Gate 6 Closed	110
27	SCCL35WG11006.oREMOTE	DI	Clarifier Splitter Weir Gate 6 Remote	110
28	SCCL35WG11006.oFAULT	DI	Clarifier Splitter Weir Gate 6 Fault	110
29	SCCL35WG11007.oOPEN	DI	Clarifier Splitter Weir Gate 7 Open	110
30	SCCL35WG11007.oCLOSED	DI	Clarifier Splitter Weir Gate 7 Closed	110
31	SCCL35WG11007.oREMOTE	DI	Clarifier Splitter Weir Gate 7 Remote	110
32	SCCL35WG11007.oFAULT	DI	Clarifier Splitter Weir Gate 7 Fault	110
33	SCCL35WG11008.oOPEN	DI	Clarifier Splitter Weir Gate 8 Open	110
34	SCCL35WG11008.oCLOSED	DI	Clarifier Splitter Weir Gate 8 Closed	110
35	SCCL35WG11008.oREMOTE	DI	Clarifier Splitter Weir Gate 8 Remote	110
36	SCCL35WG11008.oFAULT	DI	Clarifier Splitter Weir Gate 8 Fault	110
37	SCCL35PV11501.oREMOTE	DI	Clarifier 1 Plug Valve Remote	115
38	SCCL35PV11501.oOPEN	DI	Clarifier 1 Plug Valve Open	115
39	SCCL35PV11501.oCLOSED	DI	Clarifier 1 Plug Valve Closed	115
40	SCCL35PV11501.oFAULT	DI	Clarifier 1 Plug Valve Fault	115
41	SCCL35PV11502.oREMOTE	DI	Clarifier 2 Plug Valve Remote	115
42	SCCL35PV11502.oOPEN	DI	Clarifier 2 Plug Valve Open	115
43	SCCL35PV11502.oCLOSED	DI	Clarifier 2 Plug Valve Closed	115
44	SCCL35PV11502.oFAULT	DI	Clarifier 2 Plug Valve Fault	115
45	SCCL35PV11503.oREMOTE	DI	Clarifier 3 Plug Valve Remote	115
46	SCCL35PV11503.oOPEN	DI	Clarifier 3 Plug Valve Open	115
47	SCCL35PV11503.oCLOSED	DI	Clarifier 3 Plug Valve Closed	115
48	SCCL35PV11503.oFAULT	DI	Clarifier 3 Plug Valve Fault	115
49	SCCL35PV11504.oREMOTE	DI	Clarifier 4 Plug Valve Remote	115
50	SCCL35PV11504.oOPEN	DI	Clarifier 4 Plug Valve Open	115
51	SCCL35PV11504.oCLOSED	DI	Clarifier 4 Plug Valve Closed	115
52	SCCL35PV11504.oFAULT	DI	Clarifier 4 Plug Valve Fault	115
53	SCCL35CLR12001.oREMOTE	DI	Clarifier 1 Remote	120
54	SCCL35CLR12001.oRUNNING	DI	Clarifier 1 Running	120
55	SCCL35CLR12001.oFAULT	DI	Clarifier 1 Fault	120
56	SCCL35CLR12001.oOVERLOAD	DI	Clarifier 1 Overload	120
57	SCCL35CLR12001.oTORQUE_HI	DI	Clarifier 1 Torque Hi	120
58	SCCL35CLR12002.oREMOTE	DI	Clarifier 2 Remote	120

59	SCCL35CLR12002.oRUNNING	DI	Clarifier 2 Running	120
60	SCCL35CLR12002.oFAULT	DI	Clarifier 2 Fault	120
61	SCCL35CLR12002.oOVERLOAD	DI	Clarifier 2 Overload	120
62	SCCL35CLR12002.oTORQUE_HI	DI	Clarifier 2 Torque Hi	120
63	SCCL35CLR12003.oREMOTE	DI	Clarifier 3 Remote	120
64	SCCL35CLR12003.oRUNNING	DI	Clarifier 3 Running	120
65	SCCL35CLR12003.oFAULT	DI	Clarifier 3 Fault	120
66	SCCL35CLR12003.oOVERLOAD	DI	Clarifier 3 Overload	120
67	SCCL35CLR12003.oTORQUE_HI	DI	Clarifier 3 Torque Hi	120
68	SCCL35CLR12004.oREMOTE	DI	Clarifier 4 Future Remote	120
69	SCCL35CLR12004.oRUNNING	DI	Clarifier 4 Future Running	120
70	SCCL35CLR12004.oFAULT	DI	Clarifier 4 Future Fault	120
71	SCCL35CLR12004.oOVERLOAD	DI	Clarifier 4 Future Overload	120
72	SCCL35CLR12004.oTORQUE_HI	DI	Clarifier 4 Future Torque Hi	120
73	SCCL35LSHH12511.oON	DI	Scum Pump Station 1 Sump Level HighHigh	125
74	SCCL35LSHH12521.oON	DI	Scum Pump Station 2 Sump Level HighHigh	125
75	SCCL35PMP14011.oRUNNING	DI	Scum Pump Station 1 Pump 1 Running	140
76	SCCL35PMP14011.oFAULT	DI	Scum Pump Station 1 Pump 1 Fault	140
77	SCCL35PMP14011.oTEMP_HI	DI	Scum Pump Station 1 Pump 1 Temp Hi	140
78	SCCL35PMP14011.oLEAK	DI	Scum Pump Station 1 Pump 1 Leak	140
79	SCCL35PMP14012.oRUNNING	DI	Scum Pump Station 1 Pump 2 Running	140
80	SCCL35PMP14012.oFAULT	DI	Scum Pump Station 1 Pump 2 Fault	140
81	SCCL35PMP14012.oTEMP_HI	DI	Scum Pump Station 1 Pump 2 Temp Hi	140
82	SCCL35PMP14012.oLEAK	DI	Scum Pump Station 1 Pump 2 Leak	140
83	SCCL35PMP14021.oRUNNING	DI	Scum Pump Station 2 Pump 1 Running	140
84	SCCL35PMP14021.oFAULT	DI	Scum Pump Station 2 Pump 1 Fault	140
85	SCCL35PMP14021.oTEMP_HI	DI	Scum Pump Station 2 Pump 1 Temp Hi	140
86	SCCL35PMP14021.oLEAK	DI	Scum Pump Station 2 Pump 1 Leak	140
87	SCCL35PMP14022.oRUNNING	DI	Scum Pump Station 2 Pump 2 Running	140
88	SCCL35PMP14022.oFAULT	DI	Scum Pump Station 2 Pump 2 Fault	140
89	SCCL35PMP14022.oTEMP_HI	DI	Scum Pump Station 2 Pump 2 Temp Hi	140
90	SCCL35PMP14022.oLEAK	DI	Scum Pump Station 2 Pump 2 Leak	140
91	SCCL35ODU70501.oLEL_ALARM	DI	Clarifier Scum Pump Station I Odor Control Unit LEL Alarm	705
92	SCCL35ODU70501.oFIRE_ALARM	DI	Clarifier Scum Pump Station I Odor Control Unit Fire Alarm	705
93	SCCL35ODU70501.oFAULT	DI	Clarifier Scum Pump Station I Odor Control Unit Common Fault	705
94	SCCL35ODU70502.oLEL_ALARM	DI	Clarifier Scum Pump Station II Odor Control Unit LEL Alarm	705
95	SCCL35ODU70502.oFIRE_ALARM	DI	Clarifier Scum Pump Station II Odor Control Unit Fire Alarm	705
96	SCCL35ODU70502.oFAULT	DI	Clarifier Scum Pump Station II Odor Control Unit Common Fault	705
97	SCRA38PMP12501.oREMOTE	DI	RAS/WAS Pump 1 Remote Mode	125
98	SCRA38PMP12501.oRUNNING	DI	RAS/WAS Pump 1 Running	125
99	SCRA38PMP12501.oESTOP	DI	RAS/WAS Pump 1 E-Stop	125
100	SCRA38PMP12501.oFAULT	DI	RAS/WAS Pump 1 Fault	125
101	SCRA38PMP12501.oVFD_FAULT	DI	RAS/WAS Pump 1 VFD Fault	125
102	SCRA38PMP12501.oTEMP_HI	DI	RAS/WAS Pump 1 Temp Hi	125
103	SCRA38PMP12501.oPSH	DI	RAS/WAS Pump 1 Pressure Hi	125
104	SCRA38PMP12501.oVIB_HI	DI	RAS/WAS Pump 1 Vibration Hi	125
105	SCRA38PMP12501.oVIB_HIHI	DI	RAS/WAS Pump 1 Vibration HiHi	125
106	SCRA38PMP12502.oREMOTE	DI	RAS/WAS Pump 2 Remote Mode	125
107	SCRA38PMP12502.oRUNNING	DI	RAS/WAS Pump 2 Running	125
108	SCRA38PMP12502.oESTOP	DI	RAS/WAS Pump 2 E-Stop	125
109	SCRA38PMP12502.oFAULT	DI	RAS/WAS Pump 2 Fault	125
110	SCRA38PMP12502.oVFD_FAULT	DI	RAS/WAS Pump 2 VFD Fault	125
111	SCRA38PMP12502.oTEMP_HI	DI	RAS/WAS Pump 2 Temp Hi	125
112	SCRA38PMP12502.oPSH	DI	RAS/WAS Pump 2 Pressure Hi	125
113	SCRA38PMP12502.oVIB_HI	DI	RAS/WAS Pump 2 Vibration Hi	125

114	SCRA38PMP12502.oVIB_HIHI	DI	RAS/WAS Pump 2 Vibration HiHi	125
115	SCRA38PMP12503.oREMOTE	DI	RAS/WAS Pump 3 Remote Mode	125
116	SCRA38PMP12503.oRUNNING	DI	RAS/WAS Pump 3 Running	125
117	SCRA38PMP12503.oESTOP	DI	RAS/WAS Pump 3 E-Stop	125
118	SCRA38PMP12503.oFAULT	DI	RAS/WAS Pump 3 Fault	125
119	SCRA38PMP12503.oVFD_FAULT	DI	RAS/WAS Pump 3 VFD Fault	125
120	SCRA38PMP12503.oTEMP_HI	DI	RAS/WAS Pump 3 Temp Hi	125
121	SCRA38PMP12503.oPSH	DI	RAS/WAS Pump 3 Pressure Hi	125
122	SCRA38PMP12503.oVIB_HI	DI	RAS/WAS Pump 3 Vibration Hi	125
123	SCRA38PMP12503.oVIB_HIHI	DI	RAS/WAS Pump 3 Vibration HiHi	125
124	SCRA38PMP12504.oREMOTE	DI	RAS/WAS Pump 4 Remote Mode	125
125	SCRA38PMP12504.oRUNNING	DI	RAS/WAS Pump 4 Running	125
126	SCRA38PMP12504.oESTOP	DI	RAS/WAS Pump 4 E-Stop	125
127	SCRA38PMP12504.oFAULT	DI	RAS/WAS Pump 4 Fault	125
128	SCRA38PMP12504.oVFD_FAULT	DI	RAS/WAS Pump 4 VFD Fault	125
129	SCRA38PMP12504.oTEMP_HI	DI	RAS/WAS Pump 4 Temp Hi	125
130	SCRA38PMP12504.oPSH	DI	RAS/WAS Pump 4 Pressure Hi	125
131	SCRA38PMP12504.oVIB_HI	DI	RAS/WAS Pump 4 Vibration Hi	125
132	SCRA38PMP12504.oVIB_HIHI	DI	RAS/WAS Pump 4 Vibration HiHi	125
133	SCRA38PMP12505.oREMOTE	DI	RAS/WAS Pump 5 Remote Mode	125
134	SCRA38PMP12505.oRUNNING	DI	RAS/WAS Pump 5 Running	125
135	SCRA38PMP12505.oESTOP	DI	RAS/WAS Pump 5 E-Stop	125
136	SCRA38PMP12505.oFAULT	DI	RAS/WAS Pump 5 Fault	125
137	SCRA38PMP12505.oVFD_FAULT	DI	RAS/WAS Pump 5 VFD Fault	125
138	SCRA38PMP12505.oTEMP_HI	DI	RAS/WAS Pump 5 Temp Hi	125
139	SCRA38PMP12505.oPSH	DI	RAS/WAS Pump 5 Pressure Hi	125
140	SCRA38PMP12505.oVIB_HI	DI	RAS/WAS Pump 5 Vibration Hi	125
141	SCRA38PMP12505.oVIB_HIHI	DI	RAS/WAS Pump 5 Vibration HiHi	125
142	SCRA38TSV20501.oREMOTE	DI	RAS/WAS Pump Station 1 Telescopic Valve Remote	205
143	SCRA38TSV20501.oRUNNING	DI	RAS/WAS Pump Station 1 Telescopic Valve Running	205
144	SCRA38TSV20501.oFAULT	DI	RAS/WAS Pump Station 1 Telescopic Valve Fault	205
145	SCRA38TSV20502.oREMOTE	DI	RAS/WAS Pump Station 2 Telescopic Valve Remote	205
146	SCRA38TSV20502.oRUNNING	DI	RAS/WAS Pump Station 2 Telescopic Valve Running	205
147	SCRA38TSV20502.oFAULT	DI	RAS/WAS Pump Station 2 Telescopic Valve Fault	205
148	SCRA38TSV20503.oREMOTE	DI	RAS/WAS Pump Station 3 Telescopic Valve Remote	205
149	SCRA38TSV20503.oRUNNING	DI	RAS/WAS Pump Station 3 Telescopic Valve Running	205
150	SCRA38TSV20503.oFAULT	DI	RAS/WAS Pump Station 3 Telescopic Valve Fault	205
151	SCRA38TSV20504.oREMOTE	DI	RAS/WAS Pump Station 4 Telescopic Valve Remote	205
152	SCRA38TSV20504.oRUNNING	DI	RAS/WAS Pump Station 4 Telescopic Valve Running	205
153	SCRA38TSV20504.oFAULT	DI	RAS/WAS Pump Station 4 Telescopic Valve Fault	205
154	SCRA38LSL21201.oON	DI	RAS/WAS Pump Station Wet Well Level Low	212
155	SCRA38LSH21301.oON	DI	RAS/WAS Pump Station Wet Well Level High	213
156	SCRA38BAV22501.oREMOTE	DI	RAS/WAS Pump Station Eff. Ball Valve Remote	225
157	SCRA38BAV22501.oRUNNING	DI	RAS/WAS Pump Station Eff. Ball Valve Running	225
158	SCRA38BAV22501.oFAULT	DI	RAS/WAS Pump Station Eff. Ball Valve Fault	225
159	SCRA38LCP40001.oLEVEL_HIHI	DI	LCP400 FEB RAS Valve Vault Sump Panel Level HighHigh	400
160	SCRA38LCP40001.oFAULT	DI	LCP400 FEB RAS Valve Vault Sump Panel Fault	400
161	SCRA38LCP41501.oLEVEL_HIHI	DI	LCP400 FEB RAS Pump Room Sump Panel Level HighHigh	415
162	SCRA38LCP41501.oFAULT	DI	LCP400 FEB RAS Pump Room Sump Panel Fault	415
163	SCRA38HCP47001.oPWR_ON	DI	RAS/WAS Pump Station Elect Room HVAC Control Panel Power On	470
164	SCRA38HCP47001.oALARM	DI	RAS/WAS Pump Station Elect Room HVAC Control Panel General Alarm	470
165	SCRA38AFU47501.oSW	DI	RAS/WAS Pump Station Elect Room Air Filter Unit Alarm	475
166	SCRA38VCP48001.oPWR_ON	DI	RAS/WAS Pump Station Pump Room Vent. Control Panel Power On	480

167	SCRA38VCP48001.oALARM	DI	RAS/WAS Pump Station Pump Room Vent. Control Panel General Alarm	480
168	SCRA38AIT60101.oH2S_HI	DI	RAS/WAS Pump Station H2S Monitor 1 H2S High	601
169	SCRA38AIT60102.oH2S_HI	DI	RAS/WAS Pump Station H2S Monitor 2 H2S High	601
170	SCRA38AIT60103.oH2S_HI	DI	RAS/WAS Pump Station H2S Monitor 3 H2S High	601
171	SCRA38AIT60104.oH2S_HI	DI	RAS/WAS Pump Station H2S Monitor 4 H2S High	601
1	SCCL35WG11001.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 1 Open Cmd	110
2	SCCL35WG11001.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 1 Close Cmd	110
3	SCCL35WG11002.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 2 Open Cmd	110
4	SCCL35WG11002.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 2 Close Cmd	110
5	SCCL35WG11003.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 3 Open Cmd	110
6	SCCL35WG11003.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 3 Close Cmd	110
7	SCCL35WG11004.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 4 Open Cmd	110
8	SCCL35WG11004.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 4 Close Cmd	110
9	SCCL35WG11005.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 5 Open Cmd	110
10	SCCL35WG11005.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 5 Close Cmd	110
11	SCCL35WG11006.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 6 Open Cmd	110
12	SCCL35WG11006.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 6 Close Cmd	110
13	SCCL35WG11007.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 7 Open Cmd	110
14	SCCL35WG11007.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 7 Close Cmd	110
15	SCCL35WG11008.oOPEN_CMD	DO	Clarifier Splitter Weir Gate 8 Open Cmd	110
16	SCCL35WG11008.oCLOSE_CMD	DO	Clarifier Splitter Weir Gate 8 Close Cmd	110
17	SCCL35PV11501.oOPEN_CMD	DO	Clarifier 1 Plug Valve Open Cmd	115
18	SCCL35PV11501.oCLOSE_CMD	DO	Clarifier 1 Plug Valve Close Cmd	115
19	SCCL35PV11502.oOPEN_CMD	DO	Clarifier 2 Plug Valve Open Cmd	115
20	SCCL35PV11502.oCLOSE_CMD	DO	Clarifier 2 Plug Valve Close Cmd	115
21	SCCL35PV11503.oOPEN_CMD	DO	Clarifier 3 Plug Valve Open Cmd	115
22	SCCL35PV11503.oCLOSE_CMD	DO	Clarifier 3 Plug Valve Close Cmd	115
23	SCCL35PV11504.oOPEN_CMD	DO	Clarifier 4 Plug Valve Open Cmd	115
24	SCCL35PV11504.oCLOSE_CMD	DO	Clarifier 4 Plug Valve Close Cmd	115
25	SCCL35CLR12001.oSTART_CMD	DO	Clarifier 1 Start Cmd	120
26	SCCL35CLR12001.oSTOP_CMD	DO	Clarifier 1 Stop Cmd	120
27	SCCL35CLR12002.oSTART_CMD	DO	Clarifier 2 Start Cmd	120
28	SCCL35CLR12002.oSTOP_CMD	DO	Clarifier 2 Stop Cmd	120
29	SCCL35CLR12003.oSTART_CMD	DO	Clarifier 3 Start Cmd	120
30	SCCL35CLR12003.oSTOP_CMD	DO	Clarifier 3 Stop Cmd	120
31	SCCL35CLR12004.oSTART_CMD	DO	Clarifier 4 Future Start Cmd	120
32	SCCL35CLR12004.oSTOP_CMD	DO	Clarifier 4 Future Stop Cmd	120
33	SCRA38PMP12501.oSTART_CMD	DO	RAS/WAS Pump 1 Start Cmd	125
34	SCRA38PMP12501.oSTOP_CMD	DO	RAS/WAS Pump 1 Stop Cmd	125
35	SCRA38PMP12502.oSTART_CMD	DO	RAS/WAS Pump 2 Start Cmd	125
36	SCRA38PMP12502.oSTOP_CMD	DO	RAS/WAS Pump 2 Stop Cmd	125
37	SCRA38PMP12503.oSTART_CMD	DO	RAS/WAS Pump 3 Start Cmd	125
38	SCRA38PMP12503.oSTOP_CMD	DO	RAS/WAS Pump 3 Stop Cmd	125
39	SCRA38PMP12504.oSTART_CMD	DO	RAS/WAS Pump 4 Start Cmd	125
40	SCRA38PMP12504.oSTOP_CMD	DO	RAS/WAS Pump 4 Stop Cmd	125
41	SCRA38PMP12505.oSTART_CMD	DO	RAS/WAS Pump 5 Start Cmd	125
42	SCRA38PMP12505.oSTOP_CMD	DO	RAS/WAS Pump 5 Stop Cmd	125
43	SCRA38TSV20501.oSTART_CMD	DO	RAS/WAS Pump Station 1 Telescopic Valve Start Cmd	205
44	SCRA38TSV20501.oSTOP_CMD	DO	RAS/WAS Pump Station 1 Telescopic Valve Stop Cmd	205
45	SCRA38TSV20502.oSTART_CMD	DO	RAS/WAS Pump Station 2 Telescopic Valve Start Cmd	205
46	SCRA38TSV20502.oSTOP_CMD	DO	RAS/WAS Pump Station 2 Telescopic Valve Stop Cmd	205
47	SCRA38TSV20503.oSTART_CMD	DO	RAS/WAS Pump Station 3 Telescopic Valve Start Cmd	205
48	SCRA38TSV20503.oSTOP_CMD	DO	RAS/WAS Pump Station 3 Telescopic Valve Stop Cmd	205
49	SCRA38TSV20504.oSTART_CMD	DO	RAS/WAS Pump Station 4 Telescopic Valve Start Cmd	205

50	SCRA38TSV20504.oSTOP_CMD	DO	RAS/WAS Pump Station 4 Telescopic Valve Stop Cmd	205
51	SCRA38BAV22501.oSTART_CMD	DO	RAS/WAS Pump Station Eff. Ball Valve Start Cmd	225
52	SCRA38BAV22501.oSTOP_CMD	DO	RAS/WAS Pump Station Eff. Ball Valve Stop Cmd	225

**Filter and Reaeration Basin PLC-500 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCFL40PLC10001.oTEMP	AI	Filters/Re-Aeration PLC Temp	100
2	SCFL40WG11001.oPOSITION	AI	Filter Unit 1 Weir Gate Position	110
3	SCFL40WG11002.oPOSITION	AI	Filter Unit 2 Weir Gate Position	110
4	SCFL40WG11003.oPOSITION	AI	Filter Unit 3 Weir Gate Position	110
5	SCFL40WG11004.oPOSITION	AI	Filter Unit 4 Weir Gate Position	110
6	SCFL40WG11005.oPOSITION	AI	Filter Unit 5 Weir Gate Position	110
7	SCFL40WG11006.oPOSITION	AI	Filter Unit 6 Weir Gate Position	110
8	SCFL40AIT18001.oNTU	AI	Filter Splitter Box Turbidity	180
9	SCFL40FIT18501.oMGD	AI	Filter Valve Vault 1 Flow	185
10	SCFL40FIT18502.oMGD	AI	Filter Valve Vault 2 Flow	185
11	SCEP55PMP11001.oSPEED	AI	Reaeration Wet Well Effluent Pump 1 Speed	110
12	SCEP55PMP11002.oSPEED	AI	Reaeration Wet Well Effluent Pump 2 Speed	110
13	SCEP55PMP11003.oSPEED	AI	Reaeration Wet Well Effluent Pump 3 Speed	110
14	SCEP55PMP11004.oSPEED	AI	Reaeration Wet Well Effluent Pump 4 Speed	110
15	SCEP55LIT13001.oFEET	AI	Reaeration Wet Well Effluent Level	130
16	SCEP55LIT14001.oFEET	AI	Reaeration Diversion Channel Effluent Level	140
17	SCEP55FIT15001.oMGD	AI	Reaeration Sump Flow	150
18	SCEP55AIT15501.oTSS	AI	Effluent Sample Panel 592 Analyzer TSS	155
19	SCEP55AIT15502.oDO	AI	Effluent Sample Panel 592 Analyzer Dissolved Oxygen	155
20	SCEP55AIT15503.oNH4	AI	Effluent Sample Panel 592 Analyzer Ammonia	155
21	SCEP55AIT15504.oTRC	AI	Effluent Sample Panel 592 Analyzer TRC	155
22	SCEP55BUV15010.oPOSITION	AI	Reaeration Modulating Valve Vault Valve Position	150
23	SCRE50TIT71001.oTEMP	AI	Reaeration Elect Room Temperature	710
24	SCRE50TIT71002.oTEMP	AI	Reaeration Blower Room Temperature	710
25	SCRE50AIT71501.oO2	AI	Reaeration Vent Room Oxygen	715
1	SCFL40WG11001.oPOS_STPT	AO	Filter Unit 1 Weir Gate Position SetPoint	110
2	SCFL40WG11002.oPOS_STPT	AO	Filter Unit 2 Weir Gate Position SetPoint	110
3	SCFL40WG11003.oPOS_STPT	AO	Filter Unit 3 Weir Gate Position SetPoint	110
4	SCFL40WG11004.oPOS_STPT	AO	Filter Unit 4 Weir Gate Position SetPoint	110
5	SCFL40WG11005.oPOS_STPT	AO	Filter Unit 5 Weir Gate Position SetPoint	110
6	SCFL40WG11006.oPOS_STPT	AO	Filter Unit 6 Weir Gate Position SetPoint	110
7	SCEP55PMP11001.oSPD_STPT	AO	Reaeration Wet Well Effluent Pump 1 Speed Setpoint	110
8	SCEP55PMP11002.oSPD_STPT	AO	Reaeration Wet Well Effluent Pump 2 Speed Setpoint	110
9	SCEP55PMP11003.oSPD_STPT	AO	Reaeration Wet Well Effluent Pump 3 Speed Setpoint	110
10	SCEP55PMP11004.oSPD_STPT	AO	Reaeration Wet Well Effluent Pump 4 Speed Setpoint	110
11	SCEP55BUV15010.oPOS_STPT	AO	Reaeration Modulating Valve Vault Valve Position SetPoint	150
1	SCFL40PLC10001.oPWR_FAIL	DI	Filters/Re-Aeration PLC 24Vdc Power Supply Fail	100
2	SCFL40PLC10001.oUPS_FAIL	DI	Filters/Re-Aeration PLC UPS Fail	100
3	SCFL40PLC10001.oUPS_BATT_FAIL	DI	Filters/Re-Aeration PLC UPS Battery Fail	100
4	SCFL40PLC10001.oINT_SW	DI	Filters/Re-Aeration PLC Intrusion Switch	100
5	SCFL40WG11001.oOPEN	DI	Filter Unit 1 Weir Gate Open	110
6	SCFL40WG11001.oCLOSED	DI	Filter Unit 1 Weir Gate Closed	110
7	SCFL40WG11001.oREMOTE	DI	Filter Unit 1 Weir Gate Remote	110
8	SCFL40WG11001.oFAULT	DI	Filter Unit 1 Weir Gate Fault	110
9	SCFL40WG11002.oOPEN	DI	Filter Unit 2 Weir Gate Open	110
10	SCFL40WG11002.oCLOSED	DI	Filter Unit 2 Weir Gate Closed	110
11	SCFL40WG11002.oREMOTE	DI	Filter Unit 2 Weir Gate Remote	110
12	SCFL40WG11002.oFAULT	DI	Filter Unit 2 Weir Gate Fault	110
13	SCFL40WG11003.oOPEN	DI	Filter Unit 3 Weir Gate Open	110
14	SCFL40WG11003.oCLOSED	DI	Filter Unit 3 Weir Gate Closed	110
15	SCFL40WG11003.oREMOTE	DI	Filter Unit 3 Weir Gate Remote	110

16	SCFL40WG11003.oFAULT	DI	Filter Unit 3 Weir Gate Fault	110
17	SCFL40WG11004.oOPEN	DI	Filter Unit 4 Weir Gate Open	110
18	SCFL40WG11004.oCLOSED	DI	Filter Unit 4 Weir Gate Closed	110
19	SCFL40WG11004.oREMOTE	DI	Filter Unit 4 Weir Gate Remote	110
20	SCFL40WG11004.oFAULT	DI	Filter Unit 4 Weir Gate Fault	110
21	SCFL40WG11005.oOPEN	DI	Filter Unit 5 Weir Gate Open	110
22	SCFL40WG11005.oCLOSED	DI	Filter Unit 5 Weir Gate Closed	110
23	SCFL40WG11005.oREMOTE	DI	Filter Unit 5 Weir Gate Remote	110
24	SCFL40WG11005.oFAULT	DI	Filter Unit 5 Weir Gate Fault	110
25	SCFL40WG11006.oOPEN	DI	Filter Unit 6 Weir Gate Open	110
26	SCFL40WG11006.oCLOSED	DI	Filter Unit 6 Weir Gate Closed	110
27	SCFL40WG11006.oREMOTE	DI	Filter Unit 6 Weir Gate Remote	110
28	SCFL40WG11006.oFAULT	DI	Filter Unit 6 Weir Gate Fault	110
29	SCFL40SG11001.oREMOTE	DI	Filters Bypass Channel Gate Remote	110
30	SCFL40SG11001.oOPEN	DI	Filters Bypass Channel Gate Open	110
31	SCFL40SG11001.oCLOSED	DI	Filters Bypass Channel Gate Closed	110
32	SCFL40SG11001.oFAULT	DI	Filters Bypass Channel Gate Fault	110
33	SCEP55LCP52001.oLEVEL_HIHI	DI	LCP520 FEB Flow Meter Vault Sump Panel Level HighHigh	520
34	SCEP55LCP52001.oFAULT	DI	LCP520 FEB Flow Meter Vault Sump Panel Fault	520
35	SCEP55LCP53001.oLEVEL_HIHI	DI	LCP530 Liquid Oxygen Sump Panel Level HighHigh	530
36	SCEP55LCP53001.oFAULT	DI	LCP530 Liquid Oxygen Sump Panel Fault	530
37	SCEP55SLG12502.oREMOTE	DI	Reaeration Wet Well Effluent Gate Remote	125
38	SCEP55SLG12502.oOPEN	DI	Reaeration Wet Well Effluent Gate Open	125
39	SCEP55SLG12502.oCLOSED	DI	Reaeration Wet Well Effluent Gate Closed	125
40	SCEP55SLG12502.oFAULT	DI	Reaeration Wet Well Effluent Gate Fault	125
41	SCEP55SLG20503.oREMOTE	DI	Chlorine Contact Basin No.3 Remote	205
42	SCEP55SLG20503.oOPEN	DI	Chlorine Contact Basin No.3 Open	205
43	SCEP55SLG20503.oCLOSED	DI	Chlorine Contact Basin No.3 Closed	205
44	SCEP55SLG20503.oFAULT	DI	Chlorine Contact Basin No.3 Fault	205
45	SCEP55SLG20504.oREMOTE	DI	Chlorine Contact Basin No.4 Remote	205
46	SCEP55SLG20504.oOPEN	DI	Chlorine Contact Basin No.4 Open	205
47	SCEP55SLG20504.oCLOSED	DI	Chlorine Contact Basin No.4 Closed	205
48	SCEP55SLG20504.oFAULT	DI	Chlorine Contact Basin No.4 Fault	205
49	SCEP55PMP11001.oREMOTE	DI	Reaeration Wet Well Effluent Pump 1 Remote Mode	110
50	SCEP55PMP11001.oRUNNING	DI	Reaeration Wet Well Effluent Pump 1 Running	110
51	SCEP55PMP11001.oFAULT	DI	Reaeration Wet Well Effluent Pump 1 Fault	110
52	SCEP55PMP11001.oVFD_FAULT	DI	Reaeration Wet Well Effluent Pump 1 VFD Fault	110
53	SCEP55PMP11001.oTEMP_HI	DI	Reaeration Wet Well Effluent Pump 1 Temp Hi	110
54	SCEP55PMP11001.oLEAK	DI	Reaeration Wet Well Effluent Pump 1 Leak	110
55	SCEP55PMP11001.oLEVEL_LOCKOUT	DI	Reaeration Wet Well Effluent Pump 1 Level Lockout	110
56	SCEP55PMP11002.oREMOTE	DI	Reaeration Wet Well Effluent Pump 2 Remote Mode	110
57	SCEP55PMP11002.oRUNNING	DI	Reaeration Wet Well Effluent Pump 2 Running	110
58	SCEP55PMP11002.oFAULT	DI	Reaeration Wet Well Effluent Pump 2 Fault	110
59	SCEP55PMP11002.oVFD_FAULT	DI	Reaeration Wet Well Effluent Pump 2 VFD Fault	110
60	SCEP55PMP11002.oTEMP_HI	DI	Reaeration Wet Well Effluent Pump 2 Temp Hi	110
61	SCEP55PMP11002.oLEAK	DI	Reaeration Wet Well Effluent Pump 2 Leak	110
62	SCEP55PMP11002.oLEVEL_LOCKOUT	DI	Reaeration Wet Well Effluent Pump 2 Level Lockout	110
63	SCEP55PMP11003.oREMOTE	DI	Reaeration Wet Well Effluent Pump 3 Remote Mode	110
64	SCEP55PMP11003.oRUNNING	DI	Reaeration Wet Well Effluent Pump 3 Running	110
65	SCEP55PMP11003.oFAULT	DI	Reaeration Wet Well Effluent Pump 3 Fault	110
66	SCEP55PMP11003.oVFD_FAULT	DI	Reaeration Wet Well Effluent Pump 3 VFD Fault	110
67	SCEP55PMP11003.oTEMP_HI	DI	Reaeration Wet Well Effluent Pump 3 Temp Hi	110
68	SCEP55PMP11003.oLEAK	DI	Reaeration Wet Well Effluent Pump 3 Leak	110
69	SCEP55PMP11003.oLEVEL_LOCKOUT	DI	Reaeration Wet Well Effluent Pump 3 Level Lockout	110



70	SCEP55PMP11004.oREMOTE	DI	Reaeration Wet Well Effluent Pump 4 Remote Mode	110
71	SCEP55PMP11004.oRUNNING	DI	Reaeration Wet Well Effluent Pump 4 Running	110
72	SCEP55PMP11004.oFAULT	DI	Reaeration Wet Well Effluent Pump 4 Fault	110
73	SCEP55PMP11004.oVFD_FAULT	DI	Reaeration Wet Well Effluent Pump 4 VFD Fault	110
74	SCEP55PMP11004.oTEMP_HI	DI	Reaeration Wet Well Effluent Pump 4 Temp Hi	110
75	SCEP55PMP11004.oLEAK	DI	Reaeration Wet Well Effluent Pump 4 Leak	110
76	SCEP55PMP11004.oLEVEL_LOCKOUT	DI	Reaeration Wet Well Effluent Pump 4 Level Lockout	110
77	SCEP55LSL11501.oON	DI	Reaeration Effluent Wet Well Level Low	115
78	SCEP55LSH12001.oON	DI	Reaeration Effluent Wet Well Level High	120
79	SCEP55LCP59001.oLEVEL_HIHI	DI	LCP590 Meter Vault Sump Panel Level HighHigh	590
80	SCEP55LCP59001.oFAULT	DI	LCP590 Meter Vault Sump Panel Fault	590
81	SCEP55LCP59101.oLEVEL_HIHI	DI	LCP591 Valve Vault Sump Panel Level HighHigh	591
82	SCEP55LCP59101.oFAULT	DI	LCP591 Valve Vault Sump Panel Fault	591
83	SCEP55LCP59201.oPOWER_LOSS	DI	Effluent Sample Panel Power Loss	592
84	SCEP55LCP59201.oNO_FLOW	DI	Effluent Sample Panel No Flow	592
85	SCEP55BUV15010.oOPEN	DI	Reaeration Modulating Valve Vault Valve Open	150
86	SCEP55BUV15010.oCLOSED	DI	Reaeration Modulating Valve Vault Valve Closed	150
87	SCEP55BUV15010.oREMOTE	DI	Reaeration Modulating Valve Vault Valve Remote	150
88	SCEP55BUV15010.oFAULT	DI	Reaeration Modulating Valve Vault Valve Fault	150
89	SCRE50HCP57001.oPWR_ON	DI	Reaeration Elect Room HVAC Control Panel Power On	570
90	SCRE50HCP57001.oALARM	DI	Reaeration Elect Room HVAC Control Panel General Alarm	570
91	SCRE50AFU57501.oSW	DI	Reaeration Elect Room Air Filter Unit Alarm	575
92	SCRE50VCP57101.oPWR_ON	DI	Reaeration Vent Room Vent Control Panel Power On	571
93	SCRE50VCP57101.oALARM	DI	Reaeration Vent Room Vent Control Panel General Alarm	571
1	SCFL40WG11001.oOPEN_CMD	DO	Filter Unit 1 Weir Gate Open Cmd	110
2	SCFL40WG11001.oCLOSE_CMD	DO	Filter Unit 1 Weir Gate Close Cmd	110
3	SCFL40WG11002.oOPEN_CMD	DO	Filter Unit 2 Weir Gate Open Cmd	110
4	SCFL40WG11002.oCLOSE_CMD	DO	Filter Unit 2 Weir Gate Close Cmd	110
5	SCFL40WG11003.oOPEN_CMD	DO	Filter Unit 3 Weir Gate Open Cmd	110
6	SCFL40WG11003.oCLOSE_CMD	DO	Filter Unit 3 Weir Gate Close Cmd	110
7	SCFL40WG11004.oOPEN_CMD	DO	Filter Unit 4 Weir Gate Open Cmd	110
8	SCFL40WG11004.oCLOSE_CMD	DO	Filter Unit 4 Weir Gate Close Cmd	110
9	SCFL40WG11005.oOPEN_CMD	DO	Filter Unit 5 Weir Gate Open Cmd	110
10	SCFL40WG11005.oCLOSE_CMD	DO	Filter Unit 5 Weir Gate Close Cmd	110
11	SCFL40WG11006.oOPEN_CMD	DO	Filter Unit 6 Weir Gate Open Cmd	110
12	SCFL40WG11006.oCLOSE_CMD	DO	Filter Unit 6 Weir Gate Close Cmd	110
13	SCFL40SG11001.oOPEN_CMD	DO	Filters Bypass Channel Gate Open Cmd	110
14	SCFL40SG11001.oCLOSE_CMD	DO	Filters Bypass Channel Gate Close Cmd	110
15	SCEP55SLG12502.oOPEN_CMD	DO	Reaeration Wet Well Effluent Gate Open Cmd	125
16	SCEP55SLG12502.oCLOSE_CMD	DO	Reaeration Wet Well Effluent Gate Close Cmd	125
17	SCEP55SLG20503.oOPEN_CMD	DO	Chlorine Contact Basin No.3 Open Cmd	205
18	SCEP55SLG20503.oCLOSE_CMD	DO	Chlorine Contact Basin No.3 Close Cmd	205
19	SCEP55SLG20504.oOPEN_CMD	DO	Chlorine Contact Basin No.4 Open Cmd	205
20	SCEP55SLG20504.oCLOSE_CMD	DO	Chlorine Contact Basin No.4 Close Cmd	205
21	SCEP55PMP11001.oSTART_CMD	DO	Reaeration Wet Well Effluent Pump 1 Start Cmd	110
22	SCEP55PMP11001.oSTOP_CMD	DO	Reaeration Wet Well Effluent Pump 1 Stop Cmd	110
23	SCEP55PMP11002.oSTART_CMD	DO	Reaeration Wet Well Effluent Pump 2 Start Cmd	110
24	SCEP55PMP11002.oSTOP_CMD	DO	Reaeration Wet Well Effluent Pump 2 Stop Cmd	110
25	SCEP55PMP11003.oSTART_CMD	DO	Reaeration Wet Well Effluent Pump 3 Start Cmd	110
26	SCEP55PMP11003.oSTOP_CMD	DO	Reaeration Wet Well Effluent Pump 3 Stop Cmd	110
27	SCEP55PMP11004.oSTART_CMD	DO	Reaeration Wet Well Effluent Pump 4 Start Cmd	110
28	SCEP55PMP11004.oSTOP_CMD	DO	Reaeration Wet Well Effluent Pump 4 Stop Cmd	110
29	SCEP55BUV15010.oOPEN_CMD	DO	Reaeration Modulating Valve Vault Valve Open Cmd	150
30	SCEP55BUV15010.oCLOSE_CMD	DO	Reaeration Modulating Valve Vault Valve Close Cmd	150

**Disinfection Facility PLC-600 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCCG60TIT71001.oTEMP	AI	Disinfection Facility Elect Room Temperature	710
2	SCCG60TIT71002.oTEMP	AI	Disinfection Facility Sodium Hypochlorite Room Temperature	710
3	SCCG60TIT71003.oTEMP	AI	Disinfection Facility Sodium Bisulfite Room Temperature	710
4	SCCG60TIT71004.oTEMP	AI	Disinfection Facility OSHG Room Temperature	710
5	SCCG60TIT71005.oTEMP	AI	Disinfection Facility Corridor Room Temperature	710
6	SCCG60TIT71006.oTEMP	AI	Disinfection Facility Fire Riser Room Temperature	710
1	SCCG60HCP67001.oPWR_ON	DI	Disinfection Facility Elect Room HVAC Control Panel Power On	670
2	SCCG60HCP67001.oALARM	DI	Disinfection Facility Elect Room HVAC Control Panel General Alarm	670
3	SCCG60HCP67101.oPWR_ON	DI	Disinfection Facility OSHG Room HVAC Control Panel Power On	671
4	SCCG60HCP67101.oALARM	DI	Disinfection Facility OSHG Room HVAC Control Panel General Alarm	671
5	SCCG60AFU67501.oSW	DI	Disinfection Facility Elect Room Air Filter Unit Alarm	675
6	SCCG60VCP68001.oPWR_ON	DI	Disinfection Facility Sodium Bisulfite Room Vent. Control Panel Power On	680
7	SCCG60VCP68001.oALARM	DI	Disinfection Facility Sodium Bisulfite Room Vent. Control Panel General Alarm	680
8	SCCG60ODU70501.oLEL_ALARM	DI	Disinfection Sodium Bisulfite Room Odor Unit LEL Alarm	705
9	SCCG60ODU70501.oFIRE_ALARM	DI	Disinfection Sodium Bisulfite Room Odor Unit Fire Alarm	705
10	SCCG60ODU70501.oFAULT	DI	Disinfection Sodium Bisulfite Room Odor Unit Common Fault	705

**Digester Facility PLC-650 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCDB65PLC10001.oTEMP	AI	Digester Facility PLC Temp	100
2	SCDB65TIT71001.oTEMP	AI	Digester Facility Elect Room Temperature	710
3	SCDB65TIT71002.oTEMP	AI	Digester Facility Blower Room Temperature	710
1	SCDB65PLC10001.oPWR_FAIL	DI	Digester Facility PLC 24Vdc Power Supply Fail	100
2	SCDB65PLC10001.oUPS_FAIL	DI	Digester Facility PLC UPS Fail	100
3	SCDB65PLC10001.oUPS_BATT_FAIL	DI	Digester Facility PLC UPS Battery Fail	100
4	SCDB65PLC10001.oINT_SW	DI	Digester Facility PLC Intrusion Switch	100
5	SCTH70PMP12001.oREMOTE	DI	Digester 1 Existing Motive Pump 1 Remote Mode	120
6	SCTH70PMP12001.oRUNNING	DI	Digester 1 Existing Motive Pump 1 Running	120
7	SCTH70PMP12001.oFAULT	DI	Digester 1 Existing Motive Pump 1 Fault	120
8	SCTH70PMP12002.oREMOTE	DI	Digester 1 Existing Motive Pump 2 Remote Mode	120
9	SCTH70PMP12002.oRUNNING	DI	Digester 1 Existing Motive Pump 2 Running	120
10	SCTH70PMP12002.oFAULT	DI	Digester 1 Existing Motive Pump 2 Fault	120
11	SCTH70PMP12003.oREMOTE	DI	Digester 2 Existing Motive Pump 1 Remote Mode	120
12	SCTH70PMP12003.oRUNNING	DI	Digester 2 Existing Motive Pump 1 Running	120
13	SCTH70PMP12003.oFAULT	DI	Digester 2 Existing Motive Pump 1 Fault	120
14	SCTH70PMP12004.oREMOTE	DI	Digester 2 Existing Motive Pump 2 Remote Mode	120
15	SCTH70PMP12004.oRUNNING	DI	Digester 2 Existing Motive Pump 2 Running	120
16	SCTH70PMP12004.oFAULT	DI	Digester 2 Existing Motive Pump 2 Fault	120
17	SCTH70PMP12005.oREMOTE	DI	Digester 3 Existing Motive Pump 1 Remote Mode	120
18	SCTH70PMP12005.oRUNNING	DI	Digester 3 Existing Motive Pump 1 Running	120
19	SCTH70PMP12005.oFAULT	DI	Digester 3 Existing Motive Pump 1 Fault	120
20	SCTH70PMP12006.oREMOTE	DI	Digester 3 Existing Motive Pump 2 Remote Mode	120
21	SCTH70PMP12006.oRUNNING	DI	Digester 3 Existing Motive Pump 2 Running	120
22	SCTH70PMP12006.oFAULT	DI	Digester 3 Existing Motive Pump 2 Fault	120
23	SCDB65HCP77001.oPWR_ON	DI	Digester Facility Elect Room HVAC Control Panel 1 Power On	770
24	SCDB65HCP77001.oALARM	DI	Digester Facility Elect Room HVAC Control Panel 1 General Alarm	770
25	SCDB65HCP77101.oPWR_ON	DI	Digester Facility Elect Room HVAC Control Panel 2 Power On	771
26	SCDB65HCP77101.oALARM	DI	Digester Facility Elect Room HVAC Control Panel 2 General Alarm	771
27	SCDB65AFU77501.oSW	DI	Digester Facility Elect Room Air Filter Unit Alarm	775
1	SCTH70PMP12001.oSTART_CMD	DO	Digester 1 Existing Motive Pump 1 Start Cmd	120
2	SCTH70PMP12001.oSTOP_CMD	DO	Digester 1 Existing Motive Pump 1 Stop Cmd	120
3	SCTH70PMP12002.oSTART_CMD	DO	Digester 1 Existing Motive Pump 2 Start Cmd	120
4	SCTH70PMP12002.oSTOP_CMD	DO	Digester 1 Existing Motive Pump 2 Stop Cmd	120
5	SCTH70PMP12003.oSTART_CMD	DO	Digester 2 Existing Motive Pump 1 Start Cmd	120
6	SCTH70PMP12003.oSTOP_CMD	DO	Digester 2 Existing Motive Pump 1 Stop Cmd	120
7	SCTH70PMP12004.oSTART_CMD	DO	Digester 2 Existing Motive Pump 2 Start Cmd	120
8	SCTH70PMP12004.oSTOP_CMD	DO	Digester 2 Existing Motive Pump 2 Stop Cmd	120
9	SCTH70PMP12005.oSTART_CMD	DO	Digester 3 Existing Motive Pump 1 Start Cmd	120
10	SCTH70PMP12005.oSTOP_CMD	DO	Digester 3 Existing Motive Pump 1 Stop Cmd	120
11	SCTH70PMP12006.oSTART_CMD	DO	Digester 3 Existing Motive Pump 2 Start Cmd	120
12	SCTH70PMP12006.oSTOP_CMD	DO	Digester 3 Existing Motive Pump 2 Stop Cmd	120

**Thickener Facility PLC-700 IO LIST**

NUM	POINTS NAME	TYPE	DESCRIPTION	LOOP
1	SCTH70PLC10001.oTEMP	AI	Thickener PLC Temp	100
2	SCTH70LIT11501.oFEET	AI	Thickener Wet Well Level	115
3	SCTH70AIT60101.oH2S	AI	Thickener Building H2S Monitor 1 H2S	601
4	SCTH70AIT60102.oH2S	AI	Thickener Building H2S Monitor 2 H2S	601
5	SCTH70TIT71001.oTEMP	AI	Thickener Building Temperature	710
1	SCTH70PLC10001.oPWR_FAIL	DI	Thickener PLC 24Vdc Power Supply Fail	100
2	SCTH70PLC10001.oUPS_FAIL	DI	Thickener PLC UPS Fail	100
3	SCTH70PLC10001.oUPS_BATT_FAIL	DI	Thickener PLC UPS Battery Fail	100
4	SCTH70PLC10001.oINT_SW	DI	Thickener PLC Intrusion Switch	100
5	SCTH70LSHH11611.oON	DI	Digester Pump Station 1 Level HighHigh	116
6	SCTH70LSHH11621.oON	DI	Digester Pump Station 2 Level HighHigh	116
7	SCTH70PMP11311.oRUNNING	DI	Digester Pump Station 1 Pump 1 Running	113
8	SCTH70PMP11311.oFAULT	DI	Digester Pump Station 1 Pump 1 Fault	113
9	SCTH70PMP11312.oRUNNING	DI	Digester Pump Station 1 Pump 2 Running	113
10	SCTH70PMP11312.oFAULT	DI	Digester Pump Station 1 Pump 2 Fault	113
11	SCTH70PMP11321.oRUNNING	DI	Digester Pump Station 2 Pump 1 Running	113
12	SCTH70PMP11321.oFAULT	DI	Digester Pump Station 2 Pump 1 Fault	113
13	SCTH70PMP11322.oRUNNING	DI	Digester Pump Station 2 Pump 2 Running	113
14	SCTH70PMP11322.oFAULT	DI	Digester Pump Station 2 Pump 2 Fault	113
15	SCTH70ODU70501.oLEL_ALARM	DI	Thicken Odor Control Unit LEL Alarm	705
16	SCTH70ODU70501.oFIRE_ALARM	DI	Thicken Odor Control Unit Fire Alarm	705
17	SCTH70ODU70501.oFAULT	DI	Thicken Odor Control Unit Common Fault	705
18	SCTH70ODU70502.oLEL_ALARM	DI	Wet Well Odor Control Unit LEL Alarm	705
19	SCTH70ODU70502.oFIRE_ALARM	DI	Wet Well Odor Control Unit Fire Alarm	705
20	SCTH70ODU70502.oFAULT	DI	Wet Well Odor Control Unit Common Fault	705
21	SCTH70AIT60101.oH2S_HI	DI	Thickener Building H2S Monitor 1 H2S High	601
22	SCTH70AIT60102.oH2S_HI	DI	Thickener Building H2S Monitor 2 H2S High	601
23	SCTH70VCP87001.oPWR_ON	DI	Thickener Building Vent. Control Panel Power On	870
24	SCTH70VCP87001.oALARM	DI	Thickener Building Vent. Control Panel General Alarm	870

**END OF SECTION**

**SECTION 17920****CONTROL NARRATIVE****PART 1 GENERAL****1.01 SCOPE OF WORK**

- A. Configure, design, program and test the required process control logics that are defined in the provided Control Narrative.
- B. The developed programs and configuration shall meet the required Plant operation and process control.
- C. All the developed programs, including PLC programs and configuration, OIT (Operator Interface Terminal) HMI system configuration and screens, shall be completely tested before the system field startup and commissioning.
- D. The following paragraphs are a general outline of the process control and plant operation.
- E. **Refer to City of Oklahoma City Utilities Department SCADA Standards included in the Supplemental Special Provisions Section 1 SCADA Programming Guidelines, Section 1.2 PLC Programming Guidelines, and Section 2 Control Strategy Narrative Template to provide PLC programming and configuration.**
- F. **Refer to City of Oklahoma City Utilities Department SCADA Standards Appendices included in the Supplemental Special Provisions to provide PLC IO List and Control Narratives**
- G. **All PLC programs shall use City's standard function blocks with no exception. Any new function blocks required for special process control, these function blocks must be approved by City.**

**1.02 FUTURE EQUIPMENT PROGRAMMING REQUIREMENTS**

- A. Provide all PLC/HMI programming for future equipment in this project.
- B. Future equipment shall be clearly documented in all PLC/HMI program. This includes equipment PLC input and output description and HMI database tag description.
- C. Design submittals and Owner Manuals shall include all future equipment
- D. Provide future equipment test. Test shall be from PLC IO terminals to SCADA HMI screen display and local OIT. Provide test result submittal.
- E. SCADA HMI and local OIT shall disable all future equipment alarms.



## 1.03 RELATED WORK (NOT USED)

## 1.04 SUBMITTALS

- A. The CONTRACTOR shall submit the PLC program design submittal prior to the Factory Acceptance Test. The submittals shall include:
  - 1. One copy of PLC program print-out in electronic PDF format.
  - 2. Tag name convention and database
  - 3. Control strategy narrative.
  - 4. PLC I/O List.

## 1.05 REFERENCE STANDARDS (NOT USED)

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 SYSTEM DESCRIPTION/DESIGN REQUIREMENTS (NOT USED)

## 1.08 DELIVERY, HANDLING AND STORAGE (NOT USED)

## 1.09 MAINTENANCE/SPARE PARTS (NOT USED)

## 1.10 WARRANTY/EXTENDED WARRANTY (NOT USED)

## PART 2 PRODUCTS

## PART 3 EXECUTION

## 3.01 PLC-050: ADMINISTRATION BUILDING

- A. Administration Building PLC-050 (AN00PLC05001)
  - 1. Description: Monitor the 24 VDC power supply for the PLC.
  - 2. Controller programming and configuration:
    - a. Monitor the status of the 24 VDC power supply for the PLC.
  - 3. HMI required programming and configuration:
    - a. Alarm when the 24VDC power supply fails.
- B. Administration Building SCADA Server Room Temperature (AN00TIT10101)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.

- e. Historical data recording.
  - C. Administration Building Lab Eye Wash (AN00ESW10201)
    - 1. Description: The switch provides an indication of switch status.
    - 2. Controller programming and configuration:
      - a. Monitor Switch status.
    - 3. HMI required programming and configuration:
      - a. Switch status display.
      - b. Alarm display when switch is ON.
      - c. Alarm log.
- 3.02 PLC-100: HEADWORKS AND INFLUENT PUMP STATION
- A. Headwork Influent PLC Panel (HW05PLC10001)
    - 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
    - 2. Controller programming and configuration:
      - a. Monitor intrusion switch status.
      - b. Monitor PLC panel 24 VDC power supply status.
      - c. Monitor power supply status.
      - d. Monitor PLC intrusion switch status.
      - e. Monitor temperature reading.
      - f. Monitor temperature instrument Hardware Fail.
      - g. Zero cutoff (Clamp small values to zero).
    - 3. HMI required programming and configuration:
      - a. Switches status display.
      - b. Alarm when switch ON.
      - c. Switch ON event log.
      - d. Current temperature reading display.
      - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
      - f. Current and historical data trending display.
      - g. temperature instrument reading Fail status display and alarm.
      - h. Historical data recording.
  - B. Headworks Influent Overflow Channel Gate (HW05SLG11001)
    - 1. Description: Monitor device status and control device opening when in Remote mode.
    - 2. Controller programming and configuration:
      - a. Monitor Open, Closed, LOR switch in Remote mode.
      - b. Monitor device failure status.
      - c. Open or Close device when device is in Remote mode.
    - 3. HMI required programming and configuration:
      - a. Device Open, Closed, LOR switch at Remote position status display.
      - b. Device Fault status display and alarm.
      - c. Manual Open or Close device when device is in Remote mode.



- C. Headworks Influent Channel Gate (HW05SLG12001, HW05SLG12002)
  - 1. Description: Monitor device status and control device opening when in Remote mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- D. Headworks Effluent Channel Gate (HW05SLG14001, HW05SLG14002)
  - 1. Description: Monitor device status and control device opening when in Remote mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- E. Headworks Odor Control Unit (HW05ODU70501)
  - 1. Description: Odor control unit status.
  - 2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  - 3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- F. Influent Pump Station Odor Control Unit (IP10ODU70501)
  - 1. Description: Odor control unit status.
  - 2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  - 3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- G. Well Level High and Level Low Switch (IP10LSL12501, PP15LSH11501, PP15LSL12001, IP10LSH12001)
  - 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:

- a. Monitor Switch status.
- 3. HMI required programming and configuration:
  - a. Switch status display.
  - b. Alarm display when switch is ON.
  - c. Alarm log.
- H. Influent Pump Station Wet Well Pump (IP10PMP11501, IP10PMP11502, IP10PMP11503, IP10PMP11504, IP10PMP11505)
  - 1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  - 2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.
    - b. Equipment REMOTE mode Control.
    - c. Equipment fail to start and fail to stop.
    - d. Calculate equipment runtime (0.1 hour increments) and number of starts.
  - 3. HMI required programming and configuration:
    - a. Status display: Remote, Running.
    - b. Alarm display: All faults and alarms.
    - c. Event log on: Remote, Running and each fault.
    - d. Equipment remote manual control.
      - (i) START/STOP pump control.
      - (ii) Fail to Start / Fail to Stop.
      - (iii) Fail to Start / Fail to Stop fail timer.
    - e. Equipment remote auto control.
      - (i) Pump will be controlled by station level control.
      - (ii) Level Control:
        - (a) Provide station level control. Default level setting shall be: 9 ft
        - (b) Level feedback signal: IP10LIT13001/PP15LIT12501. Provide signal backup control. The prime transmitter fails, the standby one automatically switches as level signal. Initiate an alarm for level signal switch over. If both level transmitter fail, switch pump to Remote manual mode, keep pump running status, and initiate alarm.
        - (c) Control shall adjust pump speed to meet level setpoint. All running pump shall be same speed to maintain desire level.
        - (d) If pump speed reaches minimum speed and level is higher than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next most runtime pump to stop.
        - (e) If pump speed reaches max speed and level is lower than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next least runtime pump to run.
        - (f) Provide pump runtime balance control. Most runtime pump will be called to stop and least runtime pump will be called to start.

I. Peak Flow Pump Station Pump (PP15PMP11001, PP15PMP11002)

1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.
    - b. Equipment REMOTE mode Control.
    - c. Equipment fail to start and fail to stop.
    - d. Calculate equipment runtime (0.1 hour increments) and number of starts.
  3. HMI required programming and configuration:
    - a. Status display: Remote, Running.
    - b. Alarm display: All faults and alarms.
    - c. Event log on: Remote, Running and each fault.
    - d. Equipment remote manual control.
      - (i) START/STOP pump control.
      - (ii) Fail to Start / Fail to Stop.
      - (iii) Fail to Start / Fail to Stop fail timer.
    - e. Equipment remote auto control.
      - (i) Pump will be controlled by station level lead-lag control.
      - (ii) Level lead-lag:
        - (a) Default lead level setpoint1: 11 ft
        - (b) Default lead level setpoint2: 12 ft
        - (c) Default level lag level setpoint1: 10 ft
        - (d) Default level lag level setpoint2: 9.5 ft
        - (e) Provide lead-lag pump runtime rotation control
        - (f) Level feedback signal: IP10LIT13001/PP15LIT12501. Provide signal backup control. The prime transmitter fails, the standby one automatically switches as level signal. Initiate an alarm for level signal switch over. If both level transmitter fail, switch pump to Remote manual mode, keep pump running status, and initiate alarm.
      - (iii) Level fail control: if level instrument fails, after time delay, pump shall be switched to remote manual mode, keep running status and initiate alarm.
    - f. Equipment runtime display and reset.
    - g. Equipment number of starts display.
    - h. Equipment Remote mode Speed Set Point control.
- J. Influent Pump Station/Peak Flow Pump Station Level (IP10LIT13001, PP15LIT12501)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:

- a. Current instrument reading display.
  - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - c. Current and historical data trending display.
  - d. Instrument reading Fail status display and alarm.
  - e. Historical data recording.
- K. Influent Pump Station Plant Drain Flow (IP10FIT14001)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.
    - h. Historical data recording.
    - i. Flow totalization reset.
- L. FEB Pump Station Sump Panel LCP-192 (PB18LCP19201)
  - 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- M. Influent Pump Station Elect Room Temperature (IP10TIT71001)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.

2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- N. Influent Pump Station Elect Room HVAC Control Panel (IP10HCP17001)
1. Description: The panel provides indications of HVAC control panel status.
  2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- O. Influent Pump Station Elect Room Air Filter Unit Alarm Switch (IP10AFU17501)
1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:
    - a. Monitor Switch status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- P. FEB Pump Station Odor Control Unit (PP15ODU70501)
1. Description: Odor control unit status.
  2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- Q. FEB Pump Station Sump Panel LCP-193 (PB18LCP19301)
1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.

- R. FEB Valve (PB18PV15001)
  - 1. Description: Monitor device status and control device open position when in Remote Mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device open position.
    - d. Device Open, Close, and position control when device is in Remote Mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Open, Closed and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
  
- S. FEB Pump Station Level (PP15LIT13501)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
  
- T. FEB Pump Station Level High and Level Low Switch (PP15LSH14501, PP15LSL14001)
  - 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor Switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
  
- U. FEB Pump Station Wet Well Pump (PP15PMP13001, PP15PMP13002, PP15PMP13003, PP15PMP13004)
  - 1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  - 2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.

- b. Equipment REMOTE mode Control.
- c. Equipment fail to start and fail to stop.
- d. Calculate equipment runtime (0.1 hour increments) and number of starts.
- 3. HMI required programming and configuration:
  - a. Status display: Remote, Running.
  - b. Alarm display: All faults and alarms.
  - c. Event log on: Remote, Running and each fault.
  - d. Equipment remote manual control.
    - (i) START/STOP pump control.
    - (ii) Fail to Start / Fail to Stop.
    - (iii) Fail to Start / Fail to Stop fail timer.
  - e. Equipment remote auto control.
    - (i) Pump shall be controlled by station level lead-lag control.
    - (ii) Level lead-lag:
      - (a) Default lead level setpoint1: 8.0 ft
      - (b) Default lead level setpoint2: 8.5 ft
      - (c) Default lead level setpoint3: 9.0 ft
      - (d) Default level lag level setpoint1: 5.5 ft
      - (e) Default level lag level setpoint2: 4.5 ft
      - (f) Default level lag level setpoint3: 3.5 ft
      - (g) All setpoints shall be adjustable.
      - (h) Provide lead-lag pump runtime rotation control
      - (i) Level feedback signal: PP15LIT13501.
  - f. Equipment runtime display and reset.
  - g. Equipment number of starts display.
  - h. Equipment Remote mode Speed Set Point control.

V. FEB Flow (PB18FIT14201)

- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
- 2. Controller programming and configuration:
  - a. Monitor current instrument Reading.
  - b. Monitor instrument Hardware Fail.
  - c. Monitor Flow Totalization Today.
  - d. Monitor Flow Totalization Yesterday.
  - e. Monitor Lifetime Flow Totalization.
  - f. Zero cutoff (Clamp small values to zero).
  - g. Flow Totalization Reset.
- 3. HMI required programming and configuration:
  - a. Current instrument reading display.
  - b. Flow total today display.
  - c. Flow total yesterday display.

- d. Lifetime Flow Totalization.
  - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - f. Current and historical data trending display.
  - g. Instrument reading Fail status display and alarm.
  - h. Historical data recording.
  - i. Flow totalization reset.
- W. FEB Flow Meter Vault Sump Panel (PB18LCP19401)
- 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- X. FEB Basin 1 Influent Flow (PB18FIT11001)
- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.
    - h. Historical data recording.
    - i. Flow totalization reset.
- Y. FEB Basin 1 Influent Pressure (PB18PIT11501)



1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- Z. FEB Effluent Gate (PB18SLG14501, PB18SLG14502)
1. Description: Monitor device status and control device opening when in Remote mode.
  2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- AA. FEB Basin Level (PB18LIT12501, PB18LIT12502)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- BB. FEB Basin Level High Switch (PB18LSH13001, PB18LSH13002)
1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:

- a. Monitor Switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
  - CC. FEB Basin Level Low Switch (PB18LSL13511, PB18LSL13521, PB18LSL13512, PB18LSL13522)
    - 1. Description: The switch provides an indication of switch status.
    - 2. Controller programming and configuration:
      - a. Monitor Switch status.
    - 3. HMI required programming and configuration:
      - a. Switch status display.
      - b. Alarm display when switch is ON.
      - c. Alarm log.
  - DD. FEB Mixer (PB18MX14001, PB18MX14002, PB18MX14003, PB18MX14004, PB18MX14005, PB18MX14006, PB18MX14007, PB18MX14008, PB18MX14009)
    - 1. Description: Monitor equipment status.
    - 2. Controller programming and configuration:
      - a. Monitor equipment Running status.
      - b. Monitor equipment failure statuses.
    - 3. HMI required programming and configuration:
      - a. Status display: Running.
      - b. Alarm display: All faults and alarms.
      - c. Event log on: Running and each fault.
- 3.03 PLC-200: GRIT REMOVAL FACILITY
- A. Grit Facility PLC Panel (DG20PLC10001)
    - 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
    - 2. Controller programming and configuration:
      - a. Monitor intrusion switch status.
      - b. Monitor PLC panel 24 VDC power supply status.
      - c. Monitor power supply status.
      - d. Monitor PLC intrusion switch status.
      - e. Monitor temperature reading.
      - f. Monitor temperature instrument Hardware Fail.
      - g. Zero cutoff (Clamp small values to zero).
    - 3. HMI required programming and configuration:
      - a. Switches status display.
      - b. Alarm when switch ON.
      - c. Switch ON event log.

- d. Current temperature reading display.
- e. HiHi/Hi/Lo/LoLo alarms display and configuration.
- f. Current and historical data trending display.
- g. temperature instrument reading Fail status display and alarm.
- h. Historical data recording.

B. Influent Pump Station Effluent Flow (IP10FIT13501)

- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
- 2. Controller programming and configuration:
  - a. Monitor current instrument Reading.
  - b. Monitor instrument Hardware Fail.
  - c. Monitor Flow Totalization Today.
  - d. Monitor Flow Totalization Yesterday.
  - e. Monitor Lifetime Flow Totalization.
  - f. Zero cutoff (Clamp small values to zero).
  - g. Flow Totalization Reset.
- 3. HMI required programming and configuration:
  - a. Current instrument reading display.
  - b. Flow total today display.
  - c. Flow total yesterday display.
  - d. Lifetime Flow Totalization.
  - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - f. Current and historical data trending display.
  - g. Instrument reading Fail status display and alarm.
  - h. Historical data recording.
  - i. Flow totalization reset.

C. Influent Pump Station Sump Panel (PB18LCP19101)

- 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
- 2. Controller programming and configuration:
  - a. Monitor switch status.
  - b. Monitor sump pump status.
- 3. HMI required programming and configuration:
  - a. Switch status display.
  - b. Pump fail status display.
  - c. Alarm display when switch is ON.
  - d. Alarm log.

D. Grit Basin Odor Control Unit (DG20ODU70501)

- 1. Description: odor control unit status.
- 2. Controller programming and configuration:
  - (i) Monitor equipment faults and alarms status.

3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- E. Grit Facility Influent Box Level High Switch (DG20LSH11201)
1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:
    - a. Monitor Switch status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- F. Grit Facility Channel Influent/Effluent/Bypass Channel Influent Gate (DG20SLG11501, DG20SLG11502, DG20SLG13001, DG20SLG13002, DG20SLG16001)
1. Description: Monitor device status and control device opening when in Remote mode.
  2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- G. Grit Effluent Box Sump Panel (DS18LCP22001)
1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- H. Grit Washer Facility Odor Control Unit (DG20ODU70502)
1. Description: Odor control unit status.
  2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.

- I. Grit Facility Grit Electrical Room/Removal Room Temperature (DG20TIT71001, DG20TIT71002)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
  
- J. Grit Facility Electrical Room HVAC Control Panel (DG20HCP27001)
  - 1. Description: The panel provides indications of HVAC control panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  - 3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
  
- K. Grit Facility Electrical Room HVAC Filter Unit Alarm Switch (DG20AFU27501)
  - 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
  
- L. Grit Facility H2S Monitor (DG20AIT60101, DG20AIT60102)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor the instrument high alarm.
    - c. Monitor instrument Hardware Fail.
    - d. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.

- e. Historical data recording.
- M. Grit Facility Grit Washer Room Vent. Control Panel (DG20VCP28001)
- 1. Description: The panel provides indications of ventilation control panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  - 3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- N. RAS Splitter Box Level (AB30LIT11001)
- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- O. RAS Splitter Box Weir Gate (AB30WG11201, AB30WG11202, AB30WG11203)
- 1. Description: Monitor device status and control device open position when in Remote Mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device open position.
    - d. Device Open, Close, and position control when device is in Remote Mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Open, Closed and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
- 3.04 PLC-300: AERATION BASIN FACILITY
- A. Aeration Basin PLC Panel (AB30PLC10001)
- 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.

2. Controller programming and configuration:
    - a. Monitor intrusion switch status.
    - b. Monitor PLC panel 24 VDC power supply status.
    - c. Monitor power supply status.
    - d. Monitor PLC intrusion switch status.
    - e. Monitor temperature reading.
    - f. Monitor temperature instrument Hardware Fail.
    - g. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Switches status display.
    - b. Alarm when switch ON.
    - c. Switch ON event log.
    - d. Current temperature reading display.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. temperature instrument reading Fail status display and alarm.
    - h. Historical data recording.
- B. Aeration Basin Influent Gate (AB30SLG11501, AB30SLG11502, AB30SLG11503, AB30SLG11504, AB30SLG11505, AB30SLG11506)
1. Description: Monitor device status and control device opening when in Remote mode.
  2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- C. Aeration Basin Elect Room HVAC Control Panel (AB30HCP37001)
1. Description: The panel provides indications of HVAC control panel status.
  2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- D. Aeration Basin Elect Room Air Filter Unit Alarm Switch (AB30AFU37501)
1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:
    - a. Monitor Switch status.

3. HMI required programming and configuration:

- a. Switch status display.
- b. Alarm display when switch is ON.
- c. Alarm log.

E. Aeration Basin Elect Room Temperature (AB30TIT71001)

- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
- 2. Controller programming and configuration:
  - a. Monitor current instrument reading.
  - b. Monitor instrument Hardware Fail.
  - c. Zero cutoff (Clamp small values to zero).
- 3. HMI required programming and configuration:
  - a. Current instrument reading display.
  - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - c. Current and historical data trending display.
  - d. Instrument reading Fail status display and alarm.
  - e. Historical data recording.

3.05 PLC-380: RAS/WAS PUMP STATION FACILITY

A. RAS/WAS Pump Station PLC Panel (RA38PLC10001)

- 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
- 2. Controller programming and configuration:
  - a. Monitor intrusion switch status.
  - b. Monitor PLC panel 24 VDC power supply status.
  - c. Monitor power supply status.
  - d. Monitor PLC intrusion switch status.
  - e. Monitor temperature reading.
  - f. Monitor temperature instrument Hardware Fail.
  - g. Zero cutoff (Clamp small values to zero).
- 3. HMI required programming and configuration:
  - a. Switches status display.
  - b. Alarm when switch ON.
  - c. Switch ON event log.
  - d. Current temperature reading display.
  - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - f. Current and historical data trending display.
  - g. temperature instrument reading Fail status display and alarm.
  - h. Historical data recording.

B. Clarifier Splitter Weir Gate (CL35WG11001, CL35WG11002, CL35WG11003, CL35WG11004, CL35WG11005, CL35WG11006, CL35WG11007, CL35WG11008)



1. Description: Monitor device status and control device open position when in Remote Mode.
  2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device open position.
    - d. Device Open, Close, and position control when device is in Remote Mode.
  3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Open, Closed and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
- C. Clarifier Plug Valve (CL35PV11501, CL35PV11502, CL35PV11503, CL35PV11504)
1. Description: Monitor device status and control device opening when in Remote mode.
  2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- D. Clarifier (CL35CLR12001, CL35CLR12002, CL35CLR12003, CL35CLR12004)
1. Description: Monitor clarifier status. Control clarifier running when LOR switch is position at "REMOTE".
  2. Controller programming and configuration:
    - (i) Monitor equipment running and failure statuses.
    - (ii) Equipment REMOTE mode Control.
    - (iii) Overload and high torque alarms
    - (iv) Equipment fail to start and fail to stop.
    - (v) Calculate equipment runtime (0.1 hour increments) and number of starts.
  3. HMI required programming and configuration:
    - (i) Status display: Remote, Running.
    - (ii) Alarm display: All faults and alarms.
    - (iii) Event log on: Remote, Running and each fault.
    - (iv) Equipment remote manual control
      - (a) START/STOP pump control.
      - (b) Fail to Start / Fail to Stop.
      - (c) Fail to Start / Fail to Stop fail timer.
    - (v) Equipment runtime display and reset.
    - (vi) Equipment number of starts display.
- E. Scum Pump Station Sump Level High-High Switch (CL35LSHH12511, CL35LSHH12521)

1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:
    - a. Monitor Switch status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- F. Scum Pump Station Pump (CL35PMP14011, CL35PMP14012, CL35PMP14021, CL35PMP14022)
1. Description: Monitor pump status.
  2. Controller programming and configuration:
    - (i) Monitor equipment running and failure statuses.
  3. HMI required programming and configuration:
    - (i) Status display: Running.
    - (ii) Alarm display: All faults and alarms.
    - (iii) Event log on: Running and each fault.
    - (iv) Equipment remote manual control
      - (a) N/A
    - (v) Equipment remote auto control
      - (a) N/A
- G. Clarifier Scum Pump Station Odor Control Unit (CL35ODU70501, CL35ODU70502)
1. Description: Odor control unit status.
  2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- H. RAS/WAS Pump (RA38PMP12501, RA38PMP12502, RA38PMP12503, RA38PMP12504, RA38PMP12505)
1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.
    - b. Equipment REMOTE mode Control.
    - c. Equipment fail to start and fail to stop.
    - d. Calculate equipment runtime (0.1 hour increments) and number of starts.
  3. HMI required programming and configuration:
    - a. Status display: Remote, Running.
    - b. Alarm display: All faults and alarms.
    - c. Event log on: Remote, Running and each fault.
    - d. Equipment remote manual control
      - (i) START/STOP pump control.
      - (ii) Fail to Start / Fail to Stop.

- (iii) Fail to Start / Fail to Stop fail timer.
  - e. Equipment remote auto control.
    - (i) Pump will be controlled by station level control.
    - (ii) Level Control:
      - (a) Provide level control enable and disable button.
      - (b) Provide station level control. Default level setting shall be WSE design shown on M-351.
      - (c) Level feedback signal: RA38LIT21001. If level transmitter fails, switch pump to Remote manual mode, keep pump running status, and initiate alarm.
      - (d) Control shall adjust pump speed to meet level setpoint. All running pump shall be same speed to maintain desire level.
      - (e) If pump speed reaches minimum speed and level is higher than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next most runtime pump to stop.
      - (f) If pump speed reaches max speed and level is lower than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next least runtime pump to run.
      - (g) Provide pump runtime balance control. Most runtime pump will be called to stop and least runtime pump will be called to start.
  - f. Equipment runtime display and reset.
  - g. Equipment number of starts display.
  - h. Equipment Remote mode Speed Set Point control.
- I. RAS/WAS Pump Station Influent Flow (RA38FIT20001, RA38FIT20002, RA38FIT20003, RA38FIT20004)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.

- g. Instrument reading Fail status display and alarm.
  - h. Historical data recording.
  - i. Flow totalization reset.
- J. RAS/WAS Pump Station Telescopic Valve (RA38TSV20501, RA38TSV20502, RA38TSV20503, RA38TSV20504)
- 1. Description: Monitor device status and control device open position when in Remote Mode.
  - 2. Controller programming and configuration:
    - a. Monitor LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device running status.
    - d. Monitor device open position.
    - e. Device Open, Close, and position control when device is in Remote Mode.
  - 3. HMI required programming and configuration:
    - a. Device LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Running and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
- K. RAS/WAS Pump Station Influent Box Level (RA38LIT21001)
- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- L. RAS/WAS Pump Station Wet Well Level High and Level Low Switch (RA38LSL21201, RA38LSH21301)
- 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.

- M. RAS/WAS Pump Station Eff. to RAS Splitter Box Flow (RA38FIT22001)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.
    - h. Historical data recording.
    - i. Flow totalization reset.
- N. RAS/WAS Pump Station Eff. Ball Valve (RA38BAV22501)
1. Description: Monitor device status and control device open position when in Remote Mode.
  2. Controller programming and configuration:
    - a. Monitor LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device running status.
    - d. Monitor device open position.
    - e. Device Open, Close, and position control when device is in Remote Mode.
  3. HMI required programming and configuration:
    - a. Device LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Running and Position status display.
    - d. Device Remote manual mode open, close and Position Set Point control.
    - e. Remote manual, auto 1 and auto 2 mode selection.
  4. Remote manual mode-Position Set Point control
  5. Remote Auto 1 mode-:
    - (i) Provide flow control
    - (ii) Flow Control:
      - (a) Provide flow control enable and disable button.

- (b) Default flow setting shall be 1.2 MGD.
  - (c) Provide PID loop for flow control by adjusting valve position
  - (d) Flow feedback: RA38FIT23001
  - (e) Flow feedback fail, switch valve to remote man mode and close valve.
- 6. Remote Auto 2 mode-:
  - (i) Provide schedule flow control
  - (ii) Provide this control enable and disable button.
  - (iii) Provide following settings:
    - (a) First start time: midnight (default)
    - (b) Open Duration: 55 min (default)
    - (c) Number of Operation: 6 times(default)
    - (d) When schedule is on, provide flow control
    - (e) When schedule is off, close valve
  - (iv) Flow Control:
    - (a) Default flow setting shall be 1.2 MGD.
    - (b) Provide PID loop for flow control by adjusting valve position
    - (c) Flow feedback: RA38FIT23001
    - (d) Flow feedback fail, switch valve to remote man mode and close valve.
  - (v) Flow fail control: if flow instrument fails, switch valve to remote man mode, and initiate alarm.
- O. RAS/WAS Pump Station Eff. to Digester Flow (RA38FIT23001)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.

- h. Historical data recording.
  - i. Flow totalization reset.
- P. FEB RAS Valve Vault Sump Panel (RA38LCP40001)
  - 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- Q. FEB RAS Pump Room Sump Panel (RA38LCP41501)
  - 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- R. RAS/WAS Pump Station Elect Room HVAC Control Panel (RA38HCP47001)
  - 1. Description: The panel provides indications of HVAC control panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  - 3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- S. RAS/WAS Pump Station Elect Room Air Filter Unit Alarm Switch (RA38AFU47501)
  - 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor Switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- T. RAS/WAS Pump Station Pump Room Vent. Control Panel (RA38VCP48001)
  - 1. Description: The panel provides indications of ventilation control panel status.
  - 2. Controller programming and configuration:

- a. Monitor power on status.
    - b. Monitor general alarm status.
  - 3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
  - U. RAS/WAS Pump Station H2S Monitor (RA38AIT60101, RA38AIT60102, RA38AIT60103, RA38AIT60104)
    - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
    - 2. Controller programming and configuration:
      - a. Monitor current instrument reading.
      - b. Monitor the instrument high alarm.
      - c. Monitor instrument Hardware Fail.
      - d. Zero cutoff (Clamp small values to zero).
    - 3. HMI required programming and configuration:
      - a. Current instrument reading display.
      - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
      - c. Current and historical data trending display.
      - d. Instrument reading Fail status display and alarm.
      - e. Historical data recording.
  - V. RAS/WAS Pump Station Elect Room and Pump Room Temperature (RA38TIT71001, RA38TIT71002)
    - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
    - 2. Controller programming and configuration:
      - a. Monitor current instrument reading.
      - b. Monitor instrument Hardware Fail.
      - c. Zero cutoff (Clamp small values to zero).
    - 3. HMI required programming and configuration:
      - a. Current instrument reading display.
      - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
      - c. Current and historical data trending display.
      - d. Instrument reading Fail status display and alarm.
      - e. Historical data recording.
- 3.06 PLC-500: FILTER AND REAERATION BASIN FACILITY
- A. Filter/Reaeration PLC Panel (FL40PLC10001)
    - 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
    - 2. Controller programming and configuration:
      - a. Monitor intrusion switch status.
      - b. Monitor PLC panel 24 VDC power supply status.



- c. Monitor power supply status.
    - d. Monitor PLC intrusion switch status.
    - e. Monitor temperature reading.
    - f. Monitor temperature instrument Hardware Fail.
    - g. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Switches status display.
    - b. Alarm when switch ON.
    - c. Switch ON event log.
    - d. Current temperature reading display.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. temperature instrument reading Fail status display and alarm.
    - h. Historical data recording.
- B. Filter Unit Weir Gate (FL40WG11001, FL40WG11002, FL40WG11003, FL40WG11004, FL40WG11005, FL40WG11006)
- 1. Description: Monitor device status and control device open position when in Remote Mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device open position.
    - d. Device Open, Close, and position control when device is in Remote Mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Open, Closed and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
- C. Filters Bypass Channel Gate (FL40SG11001)
- 1. Description: Monitor device status and control device opening when in Remote mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
- D. Filter Splitter Box Turbidity (FL40AIT18001)

1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- E. Filter Valve Vault Flow (FL40FIT18501, FL40FIT18502)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.
    - h. Historical data recording.
    - i. Flow totalization reset.
- F. FEB Flow Meter Vault Sump Panel (EP55LCP52001)
1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  3. HMI required programming and configuration:

- a. Switch status display.
  - b. Pump fail status display.
  - c. Alarm display when switch is ON.
  - d. Alarm log.
  
- G. Liquid Oxygen Sump Panel (EP55LCP53001)
  - 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
  
- H. Reaeration Wet Well Effluent Gate / Chlorine Contact Basin No.3 and No.4 Valve (EP55SLG12502, EP55SLG20503, EP55SLG20504)
  - 1. Description: Monitor device status and control device opening when in Remote mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Open or Close device when device is in Remote mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Manual Open or Close device when device is in Remote mode.
  
- I. Reaeration Wet Well Effluent Pump (EP55PMP11001, EP55PMP11002, EP55PMP11003, EP55PMP11004)
  - 1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  - 2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.
    - b. Equipment REMOTE mode Control.
    - c. Equipment fail to start and fail to stop.
    - d. Calculate equipment runtime (0.1 hour increments) and number of starts.
  - 3. HMI required programming and configuration:
    - a. Status display: Remote, Running.
    - b. Alarm display: All faults and alarms.
    - c. Event log on: Remote, Running and each fault.
    - d. Equipment remote manual control.
      - (i) START/STOP pump control.
      - (ii) Fail to Start / Fail to Stop.

- (iii) Fail to Start / Fail to Stop fail timer.
  - e. Equipment remote manual control.
    - (i) Equipment start/stop and speed setpoint
  - f. Equipment remote auto control.
    - (i) Provide station level control. Default level setting shall be: 9 ft
    - (ii) Level feedback signal: EP55LIT13001.
    - (iii) Control shall adjust pump speed to meet level setpoint. All running pump shall be same speed to maintain desire level.
    - (iv) If pump speed reaches minimum speed and level is higher than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next most runtime pump to stop.
    - (v) If pump speed reaches max speed and level is lower than setpoint. After time delay (HMI adjustable setting), the PLC program shall call next least runtime pump to run.
    - (vi) Provide pump runtime balance control. Most runtime pump will be called to stop and least runtime pump will be called to start.
  - g. Equipment runtime display and reset.
  - h. Equipment number of starts display.
  - i. Equipment Remote mode Speed Set Point control.
- J. Reaeration Effluent Wet Well Level High and Level Low Switch (EP55LSL11501, EP55LSH12001)
- 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- K. Reaeration Wet Well/Diversion Channel Effluent Level (EP55LIT13001, EP55LIT14001)
- 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.

- L. Reaeration Sump Flow (EP55FIT15001)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument Reading.
    - b. Monitor instrument Hardware Fail.
    - c. Monitor Flow Totalization Today.
    - d. Monitor Flow Totalization Yesterday.
    - e. Monitor Lifetime Flow Totalization.
    - f. Zero cutoff (Clamp small values to zero).
    - g. Flow Totalization Reset.
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. Flow total today display.
    - c. Flow total yesterday display.
    - d. Lifetime Flow Totalization.
    - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - f. Current and historical data trending display.
    - g. Instrument reading Fail status display and alarm.
    - h. Historical data recording.
    - i. Flow totalization reset.
  
- M. Effluent Sample Panel 592 Analyzer (EP55AIT15501, EP55AIT15502, EP55AIT15503, EP55AIT15504)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
  
- N. Meter Vault Sump Panel (EP55LCP59001)
  - 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.

- b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- O. Valve Vault Sump Panel (EP55LCP59101)
- 1. Description: The panel provides an indication of switch status and an indication of sump pump status.
  - 2. Controller programming and configuration:
    - a. Monitor switch status.
    - b. Monitor sump pump status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Pump fail status display.
    - c. Alarm display when switch is ON.
    - d. Alarm log.
- P. Effluent Sample Panel (EP55LCP59201)
- 1. Description: The panel provides indications of sample panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power loss alarm.
    - b. Monitor no flow alarm.
  - 3. HMI required programming and configuration:
    - a. Power loss alarm and no flow alarm display.
    - b. Alarm log.
- Q. Reaeration Modulating Valve Vault Valve (EP55BUV15010)
- 1. Description: Monitor device status and control device open position when in Remote Mode.
  - 2. Controller programming and configuration:
    - a. Monitor Open, Closed, LOR switch in Remote mode.
    - b. Monitor device failure status.
    - c. Monitor device open position.
    - d. Device Open, Close, and position control when device is in Remote Mode.
  - 3. HMI required programming and configuration:
    - a. Device Open, Closed, LOR switch at Remote position status display.
    - b. Device Fault status display and alarm.
    - c. Device Open, Closed and Position status display.
    - d. Device Remote mode Open, Close, and Position Set Point control.
- R. Reaeration Elect Room HVAC Control Panel (RE50HCP57001)
- 1. Description: The panel provides indications of HVAC control panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.

3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- S. Reaeration Elect Room Air Filter Unit Alarm Switch (RE50AFU57501)
1. Description: The switch provides an indication of switch status.
  2. Controller programming and configuration:
    - a. Monitor Switch status.
  3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
- T. Reaeration Vent Room Vent Control Panel (RE50VCP57101)
1. Description: The panel provides indications of ventilation control panel status.
  2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- U. Reaeration Elect Room/Blower Room Temperature (RE50TIT71001, RE50TIT71002)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
- V. Reaeration Vent Room Oxygen (RE50AIT71501)
1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  3. HMI required programming and configuration:

- a. Current instrument reading display.
- b. HiHi/Hi/Lo/LoLo alarms display and configuration.
- c. Current and historical data trending display.
- d. Instrument reading Fail status display and alarm.
- e. Historical data recording.

### 3.07 PLC-600: DISINFECTION FACILITY

#### A. Disinfection PLC Panel (CG60PLC10001)

1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
2. Controller programming and configuration:
  - a. Monitor intrusion switch status.
  - b. Monitor PLC panel 24 VDC power supply status.
  - c. Monitor power supply status.
  - d. Monitor PLC intrusion switch status.
  - e. Monitor temperature reading.
  - f. Monitor temperature instrument Hardware Fail.
  - g. Zero cutoff (Clamp small values to zero).
3. HMI required programming and configuration:
  - a. Switches status display.
  - b. Alarm when switch ON.
  - c. Switch ON event log.
  - d. Current temperature reading display.
  - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - f. Current and historical data trending display.
  - g. temperature instrument reading Fail status display and alarm.
  - h. Historical data recording.

#### B. Disinfection Facility Elect Room/OSHG Room HVAC Control Panel (CG60HCP67001, CG60HCP67101)

1. Description: The panel provides indications of HVAC control panel status.
2. Controller programming and configuration:
  - a. Monitor power on status.
  - b. Monitor general alarm status.
3. HMI required programming and configuration:
  - a. Power on status display.
  - b. General alarm status display.
  - c. Alarm log.

#### C. Disinfection Facility Elect Room Air Filter Unit Alarm Switch (CG60AFU67501)

1. Description: The switch provides an indication of switch status.
2. Controller programming and configuration:
  - a. Monitor Switch status.
3. HMI required programming and configuration:
  - a. Switch status display.



- b. Alarm display when switch is ON.
  - c. Alarm log.
- D. Disinfection Facility Sodium Bisulfite Room Vent. Control Panel (CG60VCP68001)
  - 1. Description: The panel provides indications of ventilation control panel status.
  - 2. Controller programming and configuration:
    - a. Monitor power on status.
    - b. Monitor general alarm status.
  - 3. HMI required programming and configuration:
    - a. Power on status display.
    - b. General alarm status display.
    - c. Alarm log.
- E. Disinfection Sodium Bisulfite Room Odor Unit (CG60ODU70501)
  - 1. Description: Odor control unit status.
  - 2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  - 3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
- F. Disinfection Facility Elect Room/Sodium Hypochlorite Room/Sodium Bisulfite Room/OSHG Room/Corridor Room/Fire Riser Room Temperature (CG60TIT71001, CG60TIT71002, CG60TIT71003, CG60TIT71004, CG60TIT71005, CG60TIT71006)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.

### 3.08 PLC-650: DIGESTER FACILITY

- A. Digester Facility PLC Panel (DB65PLC10001)
  - 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
  - 2. Controller programming and configuration:
    - a. Monitor intrusion switch status.
    - b. Monitor PLC panel 24 VDC power supply status.
    - c. Monitor power supply status.

- d. Monitor PLC intrusion switch status.
- e. Monitor temperature reading.
- f. Monitor temperature instrument Hardware Fail.
- g. Zero cutoff (Clamp small values to zero).
- 3. HMI required programming and configuration:
  - a. Switches status display.
  - b. Alarm when switch ON.
  - c. Switch ON event log.
  - d. Current temperature reading display.
  - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - f. Current and historical data trending display.
  - g. temperature instrument reading Fail status display and alarm.
  - h. Historical data recording.
- B. Digester Existing Motive Pump (TH70PMP12001, TH70PMP12002, TH70PMP12003, TH70PMP12004, TH70PMP12005, TH70PMP12006)
  - 1. Description: Monitor pump status. Control pump running when LOR switch is position at "REMOTE".
  - 2. Controller programming and configuration:
    - (i) Monitor equipment running and failure statuses.
    - (ii) Equipment REMOTE mode Control.
    - (iii) Equipment fail to start and fail to stop.
    - (iv) Calculate equipment runtime (0.1 hour increments) and number of starts.
  - 3. HMI required programming and configuration:
    - (i) Status display: Remote, Running.
    - (ii) Alarm display: All faults and alarms.
    - (iii) Event log on: Remote, Running and each fault.
    - (iv) Equipment remote manual control
      - (a) START/STOP pump control.
      - (b) Fail to Start / Fail to Stop.
      - (c) Fail to Start / Fail to Stop fail timer.
    - (v) Equipment remote auto control
      - (a) N/A
    - (vi) Equipment runtime display and reset.
    - (vii) Equipment number of starts display.
- C. Digester Facility Elect Room/Blower Room Temperature (DB65TIT71001, DB65TIT71002)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.

- b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
  - D. Digester Facility Elect Room HVAC Control Panel (DB65HCP77001, DB65HCP77101)
    - 1. Description: The panel provides indications of HVAC control panel status.
    - 2. Controller programming and configuration:
      - a. Monitor power on status.
      - b. Monitor general alarm status.
    - 3. HMI required programming and configuration:
      - a. Power on status display.
      - b. General alarm status display.
      - c. Alarm log.
  - E. Digester Facility Elect Room Air Filter Unit Alarm Switch (DB65AFU77501)
    - 1. Description: The switch provides an indication of switch status.
    - 2. Controller programming and configuration:
      - a. Monitor Switch status.
    - 3. HMI required programming and configuration:
      - a. Switch status display.
      - b. Alarm display when switch is ON.
      - c. Alarm log.
- 3.09 PLC-700: THICKENER FACILITY
- A. Thickener PLC Panel (TH70PLC10001)
    - 1. Description: Monitor PLC panel 24 VDC power supply, intrusion switch status, UPS fail, UPS battery fail.
    - 2. Controller programming and configuration:
      - a. Monitor intrusion switch status.
      - b. Monitor PLC panel 24 VDC power supply status.
      - c. Monitor power supply status.
      - d. Monitor PLC intrusion switch status.
      - e. Monitor temperature reading.
      - f. Monitor temperature instrument Hardware Fail.
      - g. Zero cutoff (Clamp small values to zero).
    - 3. HMI required programming and configuration:
      - a. Switches status display.
      - b. Alarm when switch ON.
      - c. Switch ON event log.
      - d. Current temperature reading display.
      - e. HiHi/Hi/Lo/LoLo alarms display and configuration.
      - f. Current and historical data trending display.
      - g. temperature instrument reading Fail status display and alarm.
      - h. Historical data recording.

- B. Thickener Wet Well Level (TH70LIT11501)
  - 1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
  - 2. Controller programming and configuration:
    - a. Monitor current instrument reading.
    - b. Monitor instrument Hardware Fail.
    - c. Zero cutoff (Clamp small values to zero).
  - 3. HMI required programming and configuration:
    - a. Current instrument reading display.
    - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
    - c. Current and historical data trending display.
    - d. Instrument reading Fail status display and alarm.
    - e. Historical data recording.
  
- C. Digester Pump Station High-High Switch (TH70LSHH11611, TH70LSHH11621)
  - 1. Description: The switch provides an indication of switch status.
  - 2. Controller programming and configuration:
    - a. Monitor Switch status.
  - 3. HMI required programming and configuration:
    - a. Switch status display.
    - b. Alarm display when switch is ON.
    - c. Alarm log.
  
- D. Digester Pump Station Pump (TH70PMP11311, TH70PMP11312, TH70PMP11321, TH70PMP11322)
  - 1. Description: Monitor pump status.
  - 2. Controller programming and configuration:
    - a. Monitor equipment running and failure statuses.
    - b. Calculate equipment runtime (0.1 hour increments).
  - 3. HMI required programming and configuration:
    - a. Status display: Auto, Running.
    - b. Alarm display: All faults and alarms.
    - c. Event log on: Auto, Running and each fault.
    - d. Equipment runtime display and reset.
  
- E. Thicken/Wet Well Odor Control Unit (TH70ODU70501, TH70ODU70502)
  - 1. Description: Odor control unit status.
  - 2. Controller programming and configuration:
    - (i) Monitor equipment faults and alarms status.
  - 3. HMI required programming and configuration:
    - (i) All faults and alarms display.
    - (ii) Alarm log.
  
- F. Thickener Building H2S Monitor (TH70AIT60101, TH70AIT60102)

1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
2. Controller programming and configuration:
  - a. Monitor current instrument reading.
  - b. Monitor the instrument high alarm.
  - c. Monitor instrument Hardware Fail.
  - d. Zero cutoff (Clamp small values to zero).
3. HMI required programming and configuration:
  - a. Current instrument reading display.
  - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - c. Current and historical data trending display.
  - d. Instrument reading Fail status display and alarm.
  - e. Historical data recording.

G. Thickener Building Temperature (TH70TIT71001)

1. Description: The instrument provides the current instrument reading. The Controller continuously monitors the instrument and provides the current reading for the HMI screens.
2. Controller programming and configuration:
  - a. Monitor current instrument reading.
  - b. Monitor instrument Hardware Fail.
  - c. Zero cutoff (Clamp small values to zero).
3. HMI required programming and configuration:
  - a. Current instrument reading display.
  - b. HiHi/Hi/Lo/LoLo alarms display and configuration.
  - c. Current and historical data trending display.
  - d. Instrument reading Fail status display and alarm.
  - e. Historical data recording.

H. Thickener Building Vent. Control Panel (TH70VCP87001)

1. Description: The panel provides indications of ventilation control panel status.
2. Controller programming and configuration:
  - a. Monitor power on status.
  - b. Monitor general alarm status.
3. HMI required programming and configuration:
  - a. Power on status display.
  - b. General alarm status display.
  - c. Alarm log.

### 3.10 CONTROL NARRATIVES – MANUFACTURER PROVIDED CONTROL SYSTEM

- A. Control narratives listed in this section are for SCADA HMI monitoring and controls on the Manufacturer provided control systems.
- B. SCADA HMI shall provide minimum following configuration and programming:
  1. SCADA HMI shall monitor all Manufacturer provided equipment running and fault status including HMI screen status display, alarms and event log, and historian.

2. SCADA HMI shall monitor all Manufacturer provided instrument reading and fault status including HMI screen display, alarms and event log, trending, and historian.
  3. All operation modes that are available at local control panel OIT shall be provided and programmed in the SCADA HMI. SCADA HMI shall have the exact operation mode as local OIT.
  4. The SCADA HMI screens shall have similar layout as local OIT screens.
  5. Equipment control parameters include equipment speed adjustment, control sequence settings, and equipment alarm configuration shall be programmed and configured on the SCADA HMI.
  6. All equipment alarm and events in SCADA HMI shall have the exact configuration as local OITs.
- C. Paralleling Switchgear Control System
1. Description: Provide SCADA System to monitor all information contained in the system.
  2. Perform the following control functions:
    - (i) Request to Transfer the plant load from OG&E to onsite generators.
    - (ii) Request to Transfer the plant load from onsite generators to OG&E.
  3. The SCADA System is not allowed to interfere with the critical operation of the Control System.
- D. Power Quality Meter (PQM)
1. Description: Monitor power meter statuses and alarms.
  2. Controller programming and configuration:
    - (i) N/A
  3. HMI required programming and configuration:
    - (i) Display
      - 1) Current for each phase, and each line.
      - 2) Voltage in each phase and line.
      - 3) KW, KVAR, KVA, PF, Frequency, and Harmonic.
    - (ii) Alarms display.
    - (iii) Provide historical data recording and trend display.
- E. Motor Protection Relay (MPR)
1. Description: Monitor relay statuses and alarms.
  2. Controller programming and configuration:
    - (i) N/A
  3. HMI required programming and configuration:
    - (i) Display current and voltage for each phase, and each line.
    - (ii) Display Motor Stopped, Motor Starting, and Motor Running statuses.
    - (iii) Display KW, KVA and KVAR values.
    - (iv) Display harmonics, motor overloaded, each motor winding temperature, and motor tripped alarms and provide alarm log.
    - (v) Display power factor and real power (HP) values.
    - (vi) Display motor winding temperature.
    - (vii) Display motor and pump bearing temperature.

- (viii) Display relay warning and alarms.
- (ix) Provide historical data recording and trend display.

### 3.11 REPORTS

- A. Coordinate with City SCADA and Plant Operation to all required SCADA generated reports.
- B. Coordinate with City SCADA and Plant Operation to obtain:
  - 1. Report format
  - 2. Report generation schedule
  - 3. Report storage and documentation
- C. Provide all required reports. Minimum of reports shall be 20
- D. Provide report submittal and submittal review meeting with City.
- E. Provide report training. Training shall be at Owner facility.
- F. Provide report user manual.

END OF SECTION