ADDENDUM No. 1

RFP No. 26-24

Instrumentation and Controls Improvements

Due: May 12, 2026, by 2:00 p.m. (local time)

The information contained herein shall take precedence over the original documents and all previous addenda (if any) and is appended thereto. **This Addendum is 31 pages, including attachments.**

A pre-proposal meeting was held on April 16, 2026. A meeting sign-in sheet, consisting of two pages, is included at the end of this Addendum for information only. The information disclosed in the pre-proposal meeting is available in the Project Manual. Bidders are reminded that oral statements made at the pre-proposal meeting may not be relied upon and will not be binding or legally effective.

The Bidder is to acknowledge receipt of this Addendum No. 1, including all attachments in its Bid by so indicating in the bid that the addendum has been received. Bids submitted without acknowledgement of receipt of this addendum may be considered non-conforming.

The following forms provided within the RFP document should be included in submitted Bid:

- **Attachment B - General Declarations**
- **Attachment D - Prevailing Wage Declaration of Compliance**
- **Attachment E - Living Wage Declaration of Compliance**
- **Attachment G - Vendor Conflict of Interest Disclosure Form**
- **Attachment H - Non-Discrimination Declaration of Compliance**

Bids that fail to provide these completed forms listed above upon bid opening may be rejected as non-responsive and may not be considered for award.

I. CORRECTIONS/ADDITIONS/DELETIONS

Changes to the RFP document which are outlined below are referenced to a page or Section in which they appear conspicuously. Offerors are to take note in its review of the documents and include these changes as they may affect work or details in other areas not specifically referenced here.

Section/Page(s)	**Change**
City of Ann Arbor Public Improvement Request for Proposal document, Pages 14-15	The Base Bid Tab numbering was revised.

1.0	General
1.1	General Conditions (Max 10%)
1.2	Mobilization (Max 10%)
1.3	Permit Allowance
1.4	Miscellaneous Allowance
2.0	Filter Gallery I&C Improvements
2.1	Filters 1-10
2.2	Filters 11-20
2.3	Filters 21-26
3.0	Finished Water Flow Meter Replacement
4.0	Miscellaneous Instrument Replacement
5.0	Closeout

Total Base Bid pricing shall include all Base Bid Items, 1 through 5.

Specification Section 40 05 23 – Process Valves (Reissued)	Language regarding the responsibilities of the Valve Manufacturer and Actuator Manufacturer or Representative was revised.
Specification Section 40 90 00 – Instrumentation and Control for Process Systems (Reissued)	Paragraph 2.1 D. was replaced, removing the list of Pre-Approved Acceptable System Suppliers and specifying requirements of the System Supplier. Paragraph 2.3 E. 2. was revised to correct Turbidimeter specifications.
Sheets: D402 – Process Filters 1-10 Pipe Gallery D404 – Process Filters 11-20 Pipe Gallery D406 – Process Filters 21-26 Pipe Gallery D409 – Process Photos	Backwash turbidity sensor location was revised. (17) filters have existing sensors to be demolished. Keynotes were revised to clarify demolition scope of backwash turbidity sensors. Keynote revisions apply to: Sheet D402 Keynote 11 Sheet D404 Keynote 3 Sheet D406 Keynote 2 Sheet D409 Keynote 8. “REMOVE FILTER BACKWASH TURBIDITY SENSOR AND MAINTAIN ASSOCIATED MOUNTING HARDWARE AND APPURTENANCES WHERE APPLICABLE. TYPICAL OF ALL FILTERS”

Section/Page(s)	Change
Sheet P005 – Schedules (Reissued)	Instrumentation Schedule was revised to indicate which turbidity sensors require new mounting accessories.
Sheets: P202 – Process Filters 1-10 Pipe Gallery P204 – Process Filters 11-20 Pipe Gallery P206 – Process Filters 21-26 Pipe Gallery	Keynotes were revised to clarify replacement scope of the backwash turbidity sensors and associated accessories. Keynote revisions apply to: Sheet P202 Keynote 13 Sheet P204 Keynote 6 Sheet P206 Keynote 13 “NEW FILTER BACKWASH TURBIDITY SENSOR. PROVIDE MOUNTING HARDWARE AND APPURTENANCES FOR INSTALLATION WHERE NECESSARY, PER MANUFACTURER’S RECOMMENDATIONS. REUSE EXISTING MOUNTING HARDWARE AND APPURTENANCES WHERE APPLICABLE. TYPICAL OF ALL FILTERS.”

II. QUESTIONS AND ANSWERS

The following Questions have been received by the City. Responses are being provided in accordance with the terms of the RFP. Respondents are directed to take note of the documents of the following questions and City responses as they affect work or details in other areas not specifically referenced here.

Question 1: **Is disinfection of process piping required?**

Answer 1: Disinfection of Filtered Water, Finished Water, Plant Service Water, and Surface Wash piping systems are required following dismantling, replacement, or installation. Refer to Specification Section 40 05 13 – Process Piping for disinfection requirements.

Question 2: **Will new valve actuator remote hand stations require new backboard panels for mounting?**

Answer 2: The new remote hand stations are larger than the existing remote hand stations. It is expected that installation will require adjustment in the location and orientation of the new remote hand stations, but the existing backboard can be reused.

Question 3: **Do the existing coating systems that are being replaced contain lead?**

Answer 3: All coating systems to be replaced shall be treated as lead-containing and are subject to the associated requirements of Specification Sections 02 41 19 – Selective Demolition and 09 91 00 – Painting.

SECTION 40 05 23 – PROCESS VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all valves and valve operators in the process piping system as indicated on the process Drawings and defined in Division 40 Section “Process Piping Systems.”

B. This Section does not include the valves and operators for the piping systems indicated on the plumbing and mechanical Drawings.

C. Related Section includes Division 40 Section “Process Piping Systems.”

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the valves and operators of this Section shall comply with the following as applicable:
   1. ASTM Specification:
      a. A48 - Gray Iron Castings.
      b. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A148 - Aluminum Bronze Castings.
      d. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
      e. A240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
      f. A351 - Steel Castings, Austenitic, for High Temperature.
      g. A436 - Austenitic Gray Iron Castings.
      h. A536 - Ductile Iron Castings.
      i. B21 - Naval Brass Rod, Bar, and Shapes.
   2. AWWA Standards:
      a. C 111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron.
      b. C 500 - Metal-Seated Gate Valves for Water Supply Service.
      c. C 504 - Rubber-Seated Butterfly Valves.
      d. C 507 - Ball Valves 6 In. Through 60 In.
      e. C 508 - Swing Check Valves for Waterworks Service. 2 In. Through 24 In.
      f. C 509 - Resilient-Seated Gate Valves for Water Supply Service.
      g. C 511 - Reduced Pressure Principle Backflow Prevention Assembly.
      h. C 512 - Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
      i. C 517 - Resilient-Seater Cast-iron Eccentric Plug Valves.
      j. C 519 - High Performance Waterworks Butterfly Valves 3 In. Through 60 In.
      k. C 520 - Knife Gate Valves, Sizes 2 In. Through 96 In.
      l. C 530 - Pilot-Operated Control Valves.
      m. C 541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
      n. C 542 - Electric Motor Actuators for Valves and Slide Gates.
      o. C 550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
   3. NSF/ANSI Standards:
      a. 14 – Plastic Piping System Components and Related Materials.
      b. 61 – Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

A. Shop Drawings:
   1. For equipment assemblies in this Section to include:
      a. Manufacturer.
      b. Model.
      c. Details of construction.
      d. Dimensions, including actuator dimensions and clearances.
      e. Materials of construction.
      f. Listing of components.
      g. Project specific wiring diagrams.
      h. Coatings.
      i. Weight of assemblies.
   2. For each type of equipment installed to include:
      a. Itemized listings.
      b. Deviations from the requirements of this Section.

B. Product Data: For equipment in this Section to include:
   1. Manufacturer.
   2. Model.
   3. Materials of construction.
   4. Manufacturer’s engineering and specification data.
   5. Electrical specifications and requirements.
   6. Torque specifications for actuators.

C. Torque calculations for actuators.

D. Installation instructions for equipment in this Section.

E. Operation and Maintenance Manuals: For equipment in this Section to include:
   1. Copy of reviewed Shop drawings and product/catalog data.
   2. Equipment function, normal operating characteristics and limiting conditions.
   3. Assembly, installation, alignment, adjustment and checking instructions.
   4. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   5. Lubrication and maintenance instructions.
   6. Guide to “troubleshooting.”
   7. Parts lists and predicted life of parts subject to wear.
   8. Outline, cross-sections, assembly drawings, engineering data, and wiring diagrams.

F. Certifications/Affidavits:
   1. Submit Manufacturer’s certification that products and materials conform to these specifications.
   2. Submit an affidavit from the valve manufacturer which certifies that actuators used were furnished and installed by the valve manufacturer.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, and damage by weather or elements and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

D. Ship and handle valves in conformance with Section 18 of AWWA C 504.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND TYPES

A. Provide valves of the size and type as indicated on the Drawings and these Specifications.

B. All valves of each type shall be the Product of one Manufacturer.

~~B.~~C. All actuators of each type shall be the Product of one Manufacturer, and supplied separate from the valves.

2.2 MATERIALS AND FABRICATION

A. Butterfly Valves (new):
1. Conform with the latest edition of AWWA C 504 - Resilient-Seated Gate Valves for Water Supply Service.
   a. 20-inch diameter and smaller: Class 150B.
   b. 24-inch and larger: Class 75A.
2. Tight closing, rubber seated and bubble tight at rated pressures in either direction for applications involving throttling service or valve operation after long periods of inactivity.
3. Valve Body:
   a. Cast iron or ductile iron with flanged short body design.
4. Valve Disc:
   a. Cast iron or ductile iron with stainless steel, nickel-copper or nickel chrome seating edge.
   b. Disc and shaft connection made with stainless steel pins.
5. Valve Shaft:
   a. Turned, ground and polished; constructed of stainless steel.
6. Valve Seat:
   a. Natural or synthetic rubber compound suitable for potable water service, applied to either the valve body or disc.
   b. Full 360 degrees, retained in the valve body or disc without hardware of any kind in the flow stream.
7. Coating:
   a. Interior surfaces and exterior immersed surfaces: Coat in accordance with AWWA C550 using an NSF/ANSI Standard 61 - Potable Water (NSF-pw) listed epoxy; Tnemec; or equal.
   b. Exterior Surfaces (non-immersed): Shop prime coat in accordance with Division 09 Section “Painting” for interior ferrous metals – non-immersed (epoxy system).
   c. Flange Faces: Not coated except for protection from atmospheric corrosion.
8. Testing: Conduct hydrostatic and leakage tests in accordance with AWWA C 504 Sections 5.1.2 and 5.1.3.
9. Manufacturers:
   a. Dezurik.
   b. Pratt.
   c. Crispin
10. Valve Actuators:
   a. The type as indicated in the Valve Schedule.
   b. Designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
   c. In accordance with AWWA C 504.
   ~~d. Installed, adjusted, tested, and certified by the valve manufacturer prior to shipping.~~
   ~~e.~~d. Electric Motor (See Valve Schedule in Drawings):
      1) Open/close. Refer to Division 40 Section “Instrumentation and Control for Process Systems” for additional requirements.

2) Factory wired complete with control power transformer, fused control wiring, torque and limit switch shutoffs, motor overload protection, space heater, limit switches for opened and closed indication (local and remote).
3) Identification Plate: Provide permanent Type 316 stainless steel engraved plate on each actuator. Include the following information on each:
    a) Manufacturer.
    b) Complete model number.
    c) Tag designation.
    d) Electrical requirements, including voltage, phase, and amperage.
4) Operating Conditions, not including 150% service factor:
    a) Closed Position: Differential pressure – 120 psi.
    b) Open Position: Pressure – 120 psi; Flow – 250 gpm maximum.
5) Manual, padlockable handwheel override by means of a de-clutch mechanism.
    a) Include position indicator.
    b) Indicate direction to open valve on handwheel.
6) Motor switching and adjustable speed control. Solid state motor switching incorporating 25% to 100% motor speed control.
7) Non-intrusive limit setting, commissioning and control configuration using infra-red/Bluetoot setting tool.
8) Position feedback: Integral illumidated digital position indicator showing 0.1% increments in valve position with closed and open valve limit symbol, torque, or other status data.
9) LED indicator light color coding (CAN BE REVERSED):
    a) Red: Open.
    b) Yellow: Intermediate.
    c) Green: Closed.
    d) Blinker configurable.
10) Open/Close Actuators:
    a) Integral electrically and mechanically interlocked reversing contactors suitable for up to 60 starts per hour.
    b) Drive incorporating lost motion, for releasing sticking valves.
    c) Adjustable electronic torque switches 40% to 100% of rated.
11) Provide padlockable local/off/remote selector switch.
12) Power: 480 VAC, 60 Hz, 3 phase.
13) Discrete Inputs and Outputs:
    a) In remote status.
    b) Open control.
    c) Close control.
    d) Open status.
    e) Closed status.
    f) Fault status.
14) Provide remote hand station as indicated on Drawings.
    a) Display:
        1. Replicate the actuator display and controls interface.
        2. Digital valve position indicating 0.1% increments in valve position.
    b) LED indicator light color coding (CAN BE REVERSED):
        1. Red: Open.
        2. Yellow: Intermediate.
        3. Green: Closed.
        4. Blinker configurable.
    c) Wall mountable, designed to operate, interrogate, and configure actuator within 100m distance.
    d) RHS shall provide access to viewing and downloading dataloggers.
    e) Black/red padlockable local control/stop/remove control selector. Black open/close selector.
    f) Enclosure internally and externally sealed to IP68, with one threaded cable entry. NEMA 6.
    g) Powered via the attached actuators (24 VDC).
    h) Coating:
        1. Polyester powder.
        2. 75 micron nominal thickness.

15) Manufacturer:
    a) Rotork.

B. Butterfly Valves (existing):
1. Valve Actuators:
    a. The type as indicated in the Valve Schedule.
    b. Designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
    c. In accordance with AWWA C 504.
    ~~d. Installed, adjusted, tested, and certified by the valve manufacturer prior to shipping.~~
    ~~e.~~d. New Electric Motor (See Valve Schedule in Drawings):
        1) Open/close or Modulating control to control filter operations. Refer to Division 40 Section "Instrumentation and Control for Process Systems" for additional requirements.
        2) Factory wired complete with control power transformer, fused control wiring, torque and limit switch shutoffs, motor overload protection, space heater, limit switches for opened and closed indication (local and remote).
        3) Identification Plate: Provide permanent Type 316 stainless steel engraved plate on each actuator. Include the following information on each:
            a) Manufacturer.
            b) Complete model number.
            c) Tag designation.
            d) Electrical requirements, including voltage, phase, and amperage.
        4) Operating Conditions, not including 150% service factor:
            a) Filter Influent, Effluent:
                (1) Closed Position: Differential pressure – 5 psi.
                (2) Open Position: Pressure – 5 psi; Flow – 1,380 gpm maximum.
            b) Filter Drain:
                (1) Closed Position: Differential pressure – 5 psi.
                (2) Open Position: Pressure – 5 psi; Flow – 8,260 gpm maximum.
            c) Wash Water:
                (1) Closed Position: Differential Pressure – 60 psi.
                (2) Open Position: Pressure – 25 psi; Flow – 8260 gpm maximum.
        5) Manual, padlockable handwheel override by means of a de-clutch mechanism.
            a) Include position indicator.
            b) Indicate direction to open valve on handwheel.
        6) Motor switching and adjustable speed control. Solid state motor switching incorporating 25% to 100% motor speed control.
        7) Non-intrusive limit setting, commissioning and control configuration using infra-red/Bluetoot setting tool.
        8) Position feedback: Integral illumidated digital position indicator showing 0.1% increments in valve position with closed and open valve limit symbol, torque, or other status data.
        9) LED indicator light color coding (CAN BE REVERSED):
            a) Red: Open.
            b) Yellow: Intermediate.
            c) Green: Closed.
            d) Blinker configurable.
        10) Open/Close actuators:
            a) Integral electrically and mechanically interlocked reversing contactors suitable for up to 60 starts per hour.
            b) Drive incorporating lost motion, for releasing sticking valves.
            c) Adjustable electronic torque switches 40% to 100% of rated.
        11) Modulating actuators rated for minimum 1,800 starts per hour, 50% duty cycled based on a modulating torque of 50% of rated torque.
        12) Provide padlockable local/off/remote selector switch.
        13) Power: 480 VAC, 60 Hz, 3 phase.
        14) Discrete inputs and outputs:
            a) In remote status.
            b) Open status.
            c) Closed status.
            d) Fault status.

e) Open/close actuators:
(1) Open control.
(2) Close control.

15) Analog inputs and outputs, modulating actuators only:
a) Position control.
b) Position feedback.

16) Provide remote hand station as indicated on Drawings.
a) Display:
(1) Replicate the actuator display and controls interface.
(2) Digital valve position indicating 0.1% increments in valve position.
b) LED indicator light color coding (CAN BE REVERSED):
(1) Red: Open.
(2) Yellow: Intermediate.
(3) Green: Closed.
(4) Blinker configurable.
c) Wall mountable, designed to operate, interrogate, and configure actuator within 100m distance.
d) RHS shall provide access to viewing and downloading dataloggers.
e) Black/red padlockable local control/stop/remove control selector. Black open/close selector.
f) Enclosure internally and externally sealed to IP68, with one threaded cable entry. NEMA 6.
g) Powered via the attached actuators (24 VDC)
h) Coating:
(1) Polyester powder.
(2) 75 micron nominal thickness.

17) Manufacturer:
a) Rotork.

~~f.~~e. Existing Electric Motor (Valves FE-1631 through FE-1646).
1) Furnish new analog I/O card for remote position control and feedback.

C. Hydraulic Control Valves:
1. Conform with the latest edition of AWWA C 530 - Pilot-Operated Control Valves.
2. Main Valve:
a. Globe style valve rated for 150 psig minimum.
b. 150 pound flat faced flange drilling.
c. Independent, adjustable opening and closing speeds.
d. Materials of Construction:
1) Body and Cover: Ductile iron.
2) Renewable resilient valve seats and replacement seals.
3) Disc Retainer and Diaphragm Washer: Cast iron.
4) Trim: Stainless steel.
5) Disc: Buna N.
6) Diaphragm: Nylon reinforced Buna N.
7) Stem, Nut and Spring: Stainless steel.
3. Additional Pilots:
a. Pressure Reducing Valve (Valve 2600):
1) Function: Opens and regulates downstream pressure when an operator-adjustable low pressure occurs downstream of the valve.
2) Outlet pressure adjustable over a range of 60 to 100 psig using an external adjusting screw. Coordinate set pressure with Engineer and Owner.
4. Valve Mounted Controls and Piping: Copper, brass, or bronze.
5. Coordinate valve settings with operating conditions and Division 40 Section “Instrumentation and Control for Process Systems.” Field adjust as required for proper operation.
6. Coating:
a. Interior surfaces and exterior immersed surfaces: Coat in accordance with AWWA C 550 using an NSF/ANSI Standard 61 - Potable Water (NSF-pw) listed epoxy; Tnemec; or equal.
b. Exterior Surfaces (non-immersed): Shop prime coat in accordance with Division 09 Section “Painting” for interior ferrous metals – non-immersed (epoxy system).

7. Manufacturers:
   a. Cla-Val.
   b. OCV
   c. Singer.
   d. Watts.
   e. Or equal.

D. Solenoid Valves:
   1. General:
      a. Furnish 3-way solenoid valve.
      b. Quantity:
         1) 16 in total, 2 per Particle Counter.
      c. 1/4-inch port.
      d. Universal pressure at any port.
      e. Complete with mounting brackets and conduit hubs as required.
      f. Manual override.
   2. Material and Fabrication:
      a. Manufacturer: ASCO 8327; or equal.
      b. Valve Bodies: Stainless steel.
      c. Seals and Discs: Buna N.
      d. Wetted Parts: Stainless steel.
      e. Power: 120 volt, 60 Hz.

E. Backflow Preventer:
   1. Description:
      a. Furnish and install approved backflow preventer(s) in accordance with the following table and as indicated on Drawings. Include a safewaste drain for drip from preventer valves piped to floor drain and install strainers ahead of first gate valve:

Service	Size	Rating	Description
Non-Potable and Process Water Services	4"	150#	Reduced pressure zone backflow preventer.
NOTE: Requirements of Codes having jurisdiction, that vary from the table requirements, shall be complied with for all services.			

   2. Manufacturer: Watts, Hersey, Beeco, Febco, Conbraco.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in conformance with:
   1. The Shop Drawings reviewed by Engineer.
   2. The Manufacturer's recommendations.

B. Check and adjust valves, operators and accessories for smooth operation.

C. Paint all valves and accessories in accordance with Division 09 Section “Painting.”

D. Labeling: Provide an engraved stainless steel tag securely fastened to each valve with the valve size, pressure rating, and tag number clearly indicated.

E. Provide valve actuator Manufacturer’s field service as required to start-up, adjust, participate in control loop tuning, and calibrate all valve equipment.

F. Provide valve actuator Manufacturer’s field service to install new analog I/O cards in existing actuators.

~~F.~~G. Pipe air and hydraulic actuated valve discharges to drain with an air gap.

3.2 CLEANING

A. Thoroughly clean all installed materials and products and related areas:
   1. Prior to acceptance of the work of this Section.
   2. ~~In accordance with Division 01 Section "Cleaning and Waste Management."~~

END OF SECTION 40 05 23

SECTION 40 90 00 – INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not necessarily limited to, the furnishing and installation of process control and instrumentation systems comprised of the major items listed below, as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the Work:
   1. Control panels.
   2. Field instruments.

1.3 GENERAL REQUIREMENTS

A. System Overview:
   1. Owner will self-perform programming of any PLCs or SCADA elements required to integrate new systems. Contractor to furnish and install all equipment and devices identified herein and on the Drawings and coordinate with Owner when items are ready for integration.
   2. The existing SCADA system shall be modified to control and monitor the valve actuators and instrumentation installed as part of the Ann Arbor Instrumentation and Controls Improvements project.
   3. Existing control panels (FILTER-CP, PLC-HS, PLC-C2, PLC-P2) will be reused with new signals (analog, discrete, etc.) to control and monitor control valves and instrumentation.
   4. One new remote I/O control panel (FILTER-CP2) shall be installed to control and monitor filter control valves and instrumentation.
   5. Contractor shall conduct field investigations as required to determine existing conditions, all wiring details, additional I/O requirements, signal ranges, units and calibration requirements.

B. Provide all components and labor necessary, as indicated on Drawings, to achieve functional intent as described in this Section. Some components (i.e., power supplies, terminal strips, etc.) may not be specifically itemized.

C. Provide components which are compatible with process equipment.

D. Functionally similar components shall be products of a single Manufacturer.

E. Installation of new systems and equipment shall be sequenced and coordinated to minimize disruptions to Owner’s normal operations.

F. Coordinate with the Owner to determine the number of filters that can be taken offline at a single time. Work shall be sequenced such that filters are taken offline, new equipment and devices are installed, and filters are brought back online and tested to Owner’s satisfaction before moving onto the next set of filters. Coordinate sequencing with Owner so that they are able to perform required PLC and SCADA programming.

1.4 SUBMITTALS

A. Itemized Listings:
   1. Description of deviations from the requirements of this Section.
   2. Re-submittals shall contain response(s) to each comment made by Engineer. Re-submittals that do not contain response(s) will be returned and will be subject to re-review compensation.

B. Shop Drawings:
   1. Shop Drawing submittal schedule listing Shop Drawings to be submitted with estimated time frame of submittal relative to other project milestones (e.g. programming development, factory test, performance demonstration, project closeout).
   2. General: Shop Drawing submittal material shall be project specific.
   3. For all process control and instrumentation equipment, to include:
      a. Manufacturer's name and model number.
      b. Equipment descriptions.
      c. Product data sheet(s).
      d. Standard drawings and illustrations.
      e. Dimensions.
      f. Materials of construction.
      g. Details of construction and installation.
      h. Detailed system schematic.
      i. Project specific wiring diagrams, clearly indicating all field wiring requirements.
      j. Spare parts list.
   4. For all systems with control panels, to include:
      a. Control panel layout drawing(s).
      b. Control panel conduit entrance locations and limitations.
      c. Control panel elevation drawing(s).
      d. Control panel wiring diagrams:
         1) Shall clearly differentiate between internal and field wiring.
         2) Shall indicate loop wiring numbers for all devices.
         3) Analog loop diagrams shall indicate instrument range in engineering units.
      e. Ambient temperature range design considerations, design assumptions and specifications.
      f. Detailed patch panel schematic indicating each port and field connection.
      g. Where modifications are required to existing control panels, existing control panel wiring shall be field verified and existing wiring shall be depicted in Shop Drawings to the extent required to fully indicate the extent of the modifications and to indicate the integration of the existing and new equipment. Where existing control panel drawings exist, they shall be "scanned in" to create an electronic version of the drawing. The electronic version of the existing panel drawing shall be used to indicate panel modifications for submittal and as-built purposes.

C. Operation and Maintenance Manuals:
   1. General:
      a. Table of contents.
      b. Subdivided (tabbed) into separate sections that cover separate equipment or grouping of equipment.
      c. Provide 1 electronic copy (thumb drive) per hard copy, of the overall O&M Manual. Owner shall be permitted to make copies without restriction.
   2. For all process control equipment, to include:
      a. Equipment function, normal operating characteristics and limiting conditions.
      b. Assembly, installation, alignment, adjustment and checking instructions.
      c. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
      d. Lubrication and maintenance instructions.
      e. Guide to "troubleshooting."
      f. Parts lists and predicated life of parts subject to maintenance replacement.
      g. Outline, cross-sections, assembly drawings, engineering data and wiring diagrams.
      h. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in fabrication and installation of materials and equipment.
   2. Knowledgeable of the design and reviewed Shop Drawings.

B. All materials, installation and testing shall be in accordance with ISA Standards and Recommended Practice.

C. Contractor shall conduct field investigations as required to verify existing conditions, I/O, programming, wiring requirements, instrument ranges/calibration and signal types.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors in a controlled environment with low moisture content. Do not store outdoors.

D. Reject damaged, deteriorated or contaminated materials and immediately remove from Site. Replace rejected materials with new materials at no additional cost to Owner.

1.7 FUNCTIONAL INTENT

A. General:
1. Owner will self-perform all PLC and SCADA system programming. Functional intent herein is provided as an aid to the Owner for how the Engineer recommends the system operates.
2. Contractor shall provide all devices, controls, panels, wiring and miscellaneous items required to achieve the specified functional intent whether specifically itemized on the Drawings or not.
3. Contractor shall inspect existing conditions to determine exact materials and work required to interface new control system components with existing equipment.
4. Coordinate with Owner to incorporate equipment specific parameters in programming as necessary to meet specified performance.
5. Coordinate calibration and tuning of all equipment (including pumps, valves and existing equipment being incorporated into the control system), and control components with Owner to provide a complete system and achieve specified system performance.

B. Typical Equipment Control: Minimum functionality for equipment.
1. Typical OPEN/CLOSE Valve Control:
a. Each valve shall have:
1) LOCAL-OFF-REMOTE (LOR) selector switch for local control mode selection.
2) OPEN and CLOSE selection for local control.
3) OPENED and CLOSED pilot light for local indication.
b. The following signals shall be sent to SCADA:
1) IN REMOTE; for indication and alarm.
2) OPENED and CLOSED; for indication, alarm, and event logging.
c. Operation of equipment shall be as follows:
1) Local Mode (LOCAL):
a) The equipment shall be controlled manually from its respective valve actuator when the LOR switch is placed in the LOCAL and OFF positions. Refer to the actuator wiring diagram for operation in LOCAL mode.
b) When equipment is not in REMOTE, "LOCAL" shall be displayed adjacent to the appropriate equipment symbol on the computer screen.
2) Remote Mode (REMOTE):
a) The valve shall be controlled by the SCADA system when the LOR switch is placed in the REMOTE position.
b) When valve is in REMOTE, "REMOTE" shall be displayed adjacent to the appropriate symbol on the computer screen.
c) Operation in REMOTE mode shall be as follows:
(1) In REMOTE MANUAL mode under SCADA control, it shall be possible to open and close the valve from a SCADA screen.
(a) An OPEN-CLOSE control faceplate shall be available on the computer screen only when the selected valve is in REMOTE MANUAL.
(b) When equipment is in REMOTE MANUAL, "MANUAL" shall be displayed adjacent to the appropriate symbol on the computer screen.

(2) In REMOTE AUTO mode under SCADA control, valve shall be opened and closed automatically by SCADA.
(a) AUTO control shall be based on Functional Intent description.
(b) When equipment is in REMOTE AUTO, “AUTO” shall be displayed adjacent to the appropriate symbol on the computer screen.

2. Typical Positioning/Flow Control/Modulating Valve Control:
   a. Each valve shall have:
      1) LOCAL-OFF-REMOTE (LOR) selector switch for local control mode selection.
      2) Positioning selection for local control.
      3) Local position indication.
   b. The following signals shall be sent to SCADA:
      1) IN REMOTE; for indication and alarm.
      2) Position (0-100%); for indication, and logging/trending.
   c. Operation of equipment shall be as follows:
      1) Local Mode (LOCAL):
         a) The equipment shall be controlled manually from its respective valve actuator when the LOR switch is placed in the LOCAL and OFF positions. Refer to the actuator wiring diagram for operation in LOCAL mode.
         b) When equipment is not in REMOTE, “LOCAL” shall be displayed adjacent to the appropriate equipment symbol on the computer screen.
      2) Remote Mode (REMOTE):
         a) The valve shall be controlled by the SCADA system when the LOR switch is placed in the REMOTE position.
         b) When valve is in REMOTE, “REMOTE” shall be displayed adjacent to the appropriate symbol on the computer screen.
         c) Operation in REMOTE mode shall be as follows:
            (1) In REMOTE MANUAL mode under SCADA control, it shall be possible to position the valve from a SCADA screen by inputting valve position (0-100%).
               (a) A position control faceplate shall be available on the computer screen only when the selected valve is in REMOTE MANUAL.
               (b) When equipment is in REMOTE MANUAL, “MANUAL” shall be displayed adjacent to the appropriate symbol on the computer screen.
            (2) In REMOTE AUTO mode under SCADA control, valve shall be positioned automatically by SCADA.
               (a) AUTO control shall be based on Functional Intent description.
               (b) When equipment is in REMOTE AUTO, “AUTO” shall be displayed adjacent to the appropriate symbol on the computer screen.

C. Filter Control and Monitoring:
   1. Filter effluent valves shall have control and monitoring typical of modulating control valves.
      a. New actuators for Filters 2, 3, and 5 through 10:
         1) Valve FE-1622 (202).
         2) Valve FE-1623 (203).
         3) Valves FE-1625 through FE-1630 (205 through 210).
      b. Existing actuators for Filters 1 and 4.
         1) Valve FE-1621 (201).
         2) Valve FE-1624 (204).
      c. Existing actuators to be equipped with newly furnished and installed remote I/O cards, for Filters 11 through 26.
         1) Valves FE-1631 through FE-1646 (211 through 226).
   2. Filter influent, wash water supply, drain, and surface wash valves shall have control and monitoring typical of open/close valves.
      a. New actuators for Filters 1 through 26:
         1) Valves WIP-1621 through WIP-1626 (101 through 126).
         2) Valves FV-17-5-1 through FV-17-5-26 (401 through 426).
      b. New actuators for Filters 2, 3, 5 through 26.
         1) Valve CIS-1622 (502).
         2) Valve CIS-1623 (503).
         3) Valves CIS-1625 through CIS-1646 (505 through 526).

c. New actuators for Filters 1 through 10, 12 through 21, and 23 through 26.
   1) Valves FV-17-5-1 through FV-17-5-10 (401 through 410).
   2) Valves FV-17-5-12 through FV-17-5-21 (412 through 421).
   3) Valves FV-17-5-23 through FV-17-5-26 (423 through 426).
d. New actuators for Filters 1 through 21:
   1) Valves WW-1621 through WW-1641 (301 through 321).
e. Existing actuators for Filters 1 and 4.
   1) Valves CIS-1621 (501) and CIS-1624 (504).
f. Existing actuators for Filters 11 and 22.
   1) Valves FV-17-5-11 and FV-17-5-22 (411 and 422).
g. Existing actuators equipped with newly furnished and installed remote I/O cards, for Filters 22 through 26
   1) Valves WW-1642 through WW-1646 (322 through 326).

3. A new flow meter shall continuously monitor filter effluent flow. A new transmitter shall transmit a 4-20 mAdc signal proportional to flow to SCADA for indication, control, logging, and totalization.
   a. Filters 1 through 10 Effluent Flow:
      1) 1621-FE/FI through 1630-FE/FI.
4. A new integral loss of head transmitter shall continuously monitor loss of head through the filter media. A 4-20 mAdc signal proportional to loss of head shall be transmitted to SCADA for indication, control, and logging.
   a. Filters 1 through 10:
      1) 1621-LH through 1630-LH.
5. A new particle counter shall continuously monitor filter effluent particle count.
   a. Incorporate new particle counter into existing Modbus Network.
   b. Each particle counter shall be shared between pairs of adjacent filters.
      1) Filters 1 and 3: 1621-AIPC
      2) Filters 2 and 4: 1622-AIPC
      3) Filters 5 and 7: 1625-AIPC
      4) Filters 6 and 8: 1626-AIPC
6. New turbidity sensors shall continuously monitor filter backwash turbidity. A turbidity controller shall transmit a 4-20 mAdc signal proportional to turbidity to SCADA for indication, control, and logging. Each controller shall be shared between pairs of adjacent filters
   a. Filters 1 and 3: 2621-AE & 2623-AE/2621-AINTU
   b. Filters 2 and 4: 2622-AE & 2624-AE/2624-AINTU
   c. Filters 5 and 7: 2625-AE & 2627-AE/2625-AINTU
   d. Filters 6 and 8: 2626-AE & 2628-AE/2628-AINTU
   e. Filters 9 and 11: 2629-AE & 2631-AE/2631-AINTU
   f. Filters 10 and 12: 2630-AE & 2632-AE/2632-AINTU
   g. Filters 13 and 15: 2633-AE & 2635-AE/2635-AINTU
   h. Filters 14 and 16: 2634-AE & 2636-AE/2636-AINTU
   i. Filters 17 and 19: 2637-AE & 2639-AE/2639-AINTU
   j. Filters 18 and 20: 2638-AE & 2640-AE/2638-AINTU
   k. Filters 21 and 22: 2641-AE & 2642-AE/2642-AINTU
   l. Filters 23 and 24: 2643-AE & 2644-AE/2644-AINTU
   m. Filters 25 and 26: 2645-AE & 2646-AE/2646-AINTU
7. New level sensors shall continuously monitor water level. New transmitters shall transmit a 4-20 mAdc signal proportional to level to SCADA for indication, control, and logging.
   a. Filter 8: 2628-LE/LI
   b. Filter 13: 2633-LE/LI
   c. Filter 22: 2642-LE/LI
8. New high and low level switches shall signal to audio and visual indicators upon high and low filter level.
   a. Filter 1: 2621-LSH, 2621-LSL
   b. Filter 19: 2639-LSH, 2639-LSL
   c. Filter 26: 2646-LSH, 2646;LSL

D. Finished Water Monitoring:
   1. A new flow meter shall continuously monitor finished flow. A new transmitter shall transmit a 4-20 mAdc signal proportional to flow to SCADA for indication, control, logging, and totalization.
      a. Gravity 1: HS623-FE/FI
      b. Gravity 2: HS624-FE/FI
      c. East High Service: HS1216-FE/FI
      d. West High Service: HS0327-FE/FI

E. Miscellaneous Monitoring and Control:
   1. A new level sensor shall continuously monitor level. A new transmitter shall transmit a 4-20 mAdc signal proportional to level to SCADA for indication, control, and logging.
      a. Clearwell 2: HS0310-LE/LI
      b. Cistern 1: C21610-LE/LI
      c. Cistern 2A: P21701-LE/LI
      d. Cistern 2B: P21708-LE/LI

1.8 GUARANTEE AND WARRANTY

A. Process control and instrumentation system Supplier shall guarantee the entire system for a period of 1 year. This guarantee shall cover all parts, labor, troubleshooting, telephone consulting, travel, and equipment recalibration.

B. The 1-year guarantee period shall begin at Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable Manufacturers for major system components are specified herein.

B. Not all components are specified. It is the Contractor's responsibility to furnish and install components necessary to achieve the functional intent and to meet or exceed the governing local, state or national standards and/or codes.

C. Coordination of all field mounted instrumentation device installation shall be system Supplier's responsibility:
   1. Mounting of each device shall be designed with consideration to:
      a. Manufacturer's installation recommendations.
      b. Ease of removal for maintenance.
      c. Safety.
   2. Provide all mounting hardware required.
   3. All mounting hardware shall be of the following corrosion resistant material. Coordinate mounting material with surrounding environment:
      a. PVC.
      b. Stainless steel.
      c. FRP.
   4. Provide sufficient length of sensor to transmitter cable for each field device.
   ~~4.~~5. Provide unions, bulkhead fittings, isolation valves, etc.

D. System Supplier's Qualifications and Services:
   1. Staffed with factory-trained and certified technicians fully capable of providing instructions and routine and emergency maintenance services on all components.
   2. Supplier shall have at least 5 years experience in supplying and installation of systems similar in performance to that specified herein and shall provide 5 previous project histories.
   3. Provide as much on-site time as necessary to coordinate start-up. Coordinate on site activities with Contractor and Owner. Once start-up has commenced, Supplier shall be on call for emergency situations and respond in a timely manner.
   4. Provide Owner contact names and telephone numbers for a minimum of 2 local technicians who can be called for service after the 1 year warranty has expired.

~~D. Pre-Approved Acceptable System Suppliers:~~
~~1. UIS.~~
~~2. Perceptive.~~
~~3. Engineer approved equal.~~

2.2 CONTROL PANELS AND COMMUNICATION PANELS

A. General:
1. Install all wiring in a workmanlike manner. Group, bundle, label, support, and route horizontally and vertically to provide a neat and organized appearance.
2. Provide circuit breakers and surge protection on all panel power sources.
3. All field 4-20mAdc signals shall be powered from panels, unless indicated otherwise on the Drawings.
4. All field contact closures shall be powered from UPS, when available, within control panels.
5. All wiring shall be sized, labeled and color coded in accordance with Division 26 Section “Conductors and Cables - 600V and Below.” All panel wiring shall be type MTW unless indicated otherwise on the Drawings.
6. When required, shunt resistors shall be 250 Ohm ± 0.01%.
7. Provide labeled terminal strips for all wiring entering and leaving panels.
8. Provide patch panels for all network wiring entering and leaving panels.
9. Provide Sub-plate Identification Tags:
   a. Tags shall be made from engraved plastic, white with 3/8-inch minimum black letters, for all internal enclosure components.
   b. Punched or drilled for mechanical fasteners.
   c. Stainless steel machine screw fasteners.
10. Label addressable devices with IP or node addresses.
11. Coordinate and provide all necessary mounting hardware.
12. Provide ground bar (Ilsco D-167; or equal) for each control panel. Ground “lugs” shall not be used. Remove (scrape) paint from sub-panel prior to ground bar installation to provide an effective electrical connection.
13. Conduit shall not enter into panels from top. Side, rear and bottom entry permitted only. Cast metal, O-ring type sealing conduit hubs shall be used on NEMA rated enclosures.
14. Corrosion Inhibitor Emitter: Provide an industrial corrosion inhibitor emitter to protect internal components of control panel from corrosion for panels located outdoor or in NEMA 4/4X areas. Corrosion inhibitor shall protect for up to one year, and shall be replaceable. Provide one spare for each provided.
15. Factory assemble and test all panels before shipment to Project Site.
16. A minimum of 25% spare points of each type (digital inputs, digital outputs, analog inputs, and analog outputs) shall be provided within each panel and I/O rack, wired to terminal blocks.
17. Provide minimum 25% spare terminals, unwired.
18. Provide space and DIN rail for an additional 10% for future terminals.
19. Fuse all outputs which control highly inductive loads. Provide 10 spare fuses of every size and type used per panel.
20. Cabling, connectors and accessories shall be provided for all equipment as required.
21. Contractor shall provide all mounting hardware, shelves, support brackets, patch panels, etc., as required to install equipment.

B. Modification to Existing Control Panels:
1. Provide all field modification, wiring changes, and wiring additions as indicated on Drawings or as required to achieve function as described in this section.
2. Control panels field modifications shall be performed by UL listed fabrication facility personnel to UL standards and meet the requirements of NEC and UL508/698.

C. Control Panels:
1. Furnish control panel(s) of the design and type as indicated on the Drawings and in these Specifications. Contractor is responsible for verifying panel size requirements.
2. Control panels shall contain all components listed in Paragraph 1.7 - Functional Intent, specified herein, and as indicated on the Drawings, plus any additional items (24-volt power supplies, panduit, terminal strips, etc.) necessary for completion of the Work.

3. Control panels shall be assembled by a UL listed fabrication facility. Panels shall be UL approved and meet the requirements of NEC and UL508/698. Available fault current is 10,000 amps. Each panel shall have a serialized UL label.
4. New control panels shall have a “Power On” white pilot light on the door of the control panel.

D. Enclosures:
   1. General:
      a. Size Enclosures:
         1) To adequately space necessary components in accordance with NEC.
         2) Such that UPS does not block access to terminal strips or other internal components.
      b. Data pocket.
      c. LED light fixture with lens or shatterproof coated lamp, and door activated switch. Fixture mounting shall not invalidate NEMA rating.
      d. DIN-rail mounted, 20A convenience receptacle.
      e. Provide shelf so that UPS does not set on bottom of enclosure.
      f. NEMA rated for environment.
      g. UL listed.
      h. White painted steel back panel, unless indicated otherwise on the Drawings.
      i. Provide all necessary interior supports to ensure panel structural integrity and prevent "oil canning" of side walls.
   2. Panel Enclosure Schedule:
      a. FILTER-CP2: NEMA 12.
   3. Metallic:
      a. General:
         1) Seams continuously welded and ground smooth: no holes or knockouts.
         2) Painted enclosures shall be ANSI 61 Grey exterior finish.
         3) White interior finish.
         4) Bonding provisions on door.
         5) Two-door if over 36 inches wide, with removable center post.
         6) Collar studs for mounting sub-panels.
         7) Body flange trough collar with oil resistant door gasket.
         8) Front hinged access door with heavy duty 3-point latching mechanism with latch rod rollers, 316 stainless steel pad-lockable handle all keyed alike.
         9) Heavy duty continuous door hinges.
      b. Freestanding:
         1) Material: 12 gage sheet metal, minimum.
         2) Heavy duty lifting eyes.
         3) 84-inch (minimum) height.
      c. Manufacturer:
         1) Hoffman.
         2) Copper B-Line.
         3) Saginaw Control and Engineering.

E. Panel Devices:
   1. General:
      a. Pilot lights, selector switches and push buttons shall be from same Manufacturer. NEMA ratings shall match that of control panel.
      b. Indicators and totalizers shall be from same Manufacturer.
   2. Pilot Lights:
      a. Heavy duty, oil tight, LED-type, 30.5 mm with full voltage, push-to-test feature, nameplate and replaceable color lens and replaceable light unit.
      b. Manufacturer:
         1) Allen-Bradley, 800T/H.
         2) Square D, Type K/SK.
         3) Eaton\Cutler-Hammer 10250T, E34.
   3. Control Relays:
      a. Heavy duty, 15 amp minimum, 3-pole double throw (minimum).
      b. Pin or blade terminals.
      c. DIN mount sockets IP20, finger safe.
      d. Indicating light and check button.

e. UL listed.
f. Provide hold down clips for all relays.
g. Provide 2 spare of each type provided, per panel. Installed in panel, un-wired.
h. Provide interposing relay for all solenoids and motor loads.
i. Manufacturer:
1) Allen-Bradley.
2) Square D.
3) Magnecraft.
4) Potter & Brumfield.

4. DIN Rail Mounted Miniature Circuit Breakers and Supplementary Protection:
a. Rated for 250 VAC, 50/60 Hz, 65 Vdc.
b. Rated cross section for wire sizes #22 to #10 AWG.
c. Operating life of 6,000 cycles at rated current.
d. UL listed.
e. Short-Circuit Current Rating: 10 kA at 125 VAC (minimum).
f. Provide bus bar where more than 4 circuit breakers are provided in the same panel. Cap unused connectors.
g. Finger safe terminals.
h. Amperage ratings of 0.2A to 15.0A, system Supplier shall calculate required ratings, unless otherwise noted.
i. Manufacturer:
1) Allen-Bradley.
2) Square D/Merlin-Gerin.
3) Moeller Electric.

5. Terminal Blocks:
a. General: 6mm (nominal), screw type, single tier terminal blocks.
b. Mounting: Standard TS 35 DIN rail.
c. Wire Range: 22-2 AWG.
d. Removable/replaceable marking system (labels).
e. Manufacturer:
1) Wieland, WKI series.
2) Phoenix Contact, UT series.
3) Weidmuller.
f. Spare Parts: 25% spare terminal blocks, mounted and unwired.

6. Surge Protection Device (SPD):
a. General: Device shall not interfere with normal operation of circuit being protected.
b. 120 VAC 1-Phase:
1) General: High speed, high current, solid state device designed to protect electronic equipment and systems from transient over-voltages.
2) Mounting: DIN-rail, 2-piece design with removable suppressor module/relay.
3) “Operational/Non-operational” visual indication.
4) Remote indicator contact.
5) Protection Method/Type: Silicon Avalanche Suppressor diodes.
6) Automatic Reset: After each suppression function with no degradation to protection capabilities.
7) Compliance: UL 1449 Edition 3.
8) Rating: 1.5 kA 8x20µs (minimum) surge current capacity.
9) Provide overcurrent protection.
10) Manufacturer:
a) Bussmann.
b) Phoenix Contact.
c) Transtector.
d) DEHN\Pepperl + Fuchs.

F. Remote I/O:
1. Remote I/O (Allen-Bradley ControlLogix):
a. General: Equipment shall be sized to perform functions as listed. Equipment specifications shall be verified and adjusted as required to ensure proper performance and functionality. Model numbers shall be adjusted as required where compatibility and interaction with other specified components are limited or are not supported by the manufacturer.

b. Power Supplies: Power supplies shall operate on 120 VAC and shall supply 24 Vdc and 5 Vdc to the I/O chassis backplane as required. Power supplies shall be Allen-Bradley Model 1756-PA75.
c. I/O Chassis:
    1) All I/O and required communication modules shall be mounted in a modular style chassis. I/O chassis shall provide power to modules through the backplane. I/O chassis shall also provide a communication link to installed modules through the backplane. I/O chassis shall be sized as required to provide slots for required modules, as well as 25% spare slots. Chassis shall be a minimum of 4 slots.
    2) Manufacturer: Allen-Bradley 1756-A7 (7 slot), 1756-A10 (10 slot), 1756-A13 (13 slot) or 1756-17 (17 slot) as required for I/O and communication modules.
d. Discrete Input Modules:
    1) 120 VAC discrete input modules shall operate on voltage provided through the I/O chassis backplane. Modules shall include LED status indicators. Modules shall contain 16 inputs, individually isolated for use with multiple power sources.
    2) Modules shall be provided with 36 pin, screw clamp, removable terminal blocks Allen-Bradley 1756-TBNH, and extended wiring housing Allen-Bradley 1756-TBE.
    3) Manufacturer: Allen-Bradley 1756-IA16I.
e. Discrete Output Modules:
    1) Discrete output modules shall operate on voltage provided through the I/O chassis backplane. Modules shall include 16 normally open, individually isolated relay contact outputs capable of 2A at 125 VAC or 5-30 Vdc continuous. Modules shall include LED status indicators.
    2) Modules shall be provided with 36 pin, screw clamp, removable terminal blocks Allen-Bradley 1756-TBNH, and extended wiring housing Allen-Bradley 1756-TBE.
    3) Manufacturer: Allen-Bradley 1756-OW16I.
f. Analog Input Modules:
    1) Analog input modules shall be 16-bit resolution and shall operate on voltage provided through the I/O chassis backplane. Modules shall have 6 individually isolated channels. Modules shall be user configurable to either accept a voltage input of ±10.5 Vdc (typically 1-5 Vdc) or 0-22 mAdc (typically 4-20 mAdc). Modules shall be capable of scaling to engineering units through the software.
    2) Modules shall be provided with 20 pin, screw clamp, removable terminal blocks Allen-Bradley 1756-TBNH, and extended wiring housing Allen-Bradley 1756-TBE.
    3) Manufacturer: Allen-Bradley 1756-IF6I.
g. HART Enabled Analog Input Modules:
    1) Analog input modules shall be 16-bit resolution and shall operate on voltage provided through the backplane. Modules shall be capable to 8 differential voltage or current inputs. Modules shall be user configurable to either accept a voltage input of ±10 Vdc (typically 1-5 Vdc) or 0-20 mAdc (typically 4-20 mAdc). Modules shall be capable of scaling to engineering units through the software.
    2) Manufacturer: Allen-Bradley 1756-IF8H.
h. Analog Output Modules:
    1) Analog output modules shall be 16-bit resolution and shall operate on voltage provided through the I/O chassis backplane. Modules shall have 6 individually isolated outputs of ±10.5 Vdc (typically 1-5 Vdc) or 0-21 mAdc (typically 4-20 mAdc). Modules shall be capable of scaling to engineering units through the software.
    2) Modules shall be provided with 20 pin, screw clamp, removable terminal blocks Allen-Bradley 1756-TBNH, and extended wiring housing Allen-Bradley 1756-TBE.
    3) Manufacturer: Allen-Bradley 1756-OF6VI or 1756-OF6CI.
i. Communication Modules:
    1) General: Provide compatible modules. Verify with manufacturer. Adjust module model numbers where required for inner-operability.
    2) Ethernet:
        a) Shall be used as the “backbone” for Plant-wide control network.
        b) Modules shall be powered from the I/O chassis backplane and communicate at a rate of 10/100 Mbps via an RJ-45 connector.
        c) Ethernet modules shall be able to control I/O over an Ethernet/IP network.
        d) Ethernet modules shall act as an adapter for distributed I/O on remote Ethernet/IP links.

e) Modules used for I/O control shall be dedicated to I/O control with dedicated network segment and dedicated components.
f) Ethernet modules shall route messages to devices on other networks.
g) Manufacturer: Allen-Bradley 1756-EN4TR, 1756-EN2TR.

j. Empty Slot Filler:
1) Provide slot filler for all unused chassis slots.
2) Manufacturer: Allen-Bradley 1756-N2.

G. Shelf Mounted Uninterruptible Power Supplies (UPS):
1. Online Double Conversion UPS:
a. Power: 120 VAC input, 45-65 Hz, 120 VAC output, input power factor greater than 0.95.
b. Connection: Input line shall include a NEMA 5-15P plug. A minimum of 4 NEMA 5-15R output receptacles shall be included.
c. Output Voltage Regulation: On utility ±2% nominal, on battery ±3% nominal.
d. Topology: True online double conversion with automatic bypass.
e. Output: Pure sine wave with less than 5% total harmonic distortion (THD), and efficiency greater than 86%.
f. User Interface:
1) Power usage.
2) On battery.
3) Overload.
4) UPS fault.
g. Battery Management: Deep discharge protection.
h. Extended runtime capability with external battery modules.
i. Batteries: Sealed, maintenance free, lead acid, hot-swappable batteries with “start on battery” capability to allow UPS to start up in the absence of utility power.
j. Transfer Time to Battery: 0 ms.
k. Automatic bypass on overload of 130% for 10 seconds.
l. UPS Sizing: Where UPS size is not identified on the Drawings, Contractor shall size UPS to provide a minimum 10 minutes of runtime for control panel and equipment served.
m. All PLC control panels shall be equipped with a UPS whether existing or new. Provide separate enclosures for UPSs which will not physically fit into existing enclosures.
n. Manufacturer:
1) PowerWare: Series 9130.
2) Sola/Hevi-Duty, S4K Series.
3) Liebert, GXT2.
o. Accessories:
1) Mounting bracket or shelf. UPS shall not block other devices or terminals located in the control panel. UPS display and user interface shall be easily viewable without moving UPS.
2) Receptacles to allow for removal of UPS without tools.
3) Relay to monitor UPS power and automatically switch to line power on loss of power from UPS.
4) Relay interface card for UPS alarm to provide PLC input.
5) Provide interposing relays as required.
6) Provide cabling to match UPS relay card connector.
7) Red and white labels on exterior of all enclosures (new and existing) which contain UPS units. Signs to read: “DANGER: BATTERY AND EXTERNAL VOLTAGE PRESENT”. Labels shall be 10-inch x 7-inch minimum.

H. Ethernet Networking Equipment:
1. General:
a. Ethernet Networking Equipment shall be products of a single Manufacturer.
b. Provide dedicated power supply for each Ethernet converter/switch not powered at 120VAC.
2. Unmanaged Switch:
a. Unmanaged Ethernet switch, store and forward switching mode 10Mbit/s and 100Mbit/s.
b. Ports: 10/100BASE-TX RJ-45 ports, auto-crossing, auto-negotiation, auto polarity, 6 ports minimum, additional ports where indicated on the Drawings.
c. Operating Temperature: 0 to 60 degrees Celsius.
d. Relative Humidity: 10% to 95% (non-condensing).
e. Mounting: 35 mm DIN rail.

f. Metal case.
g. Line/star topology.
h. Diagnostic LEDs.
i. 24 Vdc power with plug-in terminal block.
j. Manufacturer:
1) Hirschmann.
2) Moxa.
3) Cisco.

3. Power Supply:
a. Output Power: 3 A (minimum) at 24 Vdc.
b. Input Voltage: 120 VAC nominal.
c. Mounting: 35 mm DIN rail.
d. Manufacturer:
1) Hirschmann.
2) Weidmuller.
3) Phoenix Contact.
4) Hirschmann.
5) Moxa.

I. Patch Panels and Patch Cables:
1. General:
a. Network cables that enter or leave an enclosure shall be terminated at a patch panel.
b. Rackmount patch panels shall utilize horizontal and vertical cable manager components. Patch cables shall not block or hang in front of equipment or patch panels.
c. Standalone patch panels shall have hinged mounting brackets.
d. Provide patch cables for all patch panel points, including spare.

2. UTP (CAT 6) Patch Panels:
a. Rack Mount Patch Panel:
1) Either 19/23-inch rack mount or standalone (for control panels).
2) Rack mount patch panels shall feature a removable front access panel.
3) Available with RJ-45 style connectors.
4) Adapter panels shall be available with 6 or 12 connectors each.
5) Manufacturers: Leviton, Panduit; or equal.
b. Mini-Patch Panel:
1) DIN rail mounted.
2) Available with RJ-45 style connectors.
3) Shall be available with 3 connectors each.
4) Manufacturer:
a) Phoenix Contact, VS-PP-F-RJ45-CAT6..
b) Black Box, JPM183A.
c) Hirschmann, MIPP.

3. UTP Patch Cables:
a. Available with RJ-45 style connectors, coordinate lengths with installation requirements.
b. Connectors shall be factory installed, with snagless molded strain relief.
c. Minimum rating Category 6 in accordance with TIA/EIA-568.
d. Stranded construction, factory product. Field assembled terminations will not be acceptable.
e. Provide STP cables in panels where electrical interference may be generated within the panel (e.g. by VFDs or SCR drives).
f. Patch cables shall be colored green, unless otherwise noted.

4. Manufacturers: Leviton, Panduit; or equal.

J. Site Specific Requirements (Major Components):
1. General: The following is provided as an aid to the Contractor. It is the Contractor's responsibility to verify information contained below for completeness and to provide equipment that is indicated elsewhere on Drawings and Specifications, but not listed below.

2. FILTER-CP2:
a. General:
1) NEMA 12 metal.
2) Freestanding. Contractor to size as required for equipment.

3) Circulating cooling fan.
4) LED light interlocked with door.

b. Major Components:
1) ControlLogix I/O and communication modules.
2) UPS.

3. Modifications to Existing Main Control Panel:
a. New programming as required.
b. New networking.

2.3 FIELD INSTRUMENTS

A. General:
1. Schedules are provided as an aid to Contractor. It is Contractor's responsibility to verify information contained in the schedules for completeness and to provide equipment that is indicated elsewhere on Drawings and Specifications, but not listed in schedules.
2. Provide instruments rated for environment.
3. Field verify Manufacturer's cable lengths prior to Shop Drawing submittal.
4. Existing instruments that are relocated or modified shall be recalibrated.
5. Existing instruments with unknown scaling or ranges shall be recalibrated.
6. Existing instruments that do not agree with new instrumentation shall be recalibrated.
7. Existing instruments that are used in conjunction with new control systems shall be recalibrated.
8. Tagging: Equip all instruments with a permanently attached, stamped or engraved identification tag. The tags shall include the device name, Engineer's tag identification, and manufacturer's tag identification if different from Engineer's.
9. Finish: Finish on the instruments and accessories shall provide protection against corrosion by the elements in the environment in which they are to be installed.
10. Temperature Rating: Instruments shall be suitable for the temperature in which they are to be exposed. Therefore, instruments located outdoors or in unheated spaces shall be suitable for -20 degrees F to 120 degrees F. Instruments exposed to direct sunlight (without sunshield) shall be suitable for temperatures up to 140 degrees F.
11. Provide configuration software and cables or hand held device(s) for any instrument which cannot be fully programmed via keypad/interface which is integral to device.

B. Instrument Pipe Stand:
1. General: Modular support system for mounting of instrumentation components.
2. Provide for each instrument that cannot be wall mounted.
3. Material of construction: Galvanized carbon steel, aluminum or stainless steel as required by environment to prevent corrosion.
4. Floor stands shall have gussets for strength and stability.
5. Size as required to mount instrument at 4′-6″ above operating level, unless otherwise noted.
6. Manufacturers:
a. O'Brien, Saddlepak.
b. Techline Mfg.
c. Or equal.

C. Continuous Level Measurement:
1. Differential and Gauge Pressure Transmitters:
a. Microprocessor based smart transmitter.
b. Display: Integral LCD.
c. Material:
1) Stainless steel wetted parts and diaphragm.
2) Teflon O-rings.
3) Silicone fill fluid.
4) Stainless steel mounting bracket and hardware.
5) Epoxy covered aluminum housing.
d. Accuracy: 0.075% of span with 5-year stability.
e. Rangeability: 30:1.
f. Process Connection: Stainless steel 3-valve manifold.
g. Output: 4-20 mAdc plus HART protocol.

h. Range: 0 to 20 feet.
i. Power: Loop powered.
j. Schedule: See Instrument Schedule on Drawings.
k. Manufacturers:
1) Rosemount.
l. Accessories:
1) Integral drain and vent valve, differential pressure transmitter only.
2) Provide 316 stainless steel mounting hardware as required.

2. Non-Contact Radar:
a. General: Non-contact radar transmitter/receiver to determine level by measuring time-of-flight of a radar pulse from the radar transmitter to the product surface and back.
b. False Target Rejection shall ignore obstructions including, but not limited to, tank walls.
c. Micro-processor based transmitter.
d. Display: Integral LCD.
e. Material:
1) Epoxy covered, explosion proof, aluminum housing.
2) Antenna, as indicated on Drawings.
a) Process seal antennae.
b) 316 Stainless steel cone antennae.
f. Accuracy: ±0.4 inches.
g. Repeatability: 0.05% full scale.
h. Output: 4-20mAdc.
i. Range: 0 to 20 feet.
j. Power: 24Vdc loop powered.
k. Mounting, as indicated on Drawings.
1) Suitable for mounting via 6-inch ANSI pipe flange.
2) Mounted to bracket.
l. Provide 316 stainless steel mounting hardware as required.
m. Schedule: See Instrument Schedule on Drawings.
n. Manufacturer:
1) Rosemount.
o. Accessories:
1) Programming/diagnostic software, software license and programming cable.
2) Intrinsically safe barrier, where required by manufacturer for hazardous locations.

D. Continuous Flow Measurement:
1. Magnetic Flow Meters:
a. Accuracy: Within ±0.25% of meter scale for a velocity of 1 to 33 fps in either flow direction, and the repeatability shall be within ±0.1% of full scale.
b. Complete with grounding rings. Grounding probes are not acceptable.
c. Provide required lengths of Manufacturer's cable between meter tube and wall mounted transmitter.
d. Provide a standard 3-point calibration report traceable to a recognized standard.
e. All flow meters shall be of the same model/series.
f. Meter Tube:
1) 304 stainless steel flow tube.
2) Meter shall maintain ISO 13359 standard lay lengths.
3) Liner:
a) Teflon, PFA, or Tefzel for 10-inch or smaller.
b) Polyurethane for 12-inch or greater.
c) It is the Supplier's responsibility to provide liner that is chemically compatible with the process fluid being measured.
d) Liners utilized in drinking water applications shall be NSF certified.
4) Electrodes:
a) Bullet nose type.
b) Hasteloy C.
c) Titanium for Alum and Sodium Hypochlorite.
d) Platinum for Hydrofluosilicic Acid.
e) It is the Supplier's responsibility to provide electrodes that are chemically compatible with the process fluid being measured.

5) Grounding Rings:
   a) 316 Stainless Steel for 12-inch or smaller.
   b) 304 Stainless Steel for 14-inch or greater.
   c) Titanium for Alum and Sodium Hypochlorite.
   d) Hasteloy C for Hydrofluosilicic Acid.
   e) It is the Supplier's responsibility to provide grounding rings that are chemically compatible with the process fluid being measured.
6) Flanges:
   a) ANSI 150-pound, raised or flat for 1-inch to 24-inch.
   b) Wafer style to be mounted between 2 ANSI 150-pound flanges for smaller than 1-inch
   c) AWWA Class D flanges for meters larger than 24 inches.
   d) Meter shall be fully rated to withstand the same design pressure as the flanges.
7) Epoxy or Powder Coated: 2 coats for a minimum of 7 mils.
8) Meters above grade and smaller than 12 inches shall be capable of accidental submergence. Meters 14 inches and larger or meters installed in a meter vault shall be capable of continuous submergence or direct burial (IP68/NEMA 6P).
9) Meters located in hazardous areas shall be FM approved for Class 1, Division 2 locations.

g. Transmitter:
1) One for each flow tube.
2) Solid state type.
3) Housing:
   a) Die-cast aluminum.
   b) Remote mounted transmitters shall have rectangular housing.
4) Remote mounted from meter tube when indicated on Drawings.
5) HART protocol.
6) Provide universal HART communicator/configurator which supports all HART devices.
7) Display:
   a) Flow rate and totalized flow displayed on a backlit display.
   b) Integral transmitter display shall be able to rotated 90 or 180 degrees to accommodate meter mounting position/orientation.
8) Transmitter shall include nonvolatile memory so that flow totalization is not lost during power interruptions. Provide totalizers for forward, reverse and net flow.
9) Output:
   a) 4-20 mAdc into 0 to 800 ohms, proportional and calibrated to stated bidirectional flow range.
   b) HART.
10) Provide empty pipe detection as standard.
11) Power: 120Vac, 60 HZ.
12) Enclosure: NEMA 4X.
13) Provide required lengths of Manufacturer's cable for remote mounted indicators.

h. Schedule: See Flow Meter Schedule on Drawings.
i. Manufacturer:
1) Rosemount.

E. Continuous Analytical Measurement:
1. Particle Count Analyzer:
   a. Range: 2 to 750 microns.
   b. Display: 0 to 9,999,999 counts.
   c. Counting Mode: Cumulative or differential.
   d. Flow Rate: 100 ml/min.
   e. Pressure: 55 psig continuous.
   f. Sample and Hold Time: Programmable for 1 second to 24 hours.
   g. Power: 120 VAC cord plug transformer/adapter.
   h. Fluid Connections: 1/4-inch quick disconnect tubing.
   i. Selectable bins from 2 µm to 15 µm.
   j. Communication: RS-485. Provide Belden 9841 cabling; or equal.
   k. Zero and Span: Programmable for 1 to 9,999,999 counts.
   l. Configuration: Two weirs, not using weir arms.

m. Accessories:
1) Water weir flow controller, and all associated clamps, etc.
2) OPC Explorer software.
n. Schedule: See Instrument Schedule on Drawings.
o. Manufacturer: Chemtrac, PC3400

2. Turbidimeter:
a. Sensor and ~~analyzer~~ Controller shall be of the same Manufacturer.
b. Measures 90-degree scattered light.
c. Complete with internal bubble trap.
d. ~~Analyzer~~ Sensor shall have programmable range from 0-1000NTU.
e. ~~Analyzer~~ Controller shall have an analog 4-20mAdc output proportional to programmed NTU range.
f. ~~Analyzer~~ Sensor shall have 0.001NTU sensitivity.
g. Provide necessary sensor.
~~g.~~h. Provide all interconnecting cables between analyzer and sensor, power supply, and digital display.
~~h.~~i. Minimum 4 digit LED or backlit LCD display.
~~i.~~j. Unit shall be provided with 120VAC, 60Hz power supply, provide cord and plug. ~~Provide 20A, 125V, heavy duty, duplex receptacle with weatherproof while in use cover and non-metallic wall box, wall mounted near each turbidimeter.~~
~~j.~~k. Wall ~~or strut~~ mounted ~~sensor and analyzer~~controller, NEMA 4X.
~~k.~~l. Schedule: See Instrument Schedule on Drawings.
~~l.~~m. Manufacturer:
1) Sensor: Hach Solitax w/ Wiper
2) Controller: ~~SC200~~SC4500, one per two turbidimeters.
~~m.~~n. Accessories:
~~1) Digital indicator.~~
1) Power supply.
2) Sensor mounting accessories, as indicated on the Drawings. Including:
a) Drop pipe of UV-resistant PVC construction.
b) Stainless steel hardware.
~~2)~~3) Controller mounting accessories, including stainless steel backplate and hardware.

~~3) One Aquatrend user display/interface for each four turbidimeters to be mounted in the lab, or as noted on the Drawings. Provide repeaters as required to achieve required distances from transmitter(s) to display module.~~

F. Discrete Level Switch:
1. Float Type Switch (Mercury Free):
a. Mechanical acting.
b. Molded corrosion resistant, polypropylene or PVC body suitable for fluid application.
c. Float switches shall have 3.5-inch actuation/de-actuation level.
d. Output Contact: SPDT, 7/3.5 A, 120/230 VAC.
e. Cable shall be PVC type STO with No. 18 AWG (minimum) conductors:
1) Jacket for cable shall be factory molded to the float.
2) Minimum cable length of 20 feet.
f. Schedule: See Instrument Schedule on Drawings.
1) High Level Switches to be installed approximately 2'0" below Operating Gallery Floor, coordinate with Engineer on precise location.
2) Low Level Switches to be installed approximately 6'0" below Operating Gallery Floor coordinate with Engineer on precise location.
g. Manufacturer: Anchor Scientific "Eco-Float"; or equal.
h. Accessories:
1) Corrosion resistant hardware and mounting accessories.
2) See installation detail(s) for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION COORDINATION

A. Install process control equipment and instrumentation in conformance with:
   1. Shop Drawings reviewed by Engineer.
   2. Manufacturer's recommendation.

B. Electrical:
   1. Install wiring in conformance with applicable Sections of Division 26 – Electrical.
   2. Run all 4-20 mAdc process control wiring in separate conduit from power and control wiring.
   3. Communication cabling shall be in separate conduits from power control and analog signal wiring.

C. Mount Control Panels:
   1. Securely with framing and fasteners capable of handling additional future loads.
   2. In a way that does not restrict access to internal components.

3.2 FIELD QUALITY CONTROL

A. Contractor's Field Service:
   1. Assist with start-up and conduct performance demonstrations of filters as they are put into service. Coordinate testing/demonstrations with Owners.
   2. Schedule field services as soon as practical and at times approved by Engineer.
   3. Promptly make all changes and additions required and as necessary for proper operation of the system.

B. Field Performance Demonstration:
   1. General.
      a. Procedures shall be developed by system Supplier and submitted to Engineer for review prior to scheduling demonstration.
      b. Schedule a minimum of 2 weeks in advance.
      c. Demonstration shall include "simulation" of system operation, prior to actual operational demonstration, where Plant operation could be negatively affected.
      d. Schedule and coordinate with Owner and Owner's operation staff to minimize disruptions to plant operation.
   2. Pre-Requisite:
      a. Complete installation and test all functionality prior to calling for witnessed field demonstration by Engineer.
      b. Complete integrator sign-off portion of test procedures and route to Engineer for verification.
   3. Equipment:
      a. Demonstrate proper operation.
      b. Demonstrate that system performs control functions as specified and indicated on the Drawings.
   4. Instruments:
      a. Demonstrate proper calibration and maximum accuracy.
      b. Demonstrate that system performs monitoring functions as specified and indicated on the Drawings.
   5. System:
      a. Demonstrate proper operation in failure modes.
      b. Demonstrate backup and recovery modes.
   6. Other Supplier's Systems: Participate in Field Performance Demonstration of systems provided by other suppliers where those systems communicate with SCADA system.
   7. Demonstration shall be repeated as required by Engineer until satisfactory results are obtained.

3.3 I/O LIST

A. See the I/O lists on the Drawings.

END OF SECTION 40 90 00

INSTRUMENTATION SCHEDULE

DEVICE TAG	LOOP NUMBER	LOCATION	TYPE
FI	1621	FILTER 1	FLOW TRANSMITTER
AIPC	1621	FILTER 1/3	PARTICLE COUNT ANALYZER
LH	1621	FILTER 1	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1622	FILTER 2	FLOW TRANSMITTER
AIPC	1622	FILTER 2/4	PARTICLE COUNT ANALYZER
LH	1622	FILTER 2	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1623	FILTER 3	FLOW TRANSMITTER
LH	1623	FILTER 3	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1624	FILTER 4	FLOW TRANSMITTER
LH	1624	FILTER 4	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1625	FILTER 5	FLOW TRANSMITTER
AIPC	1625	FILTER 5/7	PARTICLE COUNT ANALYZER
LH	1625	FILTER 5	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1626	FILTER 6	FLOW TRANSMITTER
AIPC	1626	FILTER 6/8	PARTICLE COUNT ANALYZER
LH	1626	FILTER 6	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1627	FILTER 7	FLOW TRANSMITTER
LH	1627	FILTER 7	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1628	FILTER 8	FLOW TRANSMITTER
LH	1628	FILTER 8	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1629	FILTER 9	FLOW TRANSMITTER
LH	1629	FILTER 9	DIFFERENTIAL PRESSURE TRANSMITTER
FI	1630	FILTER 10	FLOW TRANSMITTER
LH	1630	FILTER 10	DIFFERENTIAL PRESSURE TRANSMITTER
LSH	2621	FILTER 1	FLOAT TYPE SWITCH
LSL	2621	FILTER 1	FLOAT TYPE SWITCH
AE	2621	FILTER 1	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AE	2622	FILTER 2	TURBIDITY SENSOR
AE	2623	FILTER 3	TURBIDITY SENSOR
AINTU	2623	FILTER 1/3	TURBIDITY CONTROLLER
AE	2624	FILTER 4	TURBIDITY SENSOR
AINTU	2624	FILTER 2/4	TURBIDITY CONTROLLER
AE	2625	FILTER 5	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AINTU	2625	FILTER 5/7	TURBIDITY CONTROLLER
AE	2626	FILTER 6	TURBIDITY SENSOR
AE	2627	FILTER 7	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
LE	2628	FILTER 8	NON-CONTACT RADAR
LI	2628	FILTER 8	LEVEL TRANSMITTER
AE	2628	FILTER 8	TURBIDITY SENSOR
AINTU	2628	FILTER 6/8	TURBIDITY CONTROLLER
AE	2629	FILTER 9	TURBIDITY SENSOR
AE	2630	FILTER 10	TURBIDITY SENSOR
AE	2631	FILTER 11	TURBIDITY SENSOR
AINTU	2631	FILTER 9/11	TURBIDITY CONTROLLER
AE	2632	FILTER 12	TURBIDITY SENSOR
AINTU	2632	FILTER 10/12	TURBIDITY CONTROLLER
AE	2633	FILTER 13	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
LE	2633	FILTER 13	NON-CONTACT RADAR
LI	2633	FILTER 13	LEVEL TRANSMITTER
AE	2634	FILTER 14	TURBIDITY SENSOR
AE	2635	FILTER 15	TURBIDITY SENSOR
AINTU	2635	FILTER 13/15	TURBIDITY CONTROLLER
AE	2636	FILTER 16	TURBIDITY SENSOR
AINTU	2636	FILTER 14/16	TURBIDITY CONTROLLER
AE	2637	FILTER 17	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AE	2638	FILTER 18	TURBIDITY SENSOR
AINTU	2638	FILTER 18/20	TURBIDITY CONTROLLER
LSL	2639	FILTER 19	FLOAT TYPE SWITCH
LSH	2639	FILTER 19	FLOAT TYPE SWITCH
AE	2639	FILTER 19	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AINTU	2639	FILTER 17/19	TURBIDITY CONTROLLER
AE	2640	FILTER 20	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AE	2641	FILTER 21	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AE	2642	FILTER 22	TURBIDITY SENSOR
LE	2642	FILTER 22	NON-CONTACT RADAR
LI	2642	FILTER 22	LEVEL TRANSMITTER
AINTU	2642	FILTER 21/22	TURBIDITY CONTROLLER
AE	2643	FILTER 23	TURBIDITY SENSOR
AE	2644	FILTER 24	TURBIDITY SENSOR
AINTU	2644	FILTER 23/24	TURBIDITY CONTROLLER
AE	2645	FILTER 25	TURBIDITY SENSOR
LSL	2646	FILTER 26	FLOAT TYPE SWITCH
LSH	2646	FILTER 26	FLOAT TYPE SWITCH
AE	2646	FILTER 26	TURBIDITY SENSOR, W/ NEW MOUNTING ACCESSORIES
AINTU	2646	FILTER 25/26	TURBIDITY CONTROLLER
LE	C21610	CISTERN 1	NON-CONTACT RADAR; CONE ANTENNA
LI	C21610	FILTER 1-10 PIPE GALLERY	LEVEL TRANSMITTER
LE/LI	HS0310	UV DISINFECTION ROOM/CLEARWELL 2	GAUGE PRESSURE TRANSMITTER
FI	HS0327	PUMP ROOM #2	FLOW TRANSMITTER
FI	HS623	GROUNDS BUILDING	FLOW TRANSMITTER
FI	HS624	GROUNDS BUILDING	FLOW TRANSMITTER
FI	HS1216	PUMP ROOM #2	FLOW TRANSMITTER
LE	P21701	CISTERN 2	NON-CONTACT RADAR
LI	P21701	FLOC 4&5 GALLERY	LEVEL TRANSMITTER
LE	P21708	CISTERN 2	NON-CONTACT RADAR
LI	P21708	FLOC 4&5 GALLERY	LEVEL TRANSMITTER

A1

FLOW METER SCHEDULE

DEVICE TAG	LOOP NUMBER	SIZE	TYPE	FLOW RANGE	SERVICE	LOCATION	NOTES
FE	1621	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 1	
FE	1622	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 2	
FE	1623	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 3	
FE	1624	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 4	
FE	1625	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 5	
FE	1626	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 6	
FE	1627	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 7	
FE	1628	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 8	
FE	1629	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 9	
FE	1630	10"	MAG METER	0-1,400 GPM	FILTER EFFLUENT	FILTER 10	
FE	HS0327	24"	MAG METER	-30 TO +30 MGD	EHS	EHS/WHS VAULT	
FE	HS623	14"	MAG METER	-15 TO +15 MGD	GRAVITY 1	GRAVITY 1 VAULT	
FE	HS624	14"	MAG METER	-15 TO +15 MGD	GRAVITY 2	GRAVITY 2 VAULT	
FE	HS1216	24"	MAG METER	-30 TO +30 MGD	WHS	EHS/WHS VAULT	

fishbeck
Engineers | Architects | Scientists | Constructors

City of Ann Arbor
Ann Arbor, Michigan

Instrumentation & Controls Improvements
SCHEDULES

REVISIONS

4/28/2026	A1	ADDENDUM NO. 1

4/7/2026	BIDS AND CONSTRUCTION

Drawn By	RSECORD
Designer	AWADE
Reviewer	BDPHILLIPS
Manager	BDPHILLIPS

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
2501593

SHEET NO.
P005

Attendance Sheet

fishbeck

MEETING: Pre Bid Conference

DATE: April 16, 2026 TIME: 1:30 p.m. PROJECT NAME: Instrumentation and Controls Improvements

LOCATION: Ann Arbor WTP PROJECT NO.: 2501593

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