Division 40

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SECTION 406000
SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. All equipment and wiring shall conform to standard electrical practice and to all applicable sections of the NEC reference to low voltage applications.

B. Include, in general, with the SCADA System but without limitation:
   1. Control panel enclosures for new applications.
   2. All necessary hardware, software and programming (both for upgrades to existing systems and for new applications) to perform the SCADA functions described herein and required for operation of the system.
   3. Provide and install an IO/Historical Server that is suitable for the SCADA system defined in this specification.
   4. Install Self-Healing Ring Fiber Optic 8 Port Switches in all PLC cabinets.
   5. Furnish and supply all variable frequency drives unless otherwise noted.
   6. Furnish and install the Main CP PLC-1 with two racks in the existing enclosure.
   7. Furnish and install the Filter #1 Console RIO#1 in the existing enclosure.
   8. Furnish and install the Filter #2 Console RIO#2 in the existing enclosure.
   9. Furnish and install the Raw Water CP PLC-2 in a Stainless Steel NEMA 4X enclosure.
   10. Furnish and install all instrumentation.
   11. Furnish and install Variable Frequency Drives (VFDs) for the three (3) Raw Water Pumps, three (3) High Lift Pumps, and two (2) Backwash Pumps.
   12. Furnish and install a VPN connection with a Firewall that meets Department of Health security requirements for a water plant.
   13. Develop the operators monthly report in digital format for printout.

C. The SCADA System shall execute the following functions:
   1. Monitor and control operations via one (1) operator work station (HMI) and four (4) local operator interface terminal (OIT) at the consisting of industrial computers with touch screen capability and HMI client application software.
   2. Automatically record information pertaining to these operations using the Historian software as specified.
   3. Communicate between hardware components and field instrumentation.
   4. Provide the operator monthly report in digital format for printing.

D. Include field-testing and services of qualified representatives of the SCADA System supplier.

E. It is the intent of this Contract that the SCADA installations be complete in all respects and ready for use and operation. The Contractor shall be responsible for all details, devices, accessories and special construction necessary to properly finish, install, adjust, test and place in successful continuous operation a complete installation.

F. The Schedules in this Section are not necessarily complete. The Contractor shall not rely on the Schedules but shall thoroughly examine the Contract Documents prior to bid to determine the work required under this Contract.

1.02 QUALITY ASSURANCE

A. All equipment covered by these specifications shall be the products of reputable, qualified, and successful manufacturers who are of proven ability and have long experience in the production of such equipment.

B. All equipment specified in this Section shall be provided by the SCADA System Supplier.

C. The Contractor shall pay all royalty or license fees for use of patented devices or systems and shall protect the Owner from patent infringement litigation thereon.

D. All components of the SCADA System have been included under this Section so that the OWNER will receive completely coordinated and properly integrated system for efficiency, ease in operation and, correct functional relationship among all elements of the system. Therefore, it is the intent of this Contract that the equipment specified under this Section will be furnished by a single SCADA System Supplier. This does not require that all equipment be manufactured by a single manufacturer, but does require that the SCADA System Supplier be responsible for the satisfactory operation of the instrumentation and metering equipment and the SCADA System furnished hereunder.

1.03 SYSTEMS INTEGRATOR:

The physical layout of the SCADA system is shown on the contract drawings and the equipment specifications. The use of an “or equal” system will require the SCADA supplier to document experience on at least 10 similar systems with major upgrades of equal size or larger subject to the approval of the ENGINEER. The SCADA System shall be in compliance with these specifications and plans.

A. If the Contactor proposes an “or equal” SCADA system, it shall be understood that the proposed system meets or exceeds the specified performance and construction and offers a cost savings to the OWNER. The CONTRACTOR may be responsible for engineering time to review proposed substitutions.

B. The following is a minimum qualifications submittal:

1. SCADA system supplier shall submit, within 15 (fifteen) calendar days of the bid, detailed information on their staff and organization to show compliance with the Quality Assurance requirements of this Section. The Qualifications submittal shall be submitted and favorably reviewed before any further submittals will be accepted. Failure to meet the minimum requirements shall be grounds for rejection as acceptable.

2. Copy of UL-508 certificate for panel fabrication facilities.

3. Five (5) references for water or wastewater projects successfully completed within the last five years. Successful completion shall be defined as a finished project completed on Potential references shall be for projects where the SCADA system supplier's contract, excluding change orders, is $125,000 minimum.

C. The SCADA System Supplier will also be the SCADA System Installer and will designate an experienced employee as the Systems Integrator. The Systems Integrator will be responsible for all planning, field planning, submittals, proposals, on site coordination, installation, proper programming and operation of the fiber equipment, all callbacks, all warranty items and training of the Owners employee's on the system operation and all field programmable system parameters. The Systems Integrator will be the sole contact for the Owner, General Contractor and the Project Engineer. After commencement of the SCADA installation, the Systems Integrator will be required to be on site at least 1 day (8 hours) per week and will provide the Project Engineer with at least 48 hours notice of the scheduled site visit.

D. The SCADA Systems Supplier will be required to be located within 100 miles of the site and be able to provide onsite assistant within 4 hours if required in the event of an emergency.

E. Warranty: The SCADA Systems Supplier will provide a complete labor, mileage and parts replacement warranty for one year after final acceptance of the work for all equipment provided by the SCADA System Supplier.

F. The SCADA System Integrator must be a UL-508A certified panel shop at the time of Bid, or utilize a UL508 panel shop for all panel design and construction.

1.04 PERFORMANCE REQUIREMENTS

A. The SCADA System Supplier, through the Systems Integrator, shall have total responsibility for the performance and compatibility of the entire SCADA system as shown on the Drawings and as specified herein. The SCADA supplier shall have sole responsibility for the

quality and proper functioning all of components shown on the Drawings, as specified herein, and as specified in Section 407000 “Instrumentation Equipment” including those not of the supplier’s manufacture.

1.05 Submittals

A. Shop Drawings

1. The SCADA System supplier shall submit detailed shop drawings, complete information on all components, theory of operation, evidence of chemical compatibility, equipment piping and valve layouts, and detailed electrical wiring and SCADA diagrams.

2. All submittals to include (3) hard copies shall be submitted as well as an electronic copy and be sufficient in detail to demonstrate that the supplier will furnish the equipment in accordance with the Contract Documents and that the equipment is satisfactory for its intended use. The Contractor shall submit a complete list of parts and supplies for each different item of equipment installed, and a list of parts and supplies that are recommended by the manufacturer to assure efficient operation of the equipment.

3. As a minimum, submit the following documentation with the shop drawings:
   a. Physical description of all hardware.
   b. Functional description of all hardware and programming.
   c. Theory of operation.
   d. Operating procedures.
   e. Listing of programming used.
   f. Internal wiring diagrams for each panel, numbered wire, numbered terminal on the instrument and numbered terminal block. This includes both new panels and upgrades to existing panels.
   g. Complete, and in every detail, interconnection wiring diagram and process and instrumentation diagrams (loop diagrams) in accordance with ISAS5.4 Instrument Loop Diagrams, Illustration 7.4, latest revision, showing all field and panel mounted equipment and terminal identification. Use the same component identification as shown on the drawings and indicated herein where possible.
   h. List of all inputs and outputs for each PLC.

4. Prior to the Instrumentation and SCADA System Supplier starting work on the SCADA system, a meeting shall be held with the General Contractor, the Electrical Contractor, the SCADA System Supplier, the Engineer, and the Owner. The purpose of the meeting will be to resolve all issues regarding system architecture, SCADA loop functions, and SCADA functions. This meeting typically takes one day and should be scheduled as soon as reasonably possible after the award of the contract (typically 30 days). The SCADA System Supplier is expected to have his project team in place prior to the

meeting and all relevant members of that team shall be in attendance at the meeting.

B. Operation and Maintenance Manual - The Contractor shall furnish complete operation and maintenance manuals for the treatment modules including part schedules to assist in assembly, disassembly, and ordering parts. Specific operation and maintenance instructions shall be prepared for the entire system by the SCADA System Supplier. Operation and maintenance instructions for individual components should be included with the package; however, written instructions, drawings, and schematics must cover the complete system, not just specific components.

PART 2 PRODUCTS

2.01 PROCESS EQUIPMENT

See Section 407000 “Instrumentation Equipment”

2.02 SYSTEM SCADA

A. The Control system vendor shall supply the SCADA system and furnish additional components to the SCADA system providing all necessary control functions for totally integrated operation of the plant process. Included in the upgrades, but not limited to, shall be the mechanical influent screen, grit removal, SBR, digester systems, UV, Sludge Press. The controls shall be as described hereafter.

B. Control Panels
1. All controls panels which are to be located indoors shall be of NEMA 12 (oil and dust tight) free standing design constructed of 14 gauge cold rolled steel provided with a finish of rust inhibiting primer followed by two (2) coats of industrial grade enamel, white inside and ANSI 61 gray outside. Panel components will be mounted and wired to terminal strips for Contractor field connections. All outdoor enclosures shall be stainless steel NEMA 4X with heaters.

C. Programmable Logic Controller

1. PLCs shall be Allen Bradley CompactLogix with Ethernet capabilities or equal.

2. Factory programmed Programmable Logic Controller (PLC) shall be provided within all control panels. The SCADA system noted herein must be capable of expansion. The PLCs shall be capable of monitoring inputs and providing outputs as required for system logic, and shall include no less than 20% spare analog and discrete inputs and outputs,

20% spare non-volatile logic memory with no less than 8K words, 1920 registers, 2.5 ms/K scan time, and 14 bit analog resolution.

3. The PLC shall accept analog inputs (4-20madc) from system analyzers and transmitters for monitoring and trending on an Operator Workstation (HMI) and Operator Interface Terminal (OIT) as specified herein, as depicted on the Process, Instrumentation and SCADA Diagram and the project specifications.

4. System logic will monitor and control all components to the WWTP as shown on the Drawings or this specification.

The following lists the required PLC, hardware and software requirements, UPS requirements, etc.

5. PLC-1 Main CP

   A. Rack -1 Layout – The PLC-1 rack 1 shall consist of 1 Allen Bradley CompactLogix Controller with CPU, Power Supply, Ethernet, 1.5M Memory, and Analog and Digital IO:

      4 – 16 Pt. Output Card 1769-OB16K
      6 – 16 Pt. 24 VDC Input Cards 1769-IQ16
      4 – 4 Pt. Analog Input Cards 1769-IF4
      3 – 8 Pt. Analog Output Cards 1769-OF8C

   B. Rack-2 Layout – The PLC-1 rack 2 shall consist of:

      1 – 16 Pt. Output Card 1769-OB16K
      1 – 16 Pt. 24 VDC Input Cards 1769-IQ16
      2 – 4 Pt. Analog Input Cards 1769-IF4
      1 – 8 Pt. Analog Output Cards 1769-OF8C

   C. Power Supply Module – Each rack shall have a power supply. The power supply module shall be a CompactLogix 1769-PA4 120/240V AC Power Supply (5V @ 4 Amp).

   D. Central Processing Unit (CPU) – The CPU shall be a CompactLogix Ethernet processor model# 1769-L33ER or Engineer Approved Equal.

   E. Fiber Optic Modem – Stratix Self-Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the SCADA

system for alarm and monitoring. The switch shall include two fiber and two ethernet ports.

F. Uninterruptible Power Supply – The UPS in PLC-1 will be shall be a 1 KVA Smart UPS.

G. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in PLC-1 as to provide a termination for Fiber Optic Cables.

H. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in PLC-1 to run from the Fiber Optic Patch Panel to the Fiber Optic Switch.

I. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 6 copper ports minimum. One of the copper ports shall be tied to the fiber switch.

J. Operator Interface Terminal (OIT) – The OIT for PLC-1 shall be a PanelView Plus 7, 15" Color Active Matrix TFT Display. The OIT will have a touchscreen, Standard Communications (Ethernet & RS-232, AC Input and 64MBFlash/64MB RAM.) as a minimum

K. All inputs shall be fused at the PLC control panel by the SCADA vendor.

L. Additional IO Points and Programming shall be added as required by the IO list and the SCADA strategies.

6. RIO-1 Filter 1 Console

A. Rack Layout – The RIO-1 rack shall consist of Power Supply, Ethernet, 1.5M Memory, and Analog and Digital IO:

1 – Remote IO communication module 1769-AENTR
2 – 16 Pt. 24VDC Input Cards 1769-IQ16
2– 16 Pt. Output Card 1769-OB16K
1 – 4 Pt. Analog Input Cards 1769-IF4
1 – 4 Pt. Analog Output Card 1769-OF4CI

B. RIO-1 shall be mounted in the existing console #1 control enclosure.

C. Power Supply Module – The power supply module shall be a CompactLogix 1769-PA4 120/240V AC Power Supply (5V @ 4 Amp).

D. Fiber Optic Modem – Stratix Self-Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the SCADA system for alarm and monitoring. The switch shall include two fiber and two ethernet ports.

E. Uninterruptible Power Supply – The UPS in RIO-1 will be shall be a 1 KVA Smart UPS.

F. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in RIO-1 as to provide a termination for Fiber Optic Cables.

G. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in RIO-1 to run from the Fiber Optic Patch Panel to the Fiber Optic Switch.

H. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 6 copper ports minimum. One of the copper ports shall be tied to the fiber switch.

I. All inputs shall be fused at the RIO control panel by the SCADA vendor.

J. Additional IO Points and Programming shall be added as required by the IO list and the SCADA strategies.

7. RIO-2 Filter 2 Console

K. Rack Layout – The RIO-2 rack shall consist of Power Supply, Ethernet, 1.5M Memory, and Analog and Digital IO:

1 – Remote IO communication module 1769-AENTR
2 – 16 Pt. 24VDC Input Cards 1769-IQ16
2– 16 Pt. Output Card 1769-OB16K
1 – 4 Pt. Analog Input Cards 1769-IF4
1 – 4 Pt. Analog Output Card 1769-OF4CI

L. RIO-2 shall be mounted in the existing console #2 control enclosure.

M. Power Supply Module – The power supply module shall be a CompactLogix 1769-PA4 120/240V AC Power Supply (5V @ 4 Amp).

N. Fiber Optic Modem – Stratix Self-Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the SCADA system for alarm and monitoring. The switch shall include two fiber and two ethernet ports.

O. Uninterruptible Power Supply – The UPS in RIO-2 will be shall be a 1 KVA Smart UPS.

P. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in RIO-2 as to provide a termination for Fiber Optic Cables.

Q. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in RIO-2 to run from the Fiber Optic Patch Panel to the Fiber Optic Switch.

R. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 6 copper ports minimum. One of the copper ports shall be tied to the fiber switch.

S. All inputs shall be fused at the RIO control panel by the SCADA vendor.

T. Additional IO Points and Programming shall be added as required by the IO list and the SCADA strategies

8. PLC-2 Raw Water Pump Station Control Panel

A. Rack -1 Layout – The PLC-1 rack 1 shall consist of 1 Allen Bradley CompactLogix Controller with CPU, Power Supply, Ethernet, 1.5M Memory, and Analog and Digital IO:

4 – 16 Pt. Output Card 1769-OB16K
6 – 16 Pt. 24 VDC Input Cards 1769-IQ16
4 – 4 Pt. Analog Input Cards 1769-IF4
3 – 8 Pt. Analog Output Cards 1769-OF8C

B. Power Supply Module – Each rack shall have a power supply. The power supply module shall be a CompactLogix 1769-PA4 120/240V AC Power Supply (5V @ 4 Amp).

C. Central Processing Unit (CPU) – The CPU shall be a CompactLogix Ethernet processor model# 1769-L33ER or Engineer Approved Equal.

D. Fiber Optic Modem – Stratix Self-Healing Ring Switch with a fault contact. The fault contact will be brought into a spare DI and incorporated into the SCADA system for alarm and monitoring. The switch shall include two fiber and two ethernet ports.

E. Uninterruptible Power Supply – The UPS in PLC-1 will be shall be a 1 KVA Smart UPS.

F. Fiber Optic Patch Panel – A Fiber Optic Patch Panel will be incorporated in PLC-1 as to provide a termination for Fiber Optic Cables.

G. Fiber Optic Patch Cables – Fiber Optic Patch Cables will be used in PLC-1 to run from the Fiber Optic Patch Panel to the Fiber Optic Switch.

H. Ethernet switch sized for application. This shall be a Stratix ethernet switch with 6 copper ports minimum. One of the copper ports shall be tied to the fiber switch.

I. Operator Interface Terminal (OIT) – The OIT for PLC-1 shall be a PanelView Plus 7, 15" Color Active Matrix TFT Display. The OIT will have a touchscreen, Standard Communications (Ethernet & RS-232, AC Input and 64MBFlash/64MB RAM.) as a minimum

J. All inputs shall be fused at the PLC control panel by the SCADA vendor.

K. Additional IO Points and Programming shall be added as required by the IO list and the SCADA strategies

9. SCADA1 – SCADA Computer 1

A. SCADA1 – SCADA Computer 1 shall be a AP Server with 5000 Tag minimum. SCADA1 shall also be equipped with TCP/IP and TCP/IP I/O drivers for plant-wide communications.

B. The SCADA vendor shall be responsible for supplying and installing all software and necessary hardware and obtaining all licenses necessary to meet the requirements of SCADA1.

C. SCADA1 will have Ethernet capabilities and come equipped with a 19" flat screen monitor. The HMI shall come with FactoryTalk View Site Edition 200 Display.

D. Automatic System Operation – WWTP

1. Automatic system operation shall be based on alarm and SCADA levels displayed on the operator work station (HMI) and operator interface terminal (OIT) in desired engineering units (ft, gpm, %, etc.) as follows:

a. Raw Water Pump Station
   1. Raw Water Pump #1 HOA status
   2. Raw Water Pump #1 Run Status
   3. Raw Water Pump #1 Speed
   4. Raw Water Pump #1 general fault alarm
   5. Raw Water Pump #1 elapsed run time
   6. Raw Water Pump #1 Seal Fail
   7. Raw Water Pump #1 Thermal Overload
   8. Raw Water Pump #1 Call to Run Pilot Light
   9. Raw Water Pump #1 Running Pilot Light
   10. Raw Water Pump #1 Fault Pilot Light
   11. Raw Water Pump #1 ETM
   12. Raw Water Pump #2 HOA status
   13. Raw Water Pump #2 Run Status
   14. Raw Water Pump #2 Speed
   15. Raw Water Pump #2 elapsed run time
   16. Raw Water Pump #2 Seal Fail
   17. Raw Water Pump #2 Thermal Overload
   18. Raw Water Pump #2 Call to Run Pilot Light
   19. Raw Water Pump #2 Running Pilot Light
   20. Raw Water Pump #2 Fault Pilot Light
   21. Raw Water Pump #2 ETM
   22. Raw Water Pump #3 HOA status
   23. Raw Water Pump #3 Run Status
   24. Raw Water Pump #3 Speed
   25. Raw Water Pump #3 elapsed run time
   26. Raw Water Pump #3 Seal Fail
   27. Raw Water Pump #3 Thermal Overload
   28. Raw Water Pump #3 Call to Run Pilot Light
   29. Raw Water Pump #3 Running Pilot Light

30. Raw Water Pump #3 Fault Pilot Light
31. Raw Water Pump #3 ETM
32. Raw Water Tank High Alarm Float
33. Raw Water Tank Low Alarm Float
34. Raw Water Tank liquid level (ft) (via pressure transducer)
35. Raw Water Tank low level alarm (via pressure transducer)
36. Raw Water Tank high level alarm (via pressure transducer)
37. Raw Water Pump Sequence 1-2-3
38. Raw Water Pump Sequence 2-3-1
39. Raw Water Pump Sequence 3-2-1
40. Raw Water Flow Instantaneous
41. Raw Water Flow Totalizer

b. Potassium Permanganate Feed
1. Potassium Permanganate Pump #1 Start
2. Potassium Permanganate Pump #1 Speed Out
3. Potassium Permanganate Pump #1 Stroke
4. Potassium Permanganate Pump #1 High Pressure Switch
5. Potassium Permanganate Pump #1 Flow Switch
6. Potassium Permanganate Pump #2 Start
7. Potassium Permanganate Pump #2 Speed Out
8. Potassium Permanganate Pump #2 Stroke
9. Potassium Permanganate Pump #2 High Pressure Switch
10. Potassium Permanganate Pump #2 Flow Switch

c. Chlorine Feed
1. Chlorine Gas Valve Open Command
2. Chlorine Gas Valve Close Command
3. Chlorine Gas Valve Open Limit Switch
4. Chlorine Gas Valve Closed Limit Switch
5. Sodium Hypochlorite Pump #1 Start
6. Sodium Hypochlorite Pump #1 Speed Out
7. Sodium Hypochlorite Pump #1 Stroke
8. Sodium Hypochlorite Pump #1 High Pressure Switch
9. Sodium Hypochlorite Pump #1 Flow Switch
10. Sodium Hypochlorite Pump #2 Start
11. Sodium Hypochlorite Pump #2 Speed Out
12. Sodium Hypochlorite Pump #2 Stroke
13. Sodium Hypochlorite Pump #2 High Pressure Switch
14. Sodium Hypochlorite Pump #2 Flow Switch
15. Chlorine Leak Detector Alarm

16. Chlorine Vacuum High
17. Chlorine Vacuum Low
18. Pre-Chlorinator Out of Gas
19. Post Chlorinator Out of Gas

d. Coagulant Feed
1. Coagulant Feed Pump #1 Start
2. Coagulant Feed Pump #1 Speed Out
3. Coagulant Feed Pump #1 Stroke
4. Coagulant Feed Pump #1 High Pressure Switch
5. Coagulant Feed Pump #1 Flow Switch
6. Coagulant Feed Pump #2 Start
7. Coagulant Feed Pump #2 Speed Out
8. Coagulant Feed Pump #2 Stroke
9. Coagulant Feed Pump #2 High Pressure Switch
10. Coagulant Feed Pump #2 Flow Switch
11. Raw Water Turbidity
12. Raw Water Turbidity Loss of Echo
13. Raw Water Turbidity Sample Valve Open
14. Raw Water pH
15. Raw Water pH Sample Valve Open
16. Streaming Current
17. Streaming Current Sample Valve Open

e. Secondary Coagulant Feed
1. Secondary Coagulant Feed Pump #1 Start
2. Secondary Coagulant Feed Pump #1 Speed Out
3. Secondary Coagulant Feed Pump #1 Stroke
4. Secondary Coagulant Feed Pump #1 High Pressure Switch
5. Secondary Coagulant Feed Pump #1 Flow Switch
6. Secondary Coagulant Feed Pump #2 Start
7. Secondary Coagulant Feed Pump #2 Speed Out
8. Secondary Coagulant Feed Pump #2 Stroke
9. Secondary Coagulant Feed Pump #2 High Pressure Switch
10. Secondary Coagulant Feed Pump #2 Flow Switch

f. Trident Unit #1
1. Unit#1 HOA
2. Unit #1 Flow
3. Unit#1 Influent Flow Control Valve FCV104 Command

4. Unit#1 Influent Flow Control Valve FCV104 Open Switch
5. Unit#1 Influent Flow Control Valve FCV104 Closed Switch
6. Unit#1 Clarifier Pressure Transmitter
7. Unit#1 High Pressure Flush Initiate
8. Unit#1 Clarifier High Pressure Shutdown
9. Unit #1 Surface Wash Solenoid Valve SV107 Open
10. Unit #1 Surface Wash Solenoid Valve SV107 Close
11. Unit #1 Filter High Level
12. Unit #1 Filter Low Level Alarm
13. Unit #1 Filter Level Transmitter
14. Unit#1 Filter High Head Loss
15. Unit #1 Filter Pressure Transmitter
16. Unit #1 Effluent Control Valve FCV101 Open Command
17. Unit #1 Effluent Control Valve FCV101 Close Command
18. Unit #1 Effluent Control Valve FCV101 Open Limit Switch
19. Unit #1 Effluent Control Valve FCV101 Closed Limit Switch
20. Unit#1 Backwash Valve CV102 Open Command
21. Unit#1 Backwash Valve CV102 Close Command
22. Unit #1 Backwash Valve CV102 Open Limit Switch
23. Unit#1 Backwash Valve CV102 Closed Limit Switch
24. Unit#1 Filter To Waste Valve FCV108 Open Command
25. Unit#1 Filter To Waste Valve FCV108 Close Command
26. Unit#1 Filter To Waste Valve FCV108 Open Limit Switch
27. Unit#1 Filter To Waste Valve FCV108 Closed Limit Switch
28. Unit#1 Air Inlet Valve CV103 Open Command
29. Unit#1 Air Inlet Valve CV103 Close Command
30. Unit#1 Air Inlet Valve CV103 Open Limit Switch
31. Unit#1 Air Inlet Valve CV103 Closed Limit Switch
32. Unit#1 Air Scour Valve CV105 Open Command
33. Unit#1 Air Scour Valve CV105 Close Command
34. Unit#1 Air Scour Valve CV105 Open Limit Switch
35. Unit#1 Air Scour Valve CV105 Close Limit Switch
36. Unit #1 Effluent Turbidity
37. Unit #1 Effluent Turbidity Loss of Echo
38. Unit#1 High Effluent Turbidity Alarm Contact
39. Unit #1 Turbidity Sample Pump Call to Run
40. Unit#1 Auto Flush Cycle Initiate Selected
41. Unit#1 Selected For Manual Initiate
42. Unit#1 Auto Backwash Cycle Initiate Selected
43. Unit#1 Flush Cycle Manual Initiate Pushbutton

44. Unit#1 Backwash Cycle Manual Initiate Pushbutton
45. Unit#1 Call to Run Pilot Light
46. Unit#1 Running Pilot Light
47. Unit#1 Fault Pilot Light
48. Unit#1 Backwashing Pilot light
49. Unit#1 Flushing Pilot Light
50. Unit#1 ETM

g. Trident Unit #2
1. Unit#2 HOA
2. Unit #2 Flow
3. Unit#2 Influent Flow Control Valve FCV204 Command
4. Unit#2 Influent Flow Control Valve FCV204 Open Limit Switch
5. Unit#2 Influent Flow Control Valve FCV204 Open Limit Switch
6. Unit#2 Clarifier Pressure Transmitter
7. Unit#2 High Pressure Flush Initiate
8. Unit#2 Clarifier High Pressure Shutdown
9. Unit #2 Surface Wash Solenoid Valve SV207 Open
10. Unit #2 Surface Wash Solenoid Valve SV207 Close
11. Unit #2 Filter High Level
12. Unit #2 Filter Low Level Alarm
13. Unit #2 Filter Level Transmitter
14. Unit#2 Filter High Head Loss
15. Unit #2 Filter Pressure Transmitter
16. Unit #2 Effluent Control Valve FCV201 Open Command
17. Unit #2 Effluent Control Valve FCV201 Close Command
18. Unit #2 Effluent Control Valve FCV201 Open Limit Switch
19. Unit #2 Effluent Control Valve FCV201 Closed Limit Switch
20. Unit#2 Backwash Valve CV202 Open Command
21. Unit#2 Backwash Valve CV202 Close Command
22. Unit #2 Backwash Valve CV202 Open Limit Switch
23. Unit#2 Backwash Valve CV202 Closed Limit Switch
24. Unit#2 Filter To Waste Valve FCV208 Open Command
25. Unit#2 Filter To Waste Valve FCV208 Close Command
26. Unit#2 Filter To Waste Valve FCV208 Open Limit Switch
27. Unit#2 Filter To Waste Valve FCV208 Closed Limit Switch
28. Unit#2 Air Inlet Valve CV203 Open Command
29. Unit#2 Air Inlet Valve CV203 Close Command
30. Unit#2 Air Inlet Valve CV203 Open Limit Switch

31. Unit#2 Air Inlet Valve CV203 Closed Limit Switch
32. Unit#2 Air Scour Valve CV205 Open Command
33. Unit#2 Air Scour Valve CV205 Close Command
34. Unit#2 Air Scour Valve CV205 Open Limit Switch
35. Unit#2 Air Scour Valve CV205 Close Limit Switch
36. Unit #2 Effluent Turbidity
37. Unit #1 Effluent Turbidity Loss of Echo
38. Unit#2 High Effluent Turbidity Alarm Contact
39. Unit #2 Turbidity Sample Pump Call to Run
40. Unit#2 Auto Flush Cycle Initiate Selected
41. Unit#2 Selected For Manual Initiate
42. Unit#2 Auto Backwash Cycle Initiate Selected
43. Unit#2 Flush Cycle Manual Initiate Pushbutton
44. Unit#2 Backwash Cycle Manual Initiate Pushbutton
45. Unit#2 Call to Run Pilot Light
46. Unit#2 Running Pilot Light
47. Unit#2 Fault Pilot Light
48. Unit#2 Backwashing Pilot light
49. Unit#2 Flushing Pilot Light
50. Unit#2 ETM

h. Air Blowers

1. Air Blower #1 HOA
2. Air Blower #1 Start
3. Air Blower #1 Run Status
4. Air Blower #1 Fault
5. Air Blower #1 ETM
6. Air Blower #2 HOA
7. Air Blower #2 Start
8. Air Blower #2 Run Status
9. Air Blower #2 Fault
10. Air Blower #2 ETM
11. Air Blower Pressure Switch
12. Air Blower #3 HOA
13. Air Blower #3 Start
14. Air Blower #3 Run Status
15. Air Blower #3 Fault
16. Air Blower #3 ETM
17. Air Blower #4 HOA
18. Air Blower #4 Start
19. Air Blower #4 Run Status

20. Air Blower #4 Fault
21. Air Blower #4 ETM

i. Backwash Pumps
1. Backwash Pump #1 HOA
2. Backwash Pump #1 Start
3. Backwash Pump #1 Run Status
4. Backwash Pump #1 Fault
5. Backwash Pump #1 Speed Out
6. Backwash Pump #1 Speed In
7. Backwash Pump #1 ETM
8. Backwash Pump #2 HOA
9. Backwash Pump #2 Start
10. Backwash Pump #2 Run Status
11. Backwash Pump #2 Fault
12. Backwash Pump #2 Speed Out
13. Backwash Pump #2 Speed In
14. Backwash Pump #2 ETM
15. Clearwell Level
16. Clearwell High Level Float
17. Clearwell Low Level Float
18. Backwash Rate Controller FCV002 Open Command
19. Backwash Rate Controller FCV002 Close Command
20. Backwash Low Rate Valve CV008 Open Command
21. Backwash High Rate Valve CV009 Open Command
22. Backwash Blow Off Valve CV010 Open Command
23. Backwash Flow Rate

j. High Service Pumps
1. High Service Pump #1 HOA
2. High Service Pump #1 Start
3. High Service Pump #1 Run Status
4. High Service Pump #1 Fault
5. High Service Pump #1 Speed Out
6. High Service Pump #1 Speed In
7. High Service Pump #1 Call to Run Pilot Light
8. High Service Pump #1 Running Pilot Light
9. High Service Pump #1 Fault Pilot Light
10. High Service Pump #1 ETM
11. High Service Pump #2 HOA
12. High Service Pump #2 Start

13. High Service Pump #2 Run Status
14. High Service Pump #2 Fault
15. High Service Pump #2 Speed Out
16. High Service Pump #2 Speed In
17. High Service Pump #2 Call to Run Pilot Light
18. High Service Pump #2 Running Pilot Light
19. High Service Pump #2 Fault Pilot Light
20. High Service Pump #2 ETM
21. High Service Pump #3 HOA
22. High Service Pump #3 Start
23. High Service Pump #3 Run Status
24. High Service Pump #3 Fault
25. High Service Pump #3 Speed Out
26. High Service Pump #3 Speed In
27. High Service Pump #3 Call to Run Pilot Light
28. High Service Pump #3 Running Pilot Light
29. High Service Pump #3 Fault Pilot Light
30. High Service Pump #3 ETM
31. High Service Pump #1 Check Valve Open
32. High Service Pump #2 Check Valve Open
33. High Service Pump #3 Check Valve Open
34. High Service Sequence 1-2-3-4 Selected
35. High Service Sequence 2-3-4-1 Selected
36. High Service Sequence 3-4-1-2 Selected
37. High Service Sequence 4-1-2-3 Selected
38. Finished Water Flow Instantaneous
39. Finished Water Flow Totalizer
40. Reservoir Level

k. Flocculator
   1. Flocculator HOA
   2. Flocculator Call to Run
   3. Flocculator Run Status
   4. Flocculator Fault
   5. Flocculator Speed Output
   6. Flocculator Speed Input
   7. Flocculator Streaming Current Meter

l. Flocculator Coagulant Feed
   1. Floc Coagulant Feed Pump #1 Start
   2. Floc Coagulant Feed Pump #1 Run Status

3. Floc Coagulant Feed Pump #1 Fault
4. Floc Coagulant Feed Pump #1 Speed Out
5. Floc Coagulant Feed Pump #1 Speed In
6. Floc Coagulant Feed Pump #1 High Pressure Switch
7. Floc Coagulant Feed Pump #1 Flow Switch
8. Floc Coagulant Feed Pump #2 Start
9. Floc Coagulant Feed Pump #2 Run Status
10. Floc Coagulant Feed Pump #2 Fault
11. Floc Coagulant Feed Pump #2 Speed Out
12. Floc Coagulant Feed Pump #2 Speed In
13. Floc Coagulant Feed Pump #2 High Pressure Switch
14. Floc Coagulant Feed Pump #2 Flow Switch

m. Conventional Filter Common
1. Raw Water Turbidity
2. Effluent Turbidity
3. Filter Sequence Manual 1-2-3-4
4. Filter Sequence Manual 2-3-4-1
5. Filter Sequence Manual 3-4-1-2
6. Filter Sequence Manual 4-1-2-3

n. Conventional Filter #1
1. Conv Filter #1 HOA
2. Treatment Unit#1 Effluent Turbidity
3. Filter#1 Effluent Turbidity
4. Conv Filter#1 Level
5. Conv Filter#1 Low Level Float
6. Conv Filter#1 High Level Float
7. Conv Filter#1 Influent Valve Open Command
8. Conv Filter#1 Influent Valve Open Limit Switch
9. Conv Filter#1 Influent Valve Closed Limit Switch
10. Conv Filter#1 Effluent Valve Open Command
11. Conv Filter#1 Effluent Valve Close Command
12. Conv Filter#1 Effluent Valve Open Limit Switch
13. Conv Filter#1 Effluent Valve Closed Limit Switch
14. Conv Filter#1 Backwash Valve Open Command
15. Conv Filter#1 Backwash Valve Open Limit Switch
16. Conv Filter#1 Backwash Valve Closed Limit Switch
17. Conv Filter#1 Air Scour Valve Open Command
18. Conv Filter#1 Air Scour Valve Open Limit Switch
19. Conv Filter#1 Air Scour Valve Closed Limit Switch

20. Conv Filter#1 Drain Valve Open Command
21. Conv Filter#1 Drain Valve Open Limit Switch
22. Conv Filter#1 Drain Valve Closed Limit Switch
23. Conv Filter#1 to Waste Valve Open Command
24. Conv Filter#1 to Waste Valve Close Command
25. Conv Filter#1 to Waste Valve Open Limit Switch
26. Conv Filter#1 to Waste Valve Closed Limit Switch

o. Conventional Filter #2
1. Conv Filter #2 HOA
2. Treatment Unit#2 Effluent Turbidity
3. Filter#2 Effluent Turbidity
4. Conv Filter#2 Level
5. Conv Filter#2 Low Level Float
6. Conv Filter#2 High Level Float
7. Conv Filter#2 Influent Valve Open Command
8. Conv Filter#2 Influent Valve Open Limit Switch
9. Conv Filter#2 Influent Valve Closed Limit Switch
10. Conv Filter#2 Effluent Valve Open Command
11. Conv Filter#2 Effluent Valve Close Command
12. Conv Filter#2 Effluent Valve Open Limit Switch
13. Conv Filter#2 Effluent Valve Closed Limit Switch
14. Conv Filter#2 Backwash Valve Open Command
15. Conv Filter#2 Backwash Valve Open Limit Switch
16. Conv Filter#2 Backwash Valve Closed Limit Switch
17. Conv Filter#2 Air Scour Valve Open Command
18. Conv Filter#2 Air Scour Valve Open Limit Switch
19. Conv Filter#2 Air Scour Valve Closed Limit Switch
20. Conv Filter#2 Drain Valve Open Command
21. Conv Filter#2 Drain Valve Open Limit Switch
22. Conv Filter#2 Drain Valve Closed Limit Switch
23. Conv Filter#2 to Waste Valve Open Command
24. Conv Filter#2 to Waste Valve Close Command
25. Conv Filter#2 to Waste Valve Open Limit Switch
26. Conv Filter#2 to Waste Valve Closed Limit Switch

p. Trident Clarifier #1
1. Clarifier#1 Influent Valve Position
2. Clarifier#1 Influent Flow
3. Clarifier#1 Inlet Turbidity
4. Clarifier#1 Tube Settler Level

5. Clarifier#1 Tube Settler High Level Alarm
6. Clarifier#1 Tube Settler Low Level Alarm
7. Clarifier#1 Sludge Collector Run Status
8. Clarifier#1 Sludge Collector Fault
9. Clarifier#1 Recirc Pump Run Status
10. Clarifier#1 Recirc Pump Fault
11. Clarifier#1 Sludge Recirc Flow
12. Clarifier#1 Transfer Pump Run Status
13. Clarifier#1 Transfer Pump Fault
14. Clarifier#1 Transfer Valve Position
15. Clarifier#1 Sludge Blowdown Valve Position
16. Clarifier#1 Polymer Pump Run Status
17. Clarifier#1 Polymer Pump Fault
18. Clarifier#1 Polymer Flow

q. Trident Clarifier #2
1. Clarifier#2 Influent Valve Position
2. Clarifier#2 Influent Flow
3. Clarifier#2 Inlet Turbidity
4. Clarifier#2 Tube Settler Level
5. Clarifier#2 Tube Settler High Level Alarm
6. Clarifier#2 Tube Settler Low Level Alarm
7. Clarifier#2 Sludge Collector Run Status
8. Clarifier#2 Sludge Collector Fault
9. Clarifier#2 Recirc Pump Run Status
10. Clarifier#2 Recirc Pump Fault
11. Clarifier#2 Sludge Recirc Flow
12. Clarifier#2 Transfer Pump Run Status
13. Clarifier#2 Transfer Pump Fault
14. Clarifier#2 Transfer Valve Position
15. Clarifier#2 Sludge Blowdown Valve Position
16. Clarifier#2 Polymer Pump Run Status
17. Clarifier#2 Polymer Pump Fault
18. Clarifier#2 Polymer Flow

r. Ultraviolet Disinfection System
1. UV #1 on
2. UV #1 off
3. UV #1 general fault alarm
4. UV #2 on
5. UV#2 off

6. UV #2 general fault
7. UV Flow

s. Emergency Generator
1. Generator on
2. Generator off
3. Generator fail to start
4. Generator general fault alarm
5. Low Fuel
6. Battery Low
7. ATS Transferred
8. ATS Failed to Transfer

E. Operator Controls – Local Control Panels (Supplied by Equipment Suppliers)
1. The Trident Clarifier#1 and Trident Clarifier#2 shall come with its own Control Panel in a NEMA 12 enclosure. The SCADA connection shall be via ethernet.

2. The UV System Shall come with two Control Panels in NEMA 12 enclosures. The SCADA connection shall be hardwired discrete signals.

F. Fiber Optic Port Switch (Six) – The fiber optic port switch shall be a Stratix Self-Healing Ring or Engineer Approved Equal.

1. General
a. The PLC ,Remote I/O panel and Workstation shall be connected to the SCADA network backbone through a 10/100 Industrial Rail Ethernet Switch. The Switch shall support fault tolerant ring architecture and shall provide full duplex capability and redundant power. 10/100 Industrial Rail Ethernet Switch shall provide five or more 10/100 Fast Ethernet ports, plus one standby port via RJ45 interfaces and one V.24 interface for external management. Two uplink ports shall be provided for integrated connectivity to the fault tolerant Network backbone. Depending upon the fiber used the uplink ports will be Cat 6 cable or multimode fiber with ST connectors.

2. Frame Switching Functions

a. All data received by the switch from the system bus or at the ports shall be stored and checked for validity. Invalid and defective frames as well as fragments shall be discarded. The switch shall forward valid frames.

b. The switch shall learn all source addresses per port. Only packets with: unknown addresses, this address or a multi/broadcast address in the destination address shall be sent to this port. The switch shall be capable of learning two thousand (2,000) addresses.

c. The Switch shall monitor the age of the learned addresses. The Switch shall delete address entries from the data table that exceed a certain age.

d. The Switch shall support two priority queues. The classification of received data packets to these classes shall be done by: the pre-defined classification in statistical address entries and the priority of the data packet included in the VLAN packet.

e. On data packets with VLAN tags the switch shall analyze the 3 bit priority field. Data packets with VLAN tags and a maximum long data field shall be transmitted. Data packets received without VLAN tags shall be transmitted without VLAN tags.

3. Specific Functions of the TP/TX Interface

a. The Switch shall monitor the connected TP/TX line segments for short circuit or interrupt using regular link test pulses in accordance with IEE standard 802.3 10/100BASE-TP/TX. The Switch shall not transmit any data in a TP/TX segment from which it does not receive a link test pulse.

b. If the reception line pair is incorrectly connected (RD+ and RD- switched) polarity shall be automatically reversed.

c. 8 Port minimum.

4. Self-Healing Functions

a. The Switches shall allow the backbone to assimilate a ring architecture. I one does switch fails or the backbone cable is cut, the ring structure shall change itself into a line structure within 0.5 seconds with up to 50 Switches on the network.

5. Voltage Supply

a. The voltage supply shall be redundant 24 VDC power supplies

6. Management

    a. The Switch shall support SNMP and Web-based management for extensive diagnosis and configuration functions to allow easy startup procedures and allow network and device information. The Switch shall support TCPP/IP protocol family.

7. Technical Specifications

    a. Operating Voltage – 24 VDC -25%, +33%

    b. Current Consumption – 0.8 A max. at 24 VDC

    c. Overload current protection – thermal fuse

    d. Ambient temperature - 0°C to 50°C

    e. Storage Temperature - -20°C to 80°C

    f. Humidity – 10% to 90% (non-condensing)

    g. Port attenuation – 11dB at 1300nm

8. Rail Switch shall be newest switch by Stratix.

2.03 SCADA STRATEGIES – WWTP

A. The following SCADA strategies describing the operations of each SCADA loop indicated on the Drawings will be considered the essence of the specifications. Furnish and install all necessary equipment, instruments, software modules and appurtenances to achieve the performance as hereinafter described, even though such items may not be included in any specific listing of equipment to be furnished. An involved system of this nature requires emphasis on the functional aspects of the Specifications while the technical details serve to indicate the desired manner in which the end result will be accomplished. The control and monitoring strategies indicated below are for equipment external to any existing or proposed packaged process equipment. Control strategies for the packaged process equipment shall be as described in other parts of this specification and as required for proper operation of the system. The following control strategies are associated with the treatment facility indicated below:

1. Raw Water Pumps
    a. The three Raw Water Pumps shall be operated via SCADA through the RAW Pump

Station CP. On the front of the main control panel there is a control station for each raw water pump, consisting of a three position Manual/Off/ Automatic selector switch, three (3) indicator lights, and elapsed run time meter (ETM). There is also a Raw Water Pump selector switch for lead/lag selection. On the front of the Raw Pump Station CP there is also a control station for each raw water pump, consisting of a three position Manual/Off/ Automatic selector switch, three (3) indicator lights, and elapsed run time meter (ETM). The functions of these devices are as follows:

b. The hand position is simply an "ON" switch, the respective raw water pump will be called to run whenever the selector switch is in the hand position. To shut the pump "OFF" simply return the selector switch to the "OFF" position. In the Automatic Position the raw water pump(s) will be called to Run by the programmable logic controller (PLC) whenever a treatment unit requires raw water either during normal filter operation or during a flush cycle. Whenever a filter is called to run either manually or automatically it will not run unless at least one raw water pump is available. A raw water pump is considered available if it's respective Hand/Off/Auto operation selector switch is in the Automatic position.

c. The Raw Water pump Selection switch at the main cp is used to set the lead lag order for the Raw Water pumps. The SCADA system shall accept the input from this switch to set the order of the pumps. The main control panel OIT shall have a software selector switch that allows the operator to choose between the physical switch setting lead lag or a software lead lag option. The software initiated lead lag shall give the operator the ability to select lead/lag/lag-lag and give an operator input for time of rotation.

If a pump is running and the pump faults the SCADA system shall shut the pump off, alarm the operator, remove the pump from rotation and start the next pump in the rotation.

d. SCADA: The SCADA shall indicate and display the operation status for each Raw Water Pump, including lead/lag status, HOA status, pump running status, general fault, motor high temperature alarm, seal failure alarm, elapsed run time and % speed. The SCADA shall accept and display each of the above status and alarm conditions.

e. At the plant SCADA shall monitor the raw water turbidity, pH, and streaming current. These parameters shall be used to inject chemical and monitor the plant.

2. Raw Water Priming Compressors

   a. The two Raw Water Priming Compressors are operated from their local control panels. SCADA shall monitor the priming compressors via the Raw Water pump Station CP. The SCADA vendor shall review the Raw Water Priming Compressors control panels to ensure compatibility between the systems.

      The RAW Water Pump Station CP shall monitor the Raw Water Priming Compressors for run status and fault. This shall be done with discrete contacts.

   b. SCADA: The SCADA shall indicate the operating status for the, raw water priming compressors, including, “raw water priming compressor #1 general alarm”, “raw water priming compressor #1 run status”, “raw water priming compressor #2 general alarm”, and “raw water priming compressor #1 run status”. The SCADA shall accept and display each of the above status and alarm conditions.

3. Permanganate Dosing Station

   a. The 2 proposed permanganate pumps shall operate and pace via with the plant SCADA to provide dosing for the total plant influent flow. The system shall operate as follows:

      SCADA shall pace permanganate feed pump #1 and #2 to maintain an operator preset permanganate dose to the raw water pump station. The 4-20 mA pacing signal for the permanganate pumps shall come from the total influent flow to the filters. The SCADA shall operate the pumps in the lead/lag configuration. In the event of the lead pump failing, the SCADA shall start the lag pump and initiate an alarm.

   b. SCADA: The SCADA shall indicate and display the operation status for each permanganate pumps, including pump HOA status, pump running status, general fault, % speed and lead/lag status. The SCADA shall continuously display and record the liquid level and total volume of the permanganate tank. The SCADA shall show the following alarm conditions for each pump: pump general fault. The SCADA shall show the following for the permanganate tank: operator preset storage tank low level alarm and redundant low level alarm (physical float. The SCADA shall display a permanganate leak alarm (float in the secondary containment for the permanganate).

4. Primary Coagulant

    a. The 2 proposed primary coagulant pumps shall operate and pace via with the plant SCADA to provide dosing for the total plant influent flow. The system shall operate as follows: SCADA shall pace primary coagulant feed pump #1 and #2 to maintain an operator preset primary coagulant dose to the raw water. The 4-20 mA pacing signal for the primary coagulant pumps shall come from the streaming current meter. The SCADA shall operate the pumps in the lead/lag configuration. In the event of the lead pump failing, the SCADA shall start the lag pump and initiate an alarm.

    b. SCADA: The SCADA shall indicate and display the operation status for each primary coagulant pumps, including pump HOA status, pump running status, general fault, % speed and lead/lag status. The SCADA shall continuously display and record the liquid level and total volume of the primary coagulant tank. The SCADA shall show the following alarm conditions for each pump: pump general fault.

    c. The SCADA shall show the following for the primary coagulant tank: operator preset storage tank low level alarm and redundant low-level alarm (physical float. The SCADA shall display a primary coagulant leak alarm (float in the secondary containment for the primary coagulant)

5. Secondary Coagulant

    a. The 2 proposed secondary coagulant pumps shall operate and pace via with the plant SCADA to provide dosing for the total plant influent flow. The system shall operate as follows: SCADA shall pace secondary coagulant feed pump #1 and #2 to maintain an operator preset secondary coagulant dose to the filter inlets. The 4-20 mA pacing signal for the secondary coagulant pumps shall come from the individual filter flow meters. The SCADA shall operate the pumps in the lead/lag configuration. In the event of the lead pump failing, the SCADA shall start the lag pump and initiate an alarm.

    b. SCADA: The SCADA shall indicate and display the operation status for each secondary coagulant pumps, including pump HOA status, pump running status, general fault, % speed and lead/lag status. The SCADA shall continuously display and record the liquid level and total volume of the secondary coagulant tank. The SCADA shall show the following alarm conditions for each pump: pump general fault. The SCADA shall show the following for the secondary coagulant tank: operator preset storage tank low level alarm and redundant low level alarm (physical

float. The SCADA shall display a secondary coagulant leak alarm (float in the secondary containment for the secondary coagulant)

6. Pre-Chlorine Gas

   a. The pre-chlorine gas valve shall be monitored and controlled by the main control panel. Scada shall allow the operator to input a dosing rate that adjusts the pre-chlorination valve based on the total plant influent flow.

   b. The SCADA shall monitor the pre-chlorine gas valve for: Valve Position, and Pre-Chlorinator out of gas. The SCADA shall accept and display each of the statuses above and alarm conditions.

Filters

There are four filters at the Rhinebeck water plant, two conventional filters and two Trident filters. In order to get the best treatment flow should be delivered evenly across the filters that are in service when the plant is in operation. The two conventional filters are rated for 400gpm and the two Tridents are rated for 338gpm. The plant will run with three filters in service and the fourth shall be resting as a backup. The operator shall set the desired plant flow as a user adjustable input on the OIT. SCADA will then calculate the flow to each filter that is in service. The operator shall set the order of the filters from the OIT or switch on the main control panel. Once the filters are called to run by the wetwell level and the raw water pumps start the SCADA system shall set the flow control valve to evenly distribute the flow to the filters. There is only one flow control valve for the two conventional filters so if both filters are being used the conventional flow control valve shall be set to the flow of two filters. Each trident has its own flow control valve that will be set to maintain the flow to each Trident. See below for specific filter operations.

7. Conventional Filters
   a. The conventional filters consist of two (2) 0.576 MGD treatment units and all associated valves and equipment. The SCADA system shall automatically sequence all valves, pumps, blowers etc. during general filtering operation, backwash and flush cycles. All treatment units can be either manually or automatically operated via a three position selector switch located on the front of the main control panel or the OIT. All filter backwash cycles can be manually or automatically initiated via control switches on the front of the main control panel or OIT.

   b. When the HOA is the auto position the conventional filters will be called to run based on the clearwell level, lead/lag treatment unit selection, and the lead/lag treatment unit “ON” setpoints set by the operator in the OIT. The conventional filter will not shutdown in the auto mode until the clearwell level is at or above the treatment units

"OFF" setpoint set by the operator in the OIT. In hand or auto the conventional filters will not run unless there is at least one raw water pump available.

c. The conventional filter flow control valve is controlled to maintain a raw water flow to the conventional filters clarifier unit based on an operator adjustable input. When the valve is set to auto the PLC adjusts the flow to conventional filters by opening and closing the conventional filter flow control valve. The operator inputs a flow setpoint to the conventional filters and the PLC monitors the conventional filter raw water flow meter. If the flow needs to be raised the PLC will send a signal to the valve to open and if the flow needs to decrease the PLC will send a signal to the valve to close.

d. The flow to the conventional filters initially enters two flocculator tanks. The flocculator tanks include streaming current meters for measuring the charge on particles entering the flocculator tank. The streaming current measurement is sent to SCADA as a 4-20mA signal. Based on the streaming current signal coagulant is added to the flocculator tanks.

   There is also a flocculator in each flocculator tank. The flocculator is driven by a VFD and is paced to maintain a user defined setpoint. SCADA shall send a signal to the flocculator for speed and monitor the flocculators for run status and fault.

e. The flow goes from the flocculation tanks through the two settling tanks to the two conventional filters. Each filter has an automated inlet valve, effluent valve, backwash valve, air scour valve, drain valve, and filter to waste valve. Each conventional filter and valve has an HOA software button on the OIT. When a filter is in auto it is turned on based on the clearwell level. When the level in the clearwell drops below the user defined filter on setpoint the SCADA system shall open the inlet and effluent valve to allow flow through the filter to the clearwell. The filters turn off by closing the inlet and effluent valves when the clearwell rises above the all filters off setpoint.

   SCADA controls the conventional filter backwash when in auto. The filter will backwash based on either the filter level rising above a user defined "filter backwash setpoint" or the filters running for a user defined "filter run time". Once an automated backwash cycle is initiated the SCADA system shall close the inlet and effluent valves on the filter, open the air scour valve and turn on the lead blower for a user defined "air scour time". Once the air scour is completed the SCADA shall shutoff the blower, close the air scour valve, open the backwash valve and open the drain valve. Once the backwash valve and drain valve are open the SCADA system shall start the backwash pumps. The backwash flow rate shall be set by the

backwash flow control valve. The backwash will continue for a use adjustable "backwash cycle time" setpoint. Once the backwash cycle is complete SCADA will shut off the backwash pumps and close the backwash and drain valves and return the filter to normal operation.

The SCADA shall monitor the filter influent turbidity and effluent turbidity. Whenever a filter influent turbidity is above a user defined influent turbidity high alarm SCADA shall alarm the operator. Whenever the filter is in auto and effluent turbidity is above a user defined filter effluent turbidity high setpoint the SCADA system shall alarm the operator and run the filter to waste. To run the filter to waste SCADA shall close the filter effluent valve, open the filter inlet valve, open the filter to waste valve, and turn on the raw water pump. SCADA shall run the filter to waste until the effluent turbidity is below the filter effluent turbidity high setpoint.

SCADA shall also allow the operator to drain the filters from the SCADA OIT. This shall be done by the operator selecting the drain valve on the OIT and clicking a software button to open the drain valve.

f. SCADA shall monitor and control the conventional filter flow meter and flow control valve for the following: Conventional Filter Flow, Conventional Filter Flow Control Valve Position, Conventional Filter Flow Control Valve Open Relay, Conventional Filter Flow Control Valve Close Relay, and Conventional Filter Flow Control Valve Fail Relay.

8. Trident Filters

a. The Trident filters consist of two (2) 0.487 MGD treatment units and all associated valves and equipment. The SCADA system shall automatically sequence all valves, pumps, blowers etc. during general filtering operation, backwash and flush cycles. All treatment units can be either manually or automatically operated via a three-position selector switch located on the front of the main control panel or the OIT. All filter backwash and clarifier flush cycles can be manually or automatically initiated via control switches on the front of the main control panel or OIT.

b. When the HOA is the auto position the Trident filters will be called to run based on the clearwell level, lead/lag treatment unit selection, and the lead/lag treatment unit "ON" setpoints set by the operator in the OIT. The Trident filter will not shutdown in the auto mode until the clearwell level is at or above the treatment units "OFF" setpoint set by the operator in the OIT. In hand or auto the Trident filters will not run unless there is at least one raw water pump available.

c. The new Trident Clarifiers will come on based on a signal they receive from the SCADA system. SCADA shall send over a flow signal to the new Trident Clarifier Control Panel to set the new clarifier influent control valve. SCADA shall receive back from the Trident Clarifier Control Panel the inlet flow.

d. SCADA shall also receive and display the following from the Trident Clarifier Control Panel: Clarifier #1 in service, clarifier #1 influent valve position, clarifier #1 influent flow, clarifier #1 transfer valve position, clarifier #1 sludge blow down valve position, clarifier #1 sludge recycle valve position, clarifier #1 tube settler level, clarifier #1 sludge recirc flow, clarifier #1 inter-clarifier turbidity, clarifier #1 sludge collector run status, clarifier #1 sludge collector fault, clarifier #1 recirc pump run status, clarifier #1 recirc pump fault, clarifier #1 transfer pump run status, clarifier #1 transfer pump fault, Clarifier #2 in service, clarifier #2 influent valve position, clarifier #2 influent flow, clarifier #2 transfer valve position, clarifier #2 sludge blow down valve position, clarifier #2 sludge recycle valve position, clarifier #2 tube settler level, clarifier #2 sludge recirc flow, clarifier #2 inter-clarifier turbidity, clarifier #2 sludge collector run status, clarifier #2 sludge collector fault, clarifier #2 recirc pump run status, clarifier #2 recirc pump fault, clarifier #2 transfer pump run status, clarifier #2 transfer pump fault,

e. The Trident filter flow control valve is controlled to maintain a raw water flow to the Trident filters clarifier unit based on an operator adjustable input. When the valve is set to auto the PLC adjusts the flow to the Trident filters by opening and closing the Trident filter flow control valve. The operator inputs a filter flow setpoint to the Trident filters and the PLC monitors the Trident filter raw water flow meter. If the flow needs to be raised the PLC will send a signal to the valve to open and if the flow needs to decrease the PLC will send a signal to the valve to close.

f. Filter Level Control - The water level in the filter compartment is controlled by a modulating control valve. This valve receives time proportioned contact closures for open/close operation from the main control panel. The level controller is used to control the filter level to a desired setpoint as set by the operator on OIT. Using the OIT, the controller can display local setpoint 1 "1 LSP" (level setpoint), actual filter level and the controller output in percent (0-100%). When a treatment unit is shut off, the level controller is programmed to go into the manual failsafe mode and force the close contact output on, fully closing the level control valve. To change a setpoint value simply enter it into the OIT.

There is a two (2) position treatment unit sequence selector switch located on the front of the control panel for lead/lag treatment unit sequence selection. This determines which treatment units will run when the clearwell level drops below the

lead/ lag unit "ON" set points as set by the operator on the operator interface unit. For example: if the sequence selector switch is placed in "1-2" position, unit 1 would be the lead unit and unit 2 would be the lag. In the above example should unit 1 not be available for operation unit 2 would then become the lead unit. This operation shall be replicated in the OIT and the operator shall have a software selector switch that allows them to choose between the OIT or selector switch on the front of the control panel.

The clearwell level determines when the lead and lag treatment units are called to run. When the clearwell level drops below the "lead unit on" setpoint as set by the operator on the operator interface unit the "lead" unit as determined by the sequence selection willbe called to filter. The unit will continue to filter until the clearwell level raises above the "all units off" setpoint as set by the operator on the operator interface unit. However should the clearwell level continue to drop below the "lag unit on" setpoint as set by the operator on the operator interface unit both the "lead" and "lag" treatment units will run until the clearwell level raises above the "all units off" setpoint as set by the operator on the operator interface unit.

g. Backwash and flush cycles may be initiated manually via the backwash/flush cycle control station located on the front of the control panel or if selected, automatically as required. The control station consists of three (3) two position selector switches one (1) formanual/auto flush cycle initiation selection, one (1) for manual/auto backwash cycle initiation selection and one (1) fortreatment unit selection formanual initiated backwash or flush. And two pushbuttons one (1) for backwash cycle manual initiate and one (1) for flush cycle manualinitiate.

To manually initiate either a flush or backwash cycle simply position the flush or backwash cycle initiate selector switch to the manual mode, select the desired treatment unit to be flushed or backwashed via the treatment unit select for manual initiate selector switch and then depress the desired flush or backwash manual initiate pushbutton. **NOTE:** the treatment unit that you desire to flush or backwash must be either in the automatic or manual mode in order to initiate a manual backwash or flush.

Automatic backwash cycle initiation will occur when the respective treatment unit run time exceeds the backwash based on run time setpoint as set by the operator on the operator interface unit or the filter reaches an operator adjustable setpoint initially set to 8’of headloss and the respective headloss pressure switch (PSLl0l or 201) closes.

Automatic flush cycle initiation will occur when the respective treatment unit run time exceeds the flush based on run time setpoint as set by the operator on the operator interface unit or the clarifier pressure exceeds 1.8 psi and the respective clarifier pressure switch (PSH104 or 204) closes.

The backwash and flush cycle initiation selector switches must be in the automatic position or the cycle will not be initiated automatically. If the switch is in the manual position the respective treatment unit flushing or backwashing pilot light will flash indicating that the unit is in need of a backwash (based on runtime or high headloss) or a flush (based on runtime or high clarifier pressure) but is not initiating the cycle because the backwash or flush cycle initiate selector switch is in the manual position.

Only one treatment unit may be flushing or backwashing at one time. Should a treatment unit require a flush or backwash while the other is currently flushing or backwashing the respective cycle pilot light will flash until the other treatment unit has completed it's cycle. Once complete the treatment unit may be flushed or backwashed either automatically or manually as described above.

A treatment unit can be flushed and backwashed in one cycle if so desired. This is accomplished by enabling the flush with backwash option for the respective unit. With this option enabled the treatment unit will automatically flush every time a backwash cycle is initiated weather or not it is needed.

There shall be clearwell level backwash/high service pump enable and inhibit set points in the operator interface terminal. These are to prevent the backwash and/or high service pump(s) from drawing down the clearwell to low and causing damage to the Pump(s). The inhibit setpoint will not allow a backwash cycle to be initiated or a high lift pump to run if the clearwell level is at or below the inhibit setpoint. The backwash cycle will not be able to be initiated or a high service pump called to run until the clearwell level rises to or above the enable setpoint.

A backwash or flush cycle may be terminated at any time in the cycle by simply turning the respective treatment unit mode of operation selector switch to the "OFF" position. Once the switch is returned to the "Auto" or "Manual" position the cycle will not continue. A new cycle could be manually initiated if desired or the unit would backwash or flush automatically if required.

h. Clarifier Flush Cycle - As described above a clarifier flush cycle may be initiated by any of the following conditions, depending on the position of the flush cycle initiate" Man/Auto" selector switch.
   1. High clarifier pressure (Auto only)
   2. Accumulated filter runtime since last flush (Autoonly)
   3. Manually pressing the initiate pushbutton (manualonly)

   Once the clarifier flush has been initiated it's respective flushing pilot light (amber) will be illuminated, the influent valve will close, the waste gate will open and the air blower will start. Once the air blower discharge has reached adequate pressure and the air blower pressure switch (PSH002) closes the clarifier air inlet valve will open and air will be injected into the clarifier (stage 1). Next, the influent valve will open untilthe flush setpoint is reached on the influent flow PID controllernow flushing the clarifier with air & water simultaneously (stage 2). After flushing the influent valve will close and the air will continue to be injected into the clarifier (stage 3). The air blower will then shut off, the clarifier air inlet valve will close and the clarifier bed will be allowed to settle (stage 4). Next the influent will again open until the flush setpoint is reached on the influent flow controller flushing the clarifier with water(stage 5). Next, the influent valve closes and the waste gate remains open allowing the trough to empty, the waste gate will then close (stage 6), completing the flush cycle. The filter will return tooperation automatically.

   There is a watch dog timer monitoring the length of time it takes for a flush cycle to complete. If the flush cycle hangs up and is not completed before the watch dog timer expires the flush cycle will be terminated and the treatment unit will return to operation. The treatment unit failure pilot light (red) will be illuminated and the operator interface unit will be flashing "Treatment Unit no.* Flush Cycle Failure". However, if the pressure in the clarifier is still to high, the treatment unit will request another flush cycle if the flush cycle initiate selector switch is in the "Auto" position. ***IMPORTANT*** The watch dog timer preset must be set greater than the sum of all six (6) flush stages to avoid incomplete flush cycles and failures.

i. Filter Backwash Cycle - As described above a filter backwash cycle may be initiated by any of the following conditions, depending on the position of the backwash cycle initiate "Man/Auto" selector switch.
   1. High headloss pressure in filter (Auto only)
   2. Accumulated filtering time since last backwash (Autoonly)
   3. Manually pressing the initiate pushbutton (Manualonly)

Once a filter backwash cycle has been initiated it's respective backwashing pilot light (amber) will be illuminated, The filter drain down valve will open and the water from the filter compartment will drain to the clearwell until the drain down timer expires or the low level float (LSLl0l or 201) is reached (stage 1). Next the filter drain down valve will close, the waste gate will open and two (2) air blowers will start, when the air blowers discharge has reached adequate pressure and the air blower pressure switch (PSH002) closes the filter air inlet valve will open allowing air to be injected into the filter compartment(stage 2). Next, the backwash pump will start, the existing filters backwash rate of flow control valve will open fully, the blowoff valve to the clearwell will open and the filter backwash isolation and low rate backwash valves will open, allowing water to be pumped into the filter compartment. The air and "low rate" water will run simultaneously until the refill timer preset has expired or the high level float (LSHlOl or 201) is reached (stage 3). Next, the air blowers will stop, the filter air inlet valve will close and the filter will continue to backwash at "low rate" (stage 4). Next, the low rate backwash valve will close and the high rate backwash valve will open allowing "high rate" water flow to enter the filter compartment (stage 5). Next, both the high rate and backwash isolation valves will close, the backwash pump will continue to run, pumping water through the blowoff valve, The waste gate will remain open allowing for the trough to drain (stage 6). Next, the waste gate, blowoff valve and existing filter backwash rate of flow valve will close and the backwash pump will shut off. The influent valve will then open until the filtering setpoint on the influent flow controller is reached, the filter to waste valve is opened and the treatment unit filters to waste until the filter to waste timer has expired (stage 7).The backwash cycle is complete after stage 7 and the treatment unit will return to operation automatically.

As described in the backwash initiation section a clarifier flush can be initiated simultaneously with a backwash if the flush with backwash option is enabled in the operator interface unit. Since the flush cycle requires an air blower through stage 3 of the flush cycle and the backwash cycle needs an air blower for stages 2 and 3 of the backwash cycle, a slight overlap of stages might occur depending on the stage timer preset values. Therefore, if the backwash cycle needs the blower before the flush cycle is done with it, the backwash cycle will simply continue in it's current stage and wait until the air blower is available before advancing.

There is a watch dog timer monitoring the length of time for a backwash cycle to complete. If the backwash cycle hangs up and is not completed before the watch dog timer expires the backwash cycle will be terminated and the treatment unit will return to operation. The treatment unit failure pilot light (red) will illuminated and the operator interface unit will be flashing

"Treatment Unit no.* Backwash Cycle Failure". ***IMPORTANT*** The watch dog timer preset must be set greater than the sum of all seven (7) backwash stages to avoid incomplete backwash cycles and failures.

j. SCADA: The SCADA shall indicate and display the operation and alarm status of the sludge press components as noted within this specification.

9. Blowers
   a. There are four (4) blowers at the Rhinbeck water treatment plant. Two blowers, Blower #1 and Blower #2, are dedicated to the Trident Units. Two blowers, Blower #3 and Blower #4, are dedicated to the conventional filters. Each blower has an HOA and when in auto are operated via SCADA as described in the sections above.

   b. SCADA shall monitor and control the blowers for Blower #1 HOA, Blower #1 Start, Blower #1 Run Status, Blower #1 Fault, Blower #2 HOA, Blower #2 Start, Blower #2 Run Status, Blower #2 Fault, Blower #3 HOA, Blower #3 Start, Blower #3 Run Status, Blower #3 Fault, Blower #4 HOA, Blower #4 Start, Blower #4 Run Status, and Blower #4 Fault.

10. High Service Pumps
    a. The three high service pumps shall be operated via SCADA through the Main CP. On the front of the control panel there is a control station for each high service pump, consisting of a three position Manual/Off/ Automatic selector switch, three (3) indicator lights, and elapsed run time meter (ETM). The functions of these devices are as follows:

    b. The hand position is simply an "ON" switch, the respective high service pump will be called to run whenever the selector switch is in the hand position. To shut the pump "OFF" simply return the selector switch to the "OFF" position. In the Automatic Position the high service pump(s) will be called to Run by the programmable logic controller (PLC) when the reservoir level decreases to operator adjustable set point for “lead-on”, “lag-on”, and “lag-lag-on”. When a high service pump is running in the "Auto" position the pump will shut off when the reservoir level increases to an operator adjustable “pump-off” set point. The set point is user defined setpoint in the control system set by the Chief Operator of the water plant. The high service pump shall run in a lead/lag/lag-lag fashion. The SCADA system shall allow the operator to set the order of pump and allow the operator to set an operator adjustable alternation time. When the reservoir level drop below the lead pump on setpoint the SCADA system shall start the lead pump at minimum speed and ramp the speed up if the reservoir level continues to drop. If

the lead pump is running at max speed and the reservoir level continues to drop the SCADA system shall start the lag pump at minimum sped and ramp the lead pump down to minimum speed. The SCADA system shall ramp the lead and lag pumps up together if the level in the reservoir continues to drop. If the lead and the lag pump are running at maximum speed and the reservoir level continues to drop the SCADA system shall start the lag-lag pump at minimum speed and ramp down the lead and lag pumps to minimum speed. If the reservoir level continues to drop the SCADA system shall ramp all three pumps, lead, lag, and lag-lag, up together.

If the lead pump faults the SCADA system shall log the fault, alarm the operator and start the lag pump. If the lag pump faults while it is being called to service the SCADA system shall log the fault, alarm the operator and start the lag-lag pump. If the lag-lag pump faults while in service the SCADA system shall log the fault, and alarm the operator.

c. The control system shall also monitor the high service pump check valve for open and closed position. The check valves shall include a limit switch that indicates the valve is closed. When SCADA sees that the valve is no longer closed it shall signal the valve as open. If a high service pump is called to run and its check valve does not open in a user defined time the SCADA system shall alarm the operator, shut the pump off and move to the next pump in the rotation.

d. SCADA: The SCADA shall indicate and display the operation status for each high service pump, including lead/lag/lag-lag status, HOA status, pump running status, general fault, motor high temperature alarm, seal failure alarm, elapsed run time and % speed. The SCADA shall continuously display and record the reservoir liquid level. The SCADA shall show the following alarm conditions: pump general fault, reservoir tank low level alarms, redundant low-level alarms (physical float), high level alarms, redundant high-level alarm (physical float), and check valve position. The SCADA shall accept and display each of the above status and alarm conditions

11. UV System

a. There shall be two UV units installed at the Rhinebeck water treatment plant. The two UV units shall be operated by vendor supplied UV control panels. The SCADA shall accept communication from the UV control panel to display run status and alarms. The SCADA system shall also accept the UV flow from the UV flow meter and display it.

b. SCADA: The SCADA shall indicate the operation status for the UV System, including run, and general fault. The SCADA shall accept and display each of the

above status and alarm conditions.

12. Backwash Pumps
    a. There are two backwash pumps at the Rhinebeck water plant. The two pumps supply backwash water for the two conventional filters and the two trident filters. When then Backwash pumps are in auto they operate as described above.

    b. SCADA shall monitor and control the following backwash parameters: Backwash Pump #1 HOA, Backwash Pump #1 Start, Backwash Pump #1 Run Status, Backwash Pump #1 Fault, Backwash Pump #1 Check Valve Status, Backwash Pump #2 HOA, Backwash Pump #2 Start, Backwash Pump #2 Run Status, Backwash Pump #2 Fault, Backwash Pump #2 Check Valve Status, and Backwash Flow.

13. Distribution Flow Meter
    a. The distribution flow meter shall be used to pace the corrosion inhibitor and the post chlorine feed.

    b. SCADA shall continuously display and record the instantaneous distribution flow and totalized flow. The SCADA system shall also display and record the daily totalized flow. Upon loss of the flow signal the SCADA shall alarm the operator.

14. Corrosion Inhibitor Feed
    a. There are two corrosion inhibitor feed pumps. The corrosion inhibitor feed pumps will be paced by the total plant effluent flow, combined sum of all filters effluent flow. The two proposed corrosion inhibitor feed pumps shall operate, and pace with one another, via the plant SCADA. When in auto the operator shall set a speed for the corrosion inhibitor pumps at the SCADA panel. In the event of the lead pump failing, the SCADA shall start the lag pump and initiate an alarm. The SCADA shall allow for the operators to set the lag order of the pumps within each control duty.

    b. SCADA: The SCADA shall indicate and display the operation status for each corrosion inhibitor pump, including pump duty status, HOA status, pump running status, general fault, % speed and lead/lag status. The SCADA shall continuously display and record the liquid level and total volume of the corrosion inhibitor tank. The SCADA shall show the following alarm conditions for each pump: pump general fault. The SCADA shall show the following for the corrosion inhibitor tank: operator preset storage tank low level alarm and redundant low-level alarm (physical float).

15. Post Chlorine Chloramatic Valve
    a. The post chlorine gas valve shall be monitored and controlled by the main control

panel. Scada shall allow the operator to input a dosing rate that adjusts the post chlorination valve based on the total plant effluent flow.

b. The SCADA shall monitor the post chlorine gas valve for: Valve Position, and Post Chlorinator out of gas. The SCADA shall accept and display each of the statuses above and alarm conditions.

16. Callout Alarm- Output System

a. The SCADA shall provide 8 distinct digital alarm outputs within main control panel PLC. The SCADA shall allow for the operator to categorize each alarm condition in the system into a "callout", no "callout category". The SCADA shall further allow each alarm condition in the "callout category" to be selected by the operator into one of the 8 digital outputs. These outputs shall be sent to an auto dialer supplied by the SCADA vender and installed in the Control Building.

2.04 POWER SUPPLIES

A. Furnish power supplies located in the PLC cabinets of the d-c solid state type, designed for 2 and 4 wire transmitter loops where integrals instrument power supplies are not provided. Furnish power supplies suitable for use up to 15 instrument loops and designed for 4-20 mAdc current signals.

2.05 OPERATOR WORKSTATIONS

1. The SCADA vendor shall supply the operator workstations as part of the base bid shown in the bid form.
2. The SCADA vendor shall include installation, software, and programming in the bid price.
3. Operator Workstations shall be Dell Precision or equal. The minimum workstation requirements are:

a. 3.00 GHz Intel® Pentium 4 processors w/2 MB Cache
b. 4GB ECC RAM
c. Dell 20" flat panel monitor
d. 80 GB Hard Drive, ATA-100 interface, 7200 RPM
e. 48X CD-ROM and 48X CD-RW/DVD combo
f. Two (2) 3COM 3C905 10/100/1000 Ethernet, PCI Adapter, Twisted Pair network cards. Motherboard mounted Ethernet ports are not acceptable.
g. Dual Monitor Graphics Card suitable to handle the graphics of the SCADA application (Include display cable(s) and adapter(s) compatible with Graphics

Card and Monitor)
h. External keyboard
i. Microsoft Mouse
j. Sound Card
k. Speakers

2.06 SERVERS

1. The SCADA vendor shall supply the servers as part of the base bid shown in the bid form.
2. The SCADA vendor shall include installation, software, and programming in the bid price.
3. Servers shall be Dell PowerEdge or equal. Server shall be a in a rack mountable chassis. Unless specified elsewhere, the Servers shall have the following minimum characteristics:
   a. 3.00 GHz Intel® Pentium 4 processors w/2 MB Cache
   b. 4GB ECC RAM
   c. Dell 20" flat panel monitor
   d. RAID 5 Controller
   e. Drive Bay for five (5) 1 inch Hot Pluggable SCSI Hard Drives
   f. Five (5) 1.2TB Hard Drives, 10000 RPM
   g. 24X DVD RW
   h. Two (2) 3COM 3C905 10/100/1000 Ethernet, PCI Adapter, Twisted Pair network cards. Motherboard mounted Ethernet ports are not acceptable.
   i. Redundant Power Supplies
   j. Dual Monitor Graphics Card suitable to handle the graphics of the SCADA application (Include display cable(s) and adapter(s) compatible with Graphics Card and Monitor)
   k. External keyboard
   l. Microsoft Mouse
   m. Sound Card
   n. Speaker

2.07 OPERATOR WORK STATION SOFTWARE DESCRIPTIONS

A. The software package shall be Allan Bradley or Engineer approved equal. Provide one copy of Microsoft Windows (latest compatible version) and one copy of Microsoft Excel for Windows (latest version). In addition, provide one copy of a remote SCADA software

package, such as PC Anywhere, to allow remote access to the plant SCADA system by the plant operator.

B. All analog inputs shall be available for trending.

C. The SCADA supplier shall assume that a total of 200 display screens will be required for this project. The exact configuration and content of each display will be determined during the kick-off meeting and shop drawing review.

D. Furnish software for the operator workstation which shall generate data, graphics, reports, alarms, journaling, historical replay, and trending and shall provide data acquisition and operator graphics. Furnish a software system consisting of a system configurator and real-time, multi-tasking SCADA system. Furnish a system configurator which shall run under DOS and shall be a CAD based system development environment including a database builder and graphic builder. Furnish a run-time system which will execute the data collection system and shall provide a graphic operator interface.

1. Operator workstation multitasking : Furnish a software operating system that provides multitasking which allows the operator workstation to perform multiple tasks in apparently, a simultaneous manner.

2. Language Compiler: Furnish a software language compiler which provides a programming facility for creation of display and report formats and allows access to signal values from the Real-Time Data Base, Static and Historic Data Bases. Furnish with the operator workstation software a full-screen editor that can be used to create and modify displays, reports and application software.

3. System Configurator: Furnish an operator workstation software system configurator which uses a menu-driven, fill-in-the-blanks method to configure or modify the system databases and lists. No programming knowledge shall be required. Furnish the data base stored on compact disks, and two 2 USB 3 thumb drives . Include the following data bases and list utilities:
   a. Polling list
   b. Static data base
   c. Real-Time data base
   d. Remote list tables
   e. Display data lists
   f. Node routing table
   g. Historic data list

4. Operator Display System: Furnish a display system which along with the keyboard shall

be the primary interface to the DCI system. Furnish the display system that presents to the operator with current operating status in alpha-numeric or mimic form and allows the operator to modify network parameters and change the status. Furnish the system designed to allow the operator to display and signal and to change set points, turn field devices on or off, and open or close valves. Furnish the system to allow the operator to call up any display with a mouse pointing device. In addition to displays required to access, to program, and to perform diagnostics, the five graphical displays shall include:

a. All alarm points
b. Alarm history
c. Equipment status display for all equipment which sends a status signal to the DCI System,
d. Running times of all major equipment.
e. Status of startup and shutdown requirements.
f. Status of startup and shutdown cycle.
g. Group displays for the following:
    1. Indicators for flow rates.
    2. Indicators for all analyzers.
    3. Numeric display for all totalizers.
    4. Indicators for wet well levels.
h. Flow schematic for each treatment process showing events of the startup and shutdown programs and operating parameters.

5. System Trend Display: Furnish a dedicated real-time display system with an internal data storage buffer which shall allow up to 40 variables to be trended simultaneously. Furnish a system which shall display any five trends in one minute, six minute or an operator-defined time frame. Furnish a data zoom which shall automatically re-compute the scale. Furnish the historic trend displays for each parameter shown on the Drawings. In addition, furnish a trend display for summation of the well flow meters.

6. X, Y Plot: Furnish a system to plot any one parameter versus four parameters in a real-time X, Y plot. The system shall allow any 40 trended variables to be plotted.

7. Trend Windows: Furnish a system capable of displaying a trend window on another display. Each trend window shall contain up to three parameters. The time frame of the window shall be operator-defined ranging from 0.5 minutes to 24 hours.

8. Report System: Furnish a report system which allows both demand reports and scheduled reports to be printed on the line printer. Accumulation of data may be accomplished at Main SCADA Room. Demand logs shall normally depict instantaneous values and shall be invoked through a Report Select Menu. Scheduled reports shall be printed daily, monthly and yearly and shall depict accumulated information over an interval.

9. Alarm System: Furnish a comprehensive alarm system including both logical and analog alarms grouped into four priority classes; critical, non-critical, operator guide and event. Time stamped state and change-of-state alarms for logical signals and high, high-high, low, low-low, set point deviation and rate-of-change alarms for analog signals shall be displayed on the CRT. In addition, all alarms shall be recorded in an alarm history file and presented in an alarm history display. Furnish an audible alarm with audible silence and alarm acknowledge function keys. Acknowledged, unacknowledged and return-to-normal alarm conditions shall be differentiated by color on the CRT. Using the printer dedicated for alarms, all alarms shall be printed to provide a hard copy historical path. The OWNER will designate the priority of each alarm during review of shop drawings.

10. Event Driven Historian: Furnish a journal file to record all significant events reported or initiated by the operator workstation. A significant event is defined as any action which directly affects the network, e.g. sign on, sign off and signal value changes. All events shall be stored with a time/date stamp. Data shall be logged to a minimum of 14 different files. Each file shall be capable of accepting 20 points. The system shall be able to log data at two rate.

11. Shift Historian: Furnish data base to file historic data. The system shall provide on-line data reduction for up to 23 variables, shall scan the selected variables every ten seconds and shall store a three sample average value in an hourly file every 30 seconds. The hourly files shall be averaged in shift file. This process shall be repeated for daily and weekly files. Each file shall contain 120 time-stamped records for each variable.

12. Historical Replay: Furnish an on-line historical replay to allow the operator to review historical files created by the Event and Shift Historian; to permit the operator to recover historical data from a floppy disk or flexible disc; to generate monthly and yearly reports if the system storage is not adequate. Furnish a system which shall replay data in a tabular or graphical format. The entire software system shall maintain full operation during historical replay.

    a. Furnish a spreadsheet, tabular replay display to permit simultaneous viewing of up to eight variables. The tabular replay shall allow the operator to scroll up and down through the file in groups of 18 records and scroll sideways in groups of eight variables.

    b. Furnish graphical relay displays in trend style display which shall graph up to five variables at a time. From the keyboard the operator shall be able to scroll through the file forward and backward. By using a cursor the operator shall be able to move across the graph to display the time and value of each sample in the file.

13. Security System: Furnish a security system to ensure that access is restricted to authorized personnel through the sign-on procedure by assigning user identification and password protection. Furnish the system so that once signed-on, the operator may set the system time and date through a menu display. Four levels of access to system functions shall be provided.

14. Timekeeping System: Furnish a five-year, battery backed up real-time calendar clock with the operator workstation which automatically updated the software clocks upon power up. Furnish the system so that the operator can set the date and time and set the software clocks via a menu display. Furnish the system to synchronize the entire system.

15. Interactive Compiler: Furnish a menu-driven program for configuring SCADA schemes. Furnish fill-in-the-blanks screen displays to enable an operator to create and edit tasks, perform linking and downloading operations, and provide self-documentation. Furnish the compiler to allow on-line modification of the controller load files.

16. Diagnostic Program: Furnish an on-line system diagnostic program that runs the Portable Engineer Interface computer and permits the user to view and edit aspects of a system while the system performs its normal task.

2.08 SPARE PARTS AND EQUIPMENT

A. Furnish the following spare parts and equipment and store as directed:
   1. One of each type of plug-in, process I/O board for PLC.
   2. 20 blank formatted re-writable CDs for the CD-RW drive
   3. 5 spares for lights, fuses, or other consumable items.
   4. 2 USB 3 thumb drives with the complete working PLC program in the format of the written program.
   5. 1 digital copy of " as built", and three (3) hard copies of " as built"

2.09 TOOLS

A. Furnish a complete set of special tools required for the maintenance and operation of this equipment, as designed by the equipment manufacturer.

2.10 SHOP PAINTING

A. Furnish equipment with a complete manufacturer's standard corrosion resistant finish at the point of manufacturer. Engage the instrumentation supplier to provide adequate paint for repainting any areas damaged during delivery, storage or installation.

2.11 SHOP TESTING THE SCADA SYSTEM

A. Prior to shipment of the new SCADA system, factory test all elements of the system, both hardware and software to demonstrate that the total system satisfies all of the requirements of this Specification.

B. Furnish all special testing materials and equipment. Where it is not practical to test with real process variables, provide suitable means of simulation. These simulation techniques shall be subject to the approval of the Engineer.

C. Testing shall not be considered complete until all tests and test documentation has been completed, reviewed, and approved by the Engineer. Tests shall generally conform to the applicable sections of ISA-RP55.1. Demonstrate that all equipment conforms to these Specifications by submitting test results for similar units.

D. Coordinate all of the testing with all other associated suppliers and with the Owner, as specified. Notify the Engineer at least four weeks prior to start of test.

E. As a minimum, test the System at the factory with simulated inputs and outputs. Exercise all components and test all functions over their entire range. During the test, operate the system long enough to demonstrate that it is capable of continuous operation.

F. Submit a minimum of six copies of the results of the factory tests to the Engineer for review.

G. In the event that the conditions specified are not met or if the test is deemed unsatisfactory for other reasons, correct the fault and retest the entire system until the tests are satisfactory to the Owner all at no additional cost to the Owner.

H. The Owner may elect to have up to three of his authorized representatives present to witness the tests. The Owner's authorized representatives will have access to all parts of the equipment, apparatus and test instruments and will have the right to check any or all readings, calibrations, or any factor necessary to determine whether or not the performances are in accordance with the Specifications.

I. Prior to the Factory Acceptance Test the SCADA vendor shall submit all screen shots to Owner for review. Once approved the SCADA vendor shall integrate them into the system.

J. The Owner reserves the right to waive the presence of any or all of his representatives at any or all witness tests. This right of waiver does not release the manufacturer from performing the required tests.

2.12 ELECTRICAL REQUIREMENTS

A. The power service to the PLC SCADA Panels shall be 120vac, 60 hz, single phase from the UPS provided under this section.

PART 3 EXECUTION

3.01 INSTALLATION

B. The SCADA System supplier shall be responsible install all equipment in accordance with the Drawings and manufacturer's recommendations or as directed by the Engineer.

3.02 PLANT STARTUP AND OPERATOR TRAINING

A. The SCADA supplier shall provide field tests of all the equipment specified to demonstrate compliance with all requirements for complete and ready for operation of all equipment. Final acceptance of the SCADA system will be made after complete system testing in the field is complete and the treatment system has operated for 2 weeks.

B. The SCADA system supplier shall provide a minimum of twenty (20) work days of onsite service for plant startup. Training shall be conducted by a factory trained plant operator employed by the manufacturer, and shall include all SCADA components.

C. The SCADA system supplier shall also provide a minimum of five (5) work days of onsite operator training. Training shall be conducted by a factory trained plant operator employed by the manufacturer, and shall include all SCADA components.

3.03 FIELD ACCEPTANCE TESTING FOR SCADA SYSTEM

A. The objective of these tests is to demonstrate that the SCADA System is operating and complying with the specified performance requirements.

B. Perform witnessed Functional Acceptance Tests on the complete system. Demonstrate each function to the satisfaction of the Engineer and the Owner on a paragraph-by paragraph basis.

C. Each test shall be witnessed and signed off by both the Contractor and the Engineer upon satisfactory completion.

D. Conduct the actual testing program with prior approved procedures and documentation.

E. For each test description include the following minimum information:
   1. Spec page and paragraph of function or loop demonstrated.
   2. Description of function or SCADA strategy and test to demonstrate it.
   3. Space for sign off and date by the Contractor, the Engineer, and the Owner.

F. After receipt of approval by the Engineer of the documentation and the test procedures and forms, set a date to start the test.

3.04 DEFINITION OF ACCEPTANCE

A. SCADA System acceptance shall be defined as that time when the following requirements have been fulfilled:

   1. All submittals and documentation have been submitted and reviewed and approved.
   2. The complete SCADA System has successfully completed all testing requirements cited herein.
   3. The training program has been completed.

END OF SECTION

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SECTION 407000
INSTRUMENTATION EQUIPMENT

PART 1. GENERAL

1.01 SUMMARY

A. This Section provides acceptable products and product requirements and installation considerations for process control and monitoring equipment to be installed.

1.02 RELATED SECTIONS

A. Section 406000 – SCADA SYSTEM
B. Section 260519 – Wiring General 600V and Under

1.03 SUBMITTALS

A. Catalog Cuts and Shop Drawings shall be submitted for approval for all equipment herein specified.
B. An Order Specification shall be included which shall describe in detail all equipment provided.
C. Manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. Standard sales brochures shall only be provided to supplement technical data. Interconnection details shall be shown on the wiring diagrams for all field mounted instrumentation.
D. A Description of Operation shall be provided detailing the operation of the component, initial configuration settings, and maintenance requirements.
E. Supplier shall submit six (6) sets of shop drawings. Shop drawings shall include equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings.
F. Supplier shall submit three (3) sets of Operation and Maintenance manuals. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

1.04 SUPPLIERS

A. Acceptable suppliers:
    1. All equipment specified in this Section as well as Section 406000 – SCADA shall be provided by the SCADA System Supplier.
    2. Where products of alternate suppliers are proposed, provide submittal information on the Specified Item and the Or Equal Item proposed. To verify suitability of Or Equal, Contractor may be required to furnish additional documentation or to extend product warranties.
B. Where products of specific manufacturers are specified, the I&C Supplier shall be responsible for integrating the part into the overall systems.

1.05 QUALITY ASSURANCE

A. Provide functional testing of all installed components in accordance with a schedule approved by the Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

SECTION 407000
INSTRUMENTATION EQUIPMENT

A. Equipment will not be delivered to the site until they are ready to be installed. Equipment stored on site will be stored in clean dry heated space and protected by the Contractor at his expense until the item is to be installed.

PART 2. PRODUCTS

2.01 PRESSURE INDICATORS

A. As specified in the Contract Drawings:
B. Two (2) on plant influent pipe
   1. All components which will be subjected to sunlight or UV shall be UV resistant or protected. All equipment that may be subject to submergence shall be rated for submergence. This includes all enclosures, sensors, junction boxes and all other components.

2.02 FLOW INDICATORS

A. General
   1. All components which will be subjected to sunlight or UV shall be UV resistant or protected. All equipment that may be subject to submergence shall be rated for submergence. This includes all enclosures, sensors, junction boxes and all other components.

B. Treatment Plant Effluent Flow Meter
   1. Furnish and install one (1) eight-inch (8") electromagnetic flow meter and transmitter for measuring the water plant effluent flow.
   2. Meter shall be furnished with polyurethane lined flowtube
   3. A 2-line, 16-digit LCD backlit display shall indicate flow rate and/or total flow. The totalizer value shall be protected by EEPROM during power outages, and utilize an overflow counter. The display shall also be capable of indicating error messages such as empty pipe condition, error condition, and low flow cutoff.
   4. Flow meter shall provide a 4-20 mA output signal transmitting the instantaneous flow rate to the SCADA.
   5. Analyzer shall be remote mounted per the Contract Drawings and the flow meter supplier shall provide a minimum of 25' of cable for connection between the flowtube and the remote meter.
   6. Input power shall be 120 volts
   7. The electromagnetic induction flowmeter shall generate a voltage linearly proportional to flow for full-scale velocity settings from one to 33 feet per second. Standard accuracy of the pulse output shall be ± 0.5% of rate ± 0.01% of full scale (33 ft/sec) for all meters.
   8. Meter shall be Endress+Hauser PROline Promag W 400, or approved equal.

C. Potassium Permanganate Instrumentation
   1. Furnish and install one (2) one-inch (1") flow meters and transmitters for measuring the use of solution, solvent water, and carry-water for the

potassium permanganate chemical feed system. Meters shall be Master Meter's bottom-load multi-jet meters, or equal.

2. Furnish and install (2) low-level alarms for the potassium permanganate tank, primary and secondary.
3. Integrate all instrumentation to SCADA.

2.03 STREAMING CURRENT ANALYZER

A. Trident Units Streaming Current Monitor

1. One (1) streaming current monitor analyzer shall be furnished and installed to monitor the streaming current of the existing trident units.
2. Sensor shall measure between -1000 and 1000 SC Units.
3. Sensor shall be rated for a sample flow rate between 1 and 5 GPM.
4. Sensor and Analyzer input power shall be 120 volts.
5. Analyzer shall provide a 4-20mA output signal transmitting streaming current level to the SCADA system.
6. Analyzer shall
7. Sensor shall be of a design suitable for measuring streaming current levels within
8. Sensor shall be constructed within an explosion proof housing.
9. A LCD backlit display shall indicate percent LEL locally.
10. The sensor shall transmit the percent LEL to the corresponding pump station control panel.
11. Sensors shall provide a 4-20 mA output signal transmitting the percent LEL to the SCADA system via PLC-1. PLC-1 and SCADA system shall monitor and display the % LEL. Refer to the Contract Drawings and Section 406000 – SCADA System for details.
12. Two wire, loop powered, 12-28 VDC – The Instrumentation vendor shall include provisions within all applicable control panels for boosters to account for conductor run distances.
13. Streaming Current Monitor shall be Chemtrac HydroACT600 with DuraTrac3 Streaming Current Sensor, or approved equal.

PART 3. EXECUTION

3.01 FLOW INDICATORS

A. Flow meter sensors shall be installed per the manufacturer's recommendations and the Contract Drawings.

B. Liquid level type flow sensors shall be securely mounted over the liquid being measured and shall be easily accessible.

C. Provide insulated anchor mounts directly connected to sound concrete or other approved surface.

D. All transmitters shall be remote and wall mounted per the Contract Drawings.

3.02 STREAMING CURRENT ANALYZERS

A. Streaming Current sensors shall be securely mounted in the liquid being monitored and shall be easily accessible.

B. Streaming Current sensor mounts shall be supplied by the instrumentation vendor and shall be designed such that the sensors are easily removed for cleaning and maintenance.

C. All transmitters shall be remote and wall mounted per the Contract Drawings.

3.03 WARRANTY

A written one year standard warranty from the date of the successful equipment start-up shall be provided by each equipment supplier to guarantee that there shall be no defects in material or workmanship in any item supplied. This shall be in addition to the Warranty as required for the SCADA system.

END OF SECTION