Stickney WTP Filter and SCADA Upgrades

MAWSS Project 10391316

February 16, 2026

ADDENDUM NO. 1

This addendum forms a part of the Contract Documents and modifies the original Request for Proposal, issued in January 2026, as noted below. Acknowledge receipt of this Addendum in the space provided on the Proposal Form. Failure to do so may subject Bidder to disqualification. This addendum consists of twenty-eight (28) pages, including all attachments.

Pre-Bid Meeting

1. The pre-bid meeting agenda and sign-in sheet are included as an attachment to this addendum.

Revisions to Plans

1. Sheet Y-601 – Network Diagram (See attached Sheet Revision)
    a. Revisions to network diagram, and revisions related to owner furnished items.

Revisions to Specifications

1. Specification Section 40 62 05 – Computer Systems Hardware and Ancillaries
    a. Specification Replaced in its entirety. See attached revised specification.

2. Specification Section 40 63 43 – Programmable Logic Controllers
    a. Specification Replaced in its entirety. See attached revised specification.

3. Specification Section 40 66 05 – Network Equipment
    a. Specification Replaced in its entirety. See attached revised specification.

4. Specification Section 43 24 05 – Vertically Suspended Centrifugal Pumps
    a. Section 2.2, C. Dimensions:
        i. **ADD** “2. Final pump column lengths will be determined once contractor verifies filed dimensions.”

-END OF ADDENDUM-

hdrinc.com

25 W. Cedar St., Suite 200, Pensacola, FL 32502-5945
T 850.429.8900

Mobile Area Water and Sewer System
Stickney WTP Filter and SCADA Upgrades
HDR Project Number 10391316

PRE-BID MEETING
Wednesday, February 11, 2026, 9:00 AM

AGENDA

1. INTRODUCTIONS
   a. HDR (Design Engineer)
   b. MAWSS (Owner)

2. General Contractor Pre-Qualifications:
   a. List of Pre-qualified Contractors are Posted on MAWSS Bid Website
   b. Only pre-qualified contractors may submit a bid proposal

3. BID OPENING DATE, TIME, AND LOCATION:
   a. Bids Due: Monday, March 2, 2026 at 12:00pm
   b. Bid Opening: Monday, March 2, 2026 at 1:00 p.m.
   c. Location: MAWSS Wesley A. James Operations Center
      4725 Moffett Road, Mobile, AL 36618

4. CONTACT INFORMATION:
   a. HDR Engineering
      i. Project Manager: Heath Hardy 850-429-8925; heath.hardy@hdrinc.com
      ii. Project Engineer: Tyler Puckett 850-429-8947; tyler.puckett@hdrinc.com

5. QUESTIONS DURING BIDDING:
   a. All questions must be submitted in writing to Heath Hardy, HDR. (cc. Tyler Puckett)
   b. Deadline for Questions is 5pm, CST, on Friday, February 20th
   c. Project Addenda will be posted on MAWSS Bid Website. Email notification will be sent to General Contractor contacts provided on Prequalification Package.
   d. All Addenda must be acknowledged in the Bid Package.

6. PROJECT SRF REQUIREMENTS
   a. Project is SRF Funded. Review all SRF Supplemental General Conditions in Contract
   b. Compliance with American Iron and Steel (AIS)
      i. Submittals must contain AIS Certification Letters for review by Engineer.
   c. Compliance with Davis-Bacon Wage Rates
      i. Wage rates: Mobile County, Heavy Construction, Dated January 2, 2026.
      ii. Wage rates may be updated, up to the bid opening
      iii. Submission of weekly payrolls throughout construction will be required
   d. Utilization of Disadvantaged Business Enterprises (DBEs)
      i. Must document DBE solicitations during bidding (emails, phone logs, etc.)
      ii. Work to be Self-Performed by GC does not require DBE solicitation

7. BID SUBMITTALS

a. Review Information for Bidders and Instructions to Bidders Checklist
b. Example Bid Manual available for reference.

8. TIME OF CONTRACT COMPLETION:

a. Contract Duration: 730 calendar days.
b. Liquidated Damages: $750 per day until Completion.

9. SCOPE OF WORK:

a. Constructing civil, structural, mechanical, architectural, electrical, and SCADA improvements at MAWSS Stickney WTP, Filter/Piping Gallery, and Administration Building:
    i. Base Bid:
        1) Renovations to Existing Admin Building (IDF Room)
        2) Replace East and West Backwash Pumps and Appurtenances
        3) Construction of New Filter Building
        4) Security Improvements (door contacts/card readers, cameras)
        5) Remove Existing Filter Media, Underdrains, Troughs
        6) Inspection of Filter Basins and Concrete Repairs as necessary
        7) Installation of New Filter Underdrains, Media, Troughs
        8) Remove and Replace Piping, Valves, and Appurtenances
        9) New Filter Control Systems
        10) SCADA Improvements across Stickney WTP
            a) MAWSS Standard Hardware Specifications
            b) MAWSS Approved Integrator List
            c) As Built P&IDs - Specifications Appendix B
    ii. Additive Alternates:
        1) No. 1 – Filter Media Level Instrumentation
        2) No. 2 – Install Actuated Chlorine Valves/Meters

10. OWNER FURNISHED MATERIALS:

a. Security Equipment
    i. Door Contacts/Card Readers
    ii. CCTV Camera Equipment
b. Instrumentation and Control Equipment
    i. VX-Rail: Virtual Host Controller (Y-601)

11. WORK TO BE PERFORMED BY OTHERS

a. Automated Systems Programmer Contracted by Owner
    i. Automation Control Services, LLC (ACS)
b. Programming and Integration of Security Equipment
    i. Security Engineering, Inc.

12. OWNER'S CONTINGENCY ALLOWANCE

13. PROJECT PERMITTING

a. City of Mobile Building Permit

b. Contractor to Pull Permits, and Pay Associated Fees

14. CONSTRUCTION SEQUENCING:

a. Stickney WTP is a fully operational plant, and must maintain operations throughout construction.
b. Close coordination with the Engineer and Owner on the Phasing and Construction of work.
c. Suggested Sequence of Construction is Provided on Sheet G-004.
d. Construction Sequencing Workshop is Contract Requirement Prior to Construction
e. Discussion of key project phasing components:
    i. Electrician/Integrator/ACS/MAWSS coordination on rewiring of PLCs
    ii. Construction of new Admin Building control panel closet/equipment room
    iii. Installation of new Filter Master PLC
    iv. Renovation of IDF Room and associated improvements
    v. Installation of SCADA rack and fiber optic ring
    vi. Installation of Low Head Pump Building PLC
    vii. Phasing of Filter Upgrades

15. QUESTIONS

16. VISIT PROJECT SITE

a. Stickney Water Treatment Plant – 4800 Moffett Road

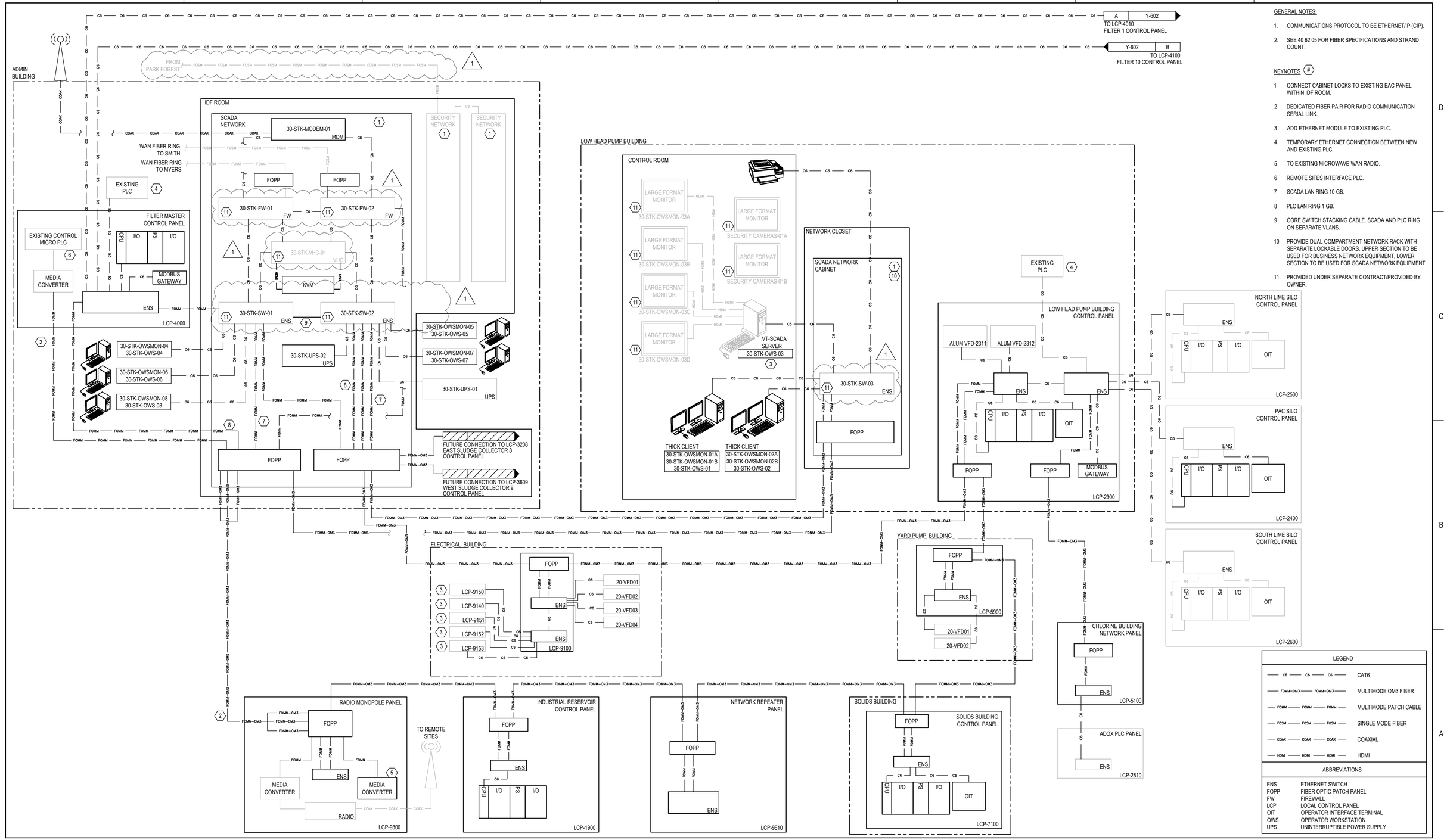
SIGN IN SHEET

Stickney WTP Filter & SCADA Upgrades

Pre-Bid Meeting
February 11, 2026

Name	Company	Phone #	Email
Heath Hardy	HDR	850-429-8925	heath.hardy@hdrinc.com
Daniel Giedt	HDR	704-338-6705	daniel.giedt@hdrinc.com
Tyler Puckett	HDR	850-429-8947	tyler.puckett@hdrinc.com
Dawn Cote	MAWSS	251-694-3188	dcote@mawss.com
Ken Faul	ACS	850 206 5868	Ken.faul@autoconserv.com
Grant Henshaw	ACS	850 503 2061	grant.henshaw@autoconserv.com
Ty Shelton	Taylor Corp.	256-499-0123	ty@taylorcorporation.com
Greg Grainger	Revere	251-284-3728	ggrainger@reverecoh.ca
John Jordan	MAWSS	251-300 7745	JJORDAN@MAWSS.com
Joseph Pourciau	Wharton-Smith	225-588-1313	jpourciau@whartonsmith.com
Zach Butler	MAWSS	251-591-7372	zbutler@mawss.com
Wilson Crockett	Hemphill	601-405-5759	WCROCKETT@HEMPHILLCONSTRUCTION.COM
Luke Yovich	SECI	334-540-1914	Luke@schmidtec.com

Name	Company	Phone #	Email
Kimo Dennis	Moody's Electric	(251) 379-7400	FDennis@MoodysElectric.Net
Markus Moore	MAWSS	251-721-0828	MAMOORE@MAWSS.com
JOSH EDWARDS	SEI	850-530-8892	JOSH.EDWARDS@SEC eng.com.
Kris Castellanos	Morrow Water	251-222-9417	kcastellanos@morrowwater.com



GENERAL NOTES:

1. COMMUNICATIONS PROTOCOL TO BE ETHERNET/IP (CIP).
2. SEE 40 62 05 FOR FIBER SPECIFICATIONS AND STRAND COUNT.

KEYNOTES (#)

1 CONNECT CABINET LOCKS TO EXISTING EAC PANEL WITHIN IDF ROOM.

2 DEDICATED FIBER PAIR FOR RADIO COMMUNICATION SERIAL LINK.

3 ADD ETHERNET MODULE TO EXISTING PLC.

4 TEMPORARY ETHERNET CONNECTION BETWEEN NEW AND EXISTING PLC.

5 TO EXISTING MICROWAVE WAN RADIO.

6 REMOTE SITES INTERFACE PLC.

7 SCADA LAN RING 10 GB.

8 PLC LAN RING 1 GB.

9 CORE SWITCH STACKING CABLE. SCADA AND PLC RING ON SEPARATE VLANS.

10 PROVIDE DUAL COMPARTMENT NETWORK RACK WITH SEPARATE LOCKABLE DOORS. UPPER SECTION TO BE USED FOR BUSINESS NETWORK EQUIPMENT, LOWER SECTION TO BE USED FOR SCADA NETWORK EQUIPMENT.

11. PROVIDED UNDER SEPARATE CONTRACT/PROVIDED BY OWNER.

LEGEND	
C6	CAT6
FOMM–OM3	MULTIMODE OM3 FIBER
FOMM	MULTIMODE PATCH CABLE
FOSM	SINGLE MODE FIBER
COAX	COAXIAL
HDMI	HDMI

ABBREVIATIONS	
ENS	ETHERNET SWITCH
FOPP	FIBER OPTIC PATCH PANEL
FW	FIREWALL
LCP	LOCAL CONTROL PANEL
OIT	OPERATOR INTERFACE TERMINAL
OWS	OPERATOR WORKSTATION
UPS	UNINTERRUPTIBLE POWER SUPPLY

HDR Engineering, Inc.
63 S. Royal Street, Suite 1202
Mobile, AL 36602-3239
Certificate of Authorization: CA-528-E

ISSUE	DATE	DESCRIPTION
B	02/2026	ADDENDUM 1
A	01/2026	ISSUED FOR BIDS

PROJECT MANAGER	HEATH E. HARDY, PE
DESIGNED BY	D. GIEDT
DRAWN BY	M. MURRAY
CHECKED BY	R. PODESZWA
HDR PROJECT NO.	10391316

PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING

MOBILE AREA WATER & SEWER SYSTEM

STICKNEY WATER TREATMENT PLANT FILTER AND SCADA UPGRADES

NETWORK DIAGRAM

0 1" 2"

FILENAME Y-601.dwg
SCALE NONE

SHEET Y-601

C:\USERS\KRWILSON\APPDATA\LOCAL\AUTODESK\AUTOCAD PLANT 3D\COLLABORATION\CACHE\10391316PID.DWG\Y-601.DWG
10/17/2023 8:27:10 AM

SECTION 40 62 05

COMPUTER SYSTEM HARDWARE AND ANCILLARIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer and HMI hardware requirements, which include, but are not necessarily limited to:
   a. LCD Flat Panel Type Monitors (Workstations).
   b. HMI/Operator Computer Workstations.
   c. Engineering Workstations.
   d. Server Racks.
   e. Panel Mounted Operator Interface Terminals (OIT).
   f. Printers.
   g. Software.
   h. Accessories and Maintenance Materials.

B. Related Specification Sections include, but are not necessarily limited to:

1. Section 40 61 13 - Process Control Systems General Requirements.
2. Section 40 61 21 - Process Control System Testing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Institute of Standards and Technologies (NIST):
   a. 800-82, Guide to Industrial Control Systems (ICS) Security.
   b. 800-53, Security and Privacy Controls for Federal Information Systems and Organizations.
2. International Society of Automation (ISA):
   a. ISA-62443, Cybersecurity Certificate Programs.

1.3 DEFINITIONS

A. HMI: Human Machine Interface.

B. LCD: Liquid Crystal Display.

C. OIT: Operator Interface Terminal.

D. OPC: “OLE for Process Control”, a software standard utilizing a client/server model that makes interoperability possible between automation/control applications and field systems/devices.

E. PC: Personal Computer.

F. RAID: Redundant Array of Independent Disks, a method of storing the same data in different places on multiple hard disks.

G. RAM: Random Access Memory.

H. SCSI: Short for Small Computer System Interface, a parallel interface standard used for attaching peripheral devices to computers.

I. SDRAM: Synchronous Dynamic RAM.

J. SNMP: Simple Network Management Protocol, a set of protocols for managing complex networks.

K. TFT: Thin-Film Transistor, a technology for building LCD screens.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Section 40 61 13 - Process Control System General Requirements.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed within the following Articles are acceptable.

2.2 LCD FLAT PANEL TYPE MONITORS (WORKSTATIONS)

A. Manufacturers:

1. Dell P2419HC.

B. Provide LCD Flat Panel Type Monitors as shown on the Drawings and the Schedule herein.

C. Design Requirements:

1. Mounting: As noted on project Drawings.
2. Type: LED-backlit LCD monitor / TFT active matrix.
3. Screen Size: 23.8 inches.
4. Resolution: 1920 x 1080 pixels at 60 Hz.
5. Brightness: 250 nits (cd/m2) minimum, with backlight LED.
6. Aspect Ratio: 16:9 Widescreen.
7. Contrast Ratio: 1000:1.
8. Viewing Angle: 178°.
9. Response Time: 8 ms normal, 5 ms fast.
10. Inputs: VGA, DVI-D (HDCP), 5 USB (2 2.0, 2 3.0, 1 type C), HDMI, two DisplayPorts (1 in, 1 out).
11. Power: 120 volts AC.
12.

D. Configuration:

1. Do not connect USB between monitor and workstation/server.

E. Schedule:

EQUIPMENT NO	LOCATION	SIZE (IN)	QUANTITY
30-STK-OWSMON-01A&B	Pump House Operations Center Control Room	24	2
30-STK-OWSMON-01A&B	Pump House Operations Center Control Room	24	2
30-STK-OWSMON-04	Filter Building Control Room	24	1

EQUIPMENT NO	LOCATION	SIZE (IN)	QUANTITY
30-STK-OWSMON-05	Filter Building Control Room	24	1
30-STK-OWSMON-06	Filter Deck	24	1
30-STK-OWSMON-07	Filter Deck	24	1
30-STK-OWSMON-08	Filter Deck	24	1

2.3 HMI/OPERATOR COMPUTER WORKSTATIONS

A. Manufacturers:

B. Dell Precision 5820.

1.

C. Provide HMI/Operator Computer Workstations as shown on the Drawings and the Schedule herein.

D. Design:

1. Operating System: Windows 10 Professional LTSC 2019.
2. Mounting: Tower configuration.
3. CPU: Intel Xeon 4.1 GHz with Turbo, 4 cores, 8 threads, 8.25MB Cache.
4. Storage Controller: None.
5. Storage: M.2 1TB PCIe Class 40 SSD. Quantity 1.
6. Memory: 2x16GB DDR4, 2.666 GHz, 2 RDIMM.
7. Graphics: One Nvidia Quadro T1000 card, 8 GB, 4 mDP to DisplayPort adapters, or latest equivalent.
8. Power: Single power supply with cord.
9. Optical Drive: None.
10. Management: None.
11. Ports:
    a. USB: 6 minimum.
    b. Networking: Two RJ45 1 Gpbs Ethernet.
12. Warranty: 3 years with Onsite Service after Remote Diagnosis.
13. Accessories:
    a. Wired keyboard.
    b. Wired mouse.
14.

E. Schedule:

EQUIPMENT NO.	LOCATION	SERVICE
30-STK-OWS-01	Pump House Operations Center Control Room	VTScada Client
30-STK-OWS-02	Pump House Operations Center Control Room	VTScada Client
30-STK-OWS-04	Filter Building Control Room	VTScada Client
30-STK-OWS-05	Filter Building Control Room	VTScada Client
30-STK-OWS-06	Filter Deck*	VTScada Client

EQUIPMENT NO.	LOCATION	SERVICE
30-STK-OWS-07	Filter Deck*	VTScada Client
30-STK-OWS-08	Filter Deck*	VTScada Client

* Provide kiosk type PC enclosure with tray for keyboard and mouse.

2.4 SERVER RACKS:

A. Manufacturers:

1. Server/Network Racks
   a. Vertiv VR3150 / VRA2000 / VRA1002 / VRA2005 / VRA1009 / VRA4000 / VRA3002
2. KVM Console
   a. Vertiv/Avocent LRA185KMM8D-G01-001
3. 48 Port RJ45 Patch Panel
   a. Leviton 49255-L48 / 61110-RL6
4. Rack Mounted Power Strip
   a. Tripp-Lite PDUMH15
5. Rack Mount UPS
   a. Vertiv GXT5-5000MVRT4UXLN / PD5-003
6. Fiber Optic Patch Panel (Rack Mount)
   a. Corning Closet Connector Housing (CCH) with CCH connector panels and LC compatible adapters
7. Cabinet lock
   a. HES Cabinet Lock Model KS200 wired to existing EAC system

B. Schedule:

EQUIPMENT NO.	LOCATION
SCADA Network/Server Rack	Filter Building IDF Room
SCADA Network Rack	Pump House Operations Center Network Closet

2.5 FIBER OPTIC CABLE

A. Manufacturers:

1. Corning, FREEDM® Cables, Type OM3 unless specified elsewhere as OM4.

B. Design:

1. Comply with TIA/EIA 568 and ANSI X3T9.5.
2. 50/125 µm graded-index glass.
3. Tight-buffered, 900 µm buffer.
4. Maximum attenuation:
   a. 850 nm: 2.8 dB/km.
   b. 1,300 nm: 1.0 dB/km.
5. Minimum effective Modal bandwidth: 5350 MHz-km.
6. Color-coded buffer as per TIA/EIA 598.

7. Minimum bend radius, buffered fiber: 1-inch.
8. Proof Testing: 100 kpsi.
9. Fiber Count: 12 fibers per cable, or as shown on the Contract Drawings.
10. All Dielectric Construction: No electrically conductive components in the fiber optic cable are allowed.
11. Gel Free: Fibers tight-buffered, not in gel-filled loose-tube.
12. Style: Distribution.
13. Water blocked.
14. Strength Member:
    a. Nonconductive; integral part of cable; supports stress of installation and load during use.
    b. Fiberglass epoxy rod, aramid fiber, Kevlar.
    c. Minimum Tensile Strength: 600 pounds.
15. Protective Covering:
    a. Polyvinylchloride (PVC).
    b. Continuous and free from holes, splices, blisters, and other imperfections.
16. Minimum Bend Radius:
    a. Short-term under Tension: 20 times cable diameter.
    b. Long-term Tension: 15 times cable diameter.
17. Identification:
    a. Identify with Identification Devices in accordance with Section 26 05 05, Conductors.
    b. Use waterproof tags and identifications.
18. Special Features:
    a. Indoor Use: Must be flame-retardant. Ratings shall be compliant with NFPA and NEC standards.
    b. Outdoor Use:
    c. Direct burial rated.
    d. UV Resistant.
    e. Suitable for installation in buried conduit.
19. Installation:
    a. Installer shall be certified by cable manufacturer. Submit current credentials and certification documentation.
    b. Special Guarantee: Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this specification section found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in General Conditions.

2.6 FIBER OPTIC CABLE CONNECTORS

A. Manufacturers:

1. Corning, UniCam unless specified otherwise

B. Design:

1. In accordance with the requirements of TIA/EIA 568, Section 12.4.3 or Annex F.
2. Connector Type: LC type, unless otherwise noted in Contract Documents.
3. Pull Strength: 0.2 N minimum.
4. Durability: Sustain minimum 500 mating cycles without violating other requirements.
    a. Ferrules: Free-floating low loss ceramic.

b. Polarizing key on duplex connector system.

5. Quantity: All fibers shall be properly terminated using an appropriate fiber optic connector.
6. Attenuation:
   a. In accordance with requirements of TIA/EIA 568, Section 12.4.4.
   b. Maximum of 0.75 dB per connector pair.
7. Installation:
   a. Installer shall be certified by cable manufacturer. Submit current credentials and certification documentation.
   b. Special Guarantee: Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this specification section found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in General Conditions.

2.7 FIBER OPTIC PATCH CABLES

A. Manufacturers:

1. Corning, Addon Networks, or approved equal

B. Design:

1. In accordance with TIA 568 C.3. Cable ratings shall be compliant with NFPA and NEC standards.
2. Comply with requirements for fiber optic cable, see Component Y201.
3. Cable Configuration:
   a. Individual tight-buffer thermoplastic.
   b. Protected with kevlar strength members and enclosed in thermoplastic jacket.
   c. OM3 or OM4 to match source/destination device or cabling.
   d. Rated OFNR or OFNP to meet requirements of Contract Documents.
4. Connectors:
   a. Comply with requirements for fiber optic connectors, see Component Y211.
   b. On-axial Pull Strength: 33 N.
   c. Normal-to-Axial Pull Strength: 22 N.
5. Color: Aqua unless otherwise noted.
6. Length: Manufacturer standard, to meet requirements of Contract Documents.
7. Connector Types:
   a. Field-mounted Patch Panel: LC type.
   b. Network Racks: LC type.
   c. Transition/conversion cables If necessary to match equipment type, provide LC connector on one end and equipment type of connector on the other end.

2.8 PANEL MOUNTED OPERATOR INTERFACE PANELS (OIT)

A. Manufacturers:

1. Allen-Bradley PanelView Plus 7

B. Design:

1. Nominal Display Size: 10 inch (minimum).
2. Touch Panel Type: Analog resistive.
3. Memory: 512 MB RAM and 1 GB nonvolatile.
4. Secure Digital (SD) Slot: One, with 2GB SD card.

5. USB Ports: Two USB 2.0 (Type A) high speed host ports and one USB 2.0 (Type B) high speed device port.
6. Ethernet Port: One 10/100Base-T, Auto MDI/MDI-X Ethernet port that supports linear or star network topologies.

C. Schedule:

EQUIPMENT NO.	LOCATION
LCP-2600	Low Head Pump Building PLC Panel
LCP-4000	Filter Building, Filter Master PLC Panel
LCP-7100	Solids Building PLC Panel
LCP-2400	PAC Silo PLC Panel (replace existing)

2.9 PRINTERS

A. Manufacturers:

1. Hewlett Packard CP5225N.

B. Design:

1. Type: LaserJet.
2. Speed: up to 20 ppm black and color.
3. Resolution: 600 x 600 dpi.
4. Duty Cycle: Up to 75k pages/month.
5. Paper Size: Print up to 11x17”.
6. Trays: Two.
7. Print Cartridges: Four.
8. Ports: USB and Fast Ethernet.
9. Emulation: Support for LaserJet III or LaserJetIIID emulation.
10. Accessories:
    a. Cables:
        1) Ethernet: Provide one for network connectivity.
        2) USB: Provide if required for direct connection to end device.
11.

C. Schedule:

EQUIPMENT NO.	LOCATION	TYPE	SERVICE
30-STK-PRINT01	Pump House Operations Center Control Room	Color Laser	SCADA Use

2.10 PANEL MOUNT FIBEROPTIC PATCH PANELS

A. Manufactures:

1. Corning Patch Panel (WCH) with CCH connector panels and LC compatible adapters

B. Schedule:

1. Panel mount patch panels are not tagged. Refer to network diagram for locations and number of fiber connections required.

2.11 SOFTWARE

A. Provide all software and associated programming/configuration required to meet performance requirements of the Contract Documents.

1. At substantial completion of the Project:
    a. Turn current licenses for all software over to the Owner in the Owner's name and install the latest version, upgrade or service pack for all software.
    b. Provide the respective software supplier's Comprehensive Support Contract for all software covering a full one-year warranty period following substantial completion which shall provide no cost software upgrades, service packs and tech support from the software supplier.

B. All software must be latest edition and licensed to the Owner.

2.12 ACCESSORIES AND MAINTENANCE MATERIALS

A. Provide all accessories required to furnish a complete computer-based network for the control system to accomplish the requirements of the Drawings and Specifications.

B. Furnish Owner with the following extra materials:

1. One spare toner cartridge of each color per laser printer provided.
2. One spare port lock key for each lock type provided.

PART 3 - EXECUTION

3.1 DEMONSTRATION

A. Demonstrate system in accordance with Section 01 75 00 - Checkout and Start-Up Procedures.

3.2 INSTALLATION AND CHECKOUT

A. Provide installation and checkout in accordance with Section 40 61 13 - Process Control System General Requirements and Section 40 61 21 - Process Control System Testing.

END OF SECTION

SECTION 40 63 43
PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Programmable logic controller (PLC) control system(s), including hardware, software, programming, documentation, and training.

B. Related Sections include but are not necessarily limited to:

1. Section 01 75 00 - Checkout and Start-Up Procedures
2. Section 40 61 13 - Process Control Systems General Requirements.
3. Section 40 67 00 - Control System Equipment Panels and Racks.
4. Section 40 61 96 - Process Control Descriptions.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C37.90.2, Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
   b. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
2. International Electrotechnical Commission (IEC)
   a. IEC 61131-3 Programmable logic controllers
3. National Electrical Manufacturers Association (NEMA):
   a. ICS 1, Industrial Control and Systems General Requirements.

B. Qualifications:

1. Installation supervisor shall have had experience in overseeing installation and startup of at least three similar installations within the last five years.
2. Programmer(s) shall have had experience in programming PLCs for at least two projects of similar size and complexity.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 40 61 13.
2. Product technical data including:
   a. Submit annotated copies of complete PLC software programs:
      1) In native-format file including all applicable formats (ladder logic, function block diagram, sequential function chart, instruction list, structured text).
      2) In PDF-format file with fully annotated PLC code that can be read without the native configuration and programming environment on electronic media (DVD or USB drive).
      3) Provide text description completely defining each unique function block used in the program if FBDs are used.
      4) Provide list of all addresses referenced in logic diagram with description of data associated with each address (Tag database).
   b. Results of factory testing or simulation procedures.
   c. Bill of material

d. Drawings containing the following information to be submitted as part of Specification Section 40 67 00 (control panels) submittals:
    1) Arrangement drawings for PLC system components.
    2) Panel and enclosure plans, sections and details.
    3) Access opening locations and required clearances for each panel and enclosure.
    4) Enclosure internal wiring and terminal blocks.
e. DIP Switch and Jumper Settings, if applicable.
f. I/O Rack and I/O Module Layout.
g. Wiring and Interconnection diagrams.
    1) Power Supplies.
    2) I/O Points.
    3) Communications.
h. Catalog cut sheets containing information on PLC components to be submitted as part of these Specification Section submittals.

3. Certifications:
    a. Qualifications of installation supervisor.
    b. Qualifications of programmer(s).

B. Operation and Maintenance Data:

1. See Specification Section 01 78 23 for requirements for:
    a. The mechanics and administration of the submittal process.
    b. The content of Operation and Maintenance Manuals.
2. Program Documentation.
    a. Program Overview.
    b. Program Listing.
    c. I/O Listing.
    d. Memory Map.
    e. I/O Cross Reference.
3. Maintenance procedures.
    a. Include the location and phone numbers of service centers (including 24 hour "hot lines").
    b. Provide specific information including operation and maintenance requirements, programming assistance, troubleshooting guide, parts ordering, field service personnel requests, and service contracts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Rockwell Automation: Allen-Bradley CompactLogix 5069 sieries.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. See Specification Section 40 61 13.

B. The PLC system shall meet the control requirements of the Section 40 61 96 - Process Control Descriptions, Drawings, and Specifications.

C. PLC programming shall be documented and factory tested.

D. The PLC system be capable of operating in ambient conditions of 32 to 140 degrees F temperatures and 5 to 95% relative humidity without the need for purging or air conditioning.

E. Environmental Controls:

1. Furnish circulation fans in solid state control system enclosures if required by contorl panel heat release calculations.
2. Over-temperature switches shall be utilized to provide special cooling if required to maintain operating temperatures within the manufacturer's specified range.
3. Air conditioning applications shall include means of preventing moisture condensation.

F. Where the PLC is utilized to control multiple trains of equipment and where the equipment in each train operates as a unit relatively independent of other equipment trains (e.g., facility with multiple boiler units or filter trains), the PLC components (I/O modules, power supplies, etc.) shall be designed so that the failure of any one component does not affect equipment on all trains. The following shall also apply.

1. I/O modules shall be segregated on a train basis unless required for safety reasons.
2. Where several equipment units operate in parallel, but are not considered assigned to a particular equipment train (e.g., multiple raw water pumps or chemical feed pumps all discharging into a common header), the PLC I/O modules associated with each equipment unit shall be assigned so that the failure of any one I/O module will not affect the other parallel unit/s.

2.3 HARDWARE

A. Processor shall include diagnostic indicators for power, mode, low battery, communications ports, and memory and I/O errors.

B. I/O modules shall be capable of being replaced while the PLC is on-line and operating.

C. All I/O modules shall have terminal block failure or removal monitoring.

D. Analog output modules shall have a resolution of at least 12 bits.

E. Electrical isolation shall be provided between logical and field device.

F. I/O Module field wiring shall remain undisturbed when removing or replacing an I/O module.

G. Fail-safe state for each I/O channel shall be capable of being defined as on, off or fail-in-place.

H. Power Supply Units:

a. Electrical service to PLC system shall be 120 VAC, 60 Hz.

I. All PLC control system components shall be capable of meeting or exceeding electromagnetic interference tests per IEEE C37.90.2.

J. Incorporate the following minimum safety measures:

1. Watchdog function to monitor:
   a. Internal processor clock failure.
   b. Processor memory failure.
   c. Loss of communication between processor and I/O modules.
   d. Processor ceases to execute logic program.
2. Safety function wiring: Emergency safety switches shall not be wired into the controller.
3. Safe wiring:
   a. Unless otherwise specified, activation of alarms and stopping of equipment shall be based on de-energization of rather than the energization of control circuits.
4. Initial safety conditions:
   a. Utilize program module to dictate output states in a known and safe manner prior to running of control program.
   b. Utilize program each time PLC is initialized/re-initiated and the control program activated.
5. Monitoring of internal faults and display:

a. Internal PLC system status and faults shall be monitored and displayed.
1) Monitored items shall include:
a) Memory ok/loss of memory.
b) Processor ok/fault.
c) Scan time overrun.

6. Control of programs: Protect access to PLC program loading with password protection or with locked, key operated selector switches.
a. Provide login, passwords, and/or keys to Owner at Substantial Completion.
7. Design PLC system with high noise immunity to prevent occurrence of false logic signals resulting from switching transients, relay and circuit breaker noise or conducted and radiated radio frequency interference.
8. Operator intervention:
a. Logic system failure shall not preclude proper operator intervention.
b. Safety shutdown of equipment or a system shall require manual operator intervention before the equipment or system operation may be reestablished.

2.4 SOFTWARE

A. All software will be furnished and licensed to Owner.
1. At Substantial Completion, transfer all licenses and media to Owner.
2. At Substantial Completion, all software must be latest edition and licensed to the Owner.
3. Software shall be lifetime licensed and be OEM supported for at least 10 years from date of license transfer.

B. Programming.
1. Program using Studio 5000 Logix Designer Professional latest version.
2. Languages supported: All application programming in IEC 61131-3 compliant language.
3. Program PLC utilizing ladder diagram, function block, or structured text format.
4. Protect program via removable key switch or password to prevent unauthorized changes. Provide password and/or programming keys to Owner.
5. Capable of on-line and off-line programming.

C. PLC program Structure.
1. Clear, concise, well-annotated logic.
2. Implement a modular design to allow specific functions to be replicated to ensure consistency.
3. Program shall align with the control strategies. Include comments reflecting alignment with control strategies.
4. Include named variables that reflect the actual use of the variable.
5. Annotate program listing to include the following (using the features of the appropriate PLC programming software):
a. Clearly identified variables, I/O points, contacts, and analog values.
b. Written description of each functional area.
c. Written description of each rung's function.
d. Reference to control loop number for each rung where applicable.
e. Reference to instrumentation tag number of I/O devices for each rung where applicable.

2.5 COMPONENTS

A. PLC System Central Processor Unit (CPU):

1. The PLC shall have the capability of communicating with other commonly specified PLC and control system protocols such as Modbus/RTU, Modbus/TCP, Profibus, Ethernet/TCP and OPC.
2. CPU shall include capability to modify logic via an Ethernet port without taking processor off line.
3. Memory:
    a. Battery-backed RAM.
    b. Non-volatile program storage via flash EEPROM:
        1) Automatically download to RAM in the event RAM is corrupted.
4. Memory battery backup shall be capable of 180 days memory retention with fresh battery.
    a. Provide visual indication of battery status and alarm low battery voltage.
    b. Memory battery backup shall be capable of 28 days memory retention after the "Battery Low" indicating LED is on.
5. Plug-in card designed to allow quick field replacement of faulty devices.
    a. Provide unit designed for field replacement and expansion of memory without requiring rewiring or use of special tools.
6. 20% minimum spare useable memory capacity after all required programming is in place and operating.
7. Capable of executing all control functions required by the Specifications and Drawings.
8. Built-in three-mode (proportional-integral-derivative) control capabilities.
    a. As directly selectable algorithms requiring no user knowledge of programming languages.
9. Lighted status indicators for "RUN" and "FAILURE".
10. Capable of manual or automatic control mode transfer from the operating console stations or from within the control strategy.
    a. Transfer shall be bumpless and balanceless.

B. Input/output (I/O) Modules:

1. Provide plug-in modular-type I/O racks with cables to connect to all other required PLC system components.
2. Provide I/O system with:
    a. I/O solid state boards with status lights indicating I/O status.
    b. Electric isolation between logic and field device.
    c. Capability of withstanding low energy common mode transient to 1000 V without failure.
    d. Incorporate noise suppression design.
    e. Capable of meeting or exceeding electrical noise tests, NEMA ICS 1-109.60-109.66.
    f. Capable of being removed and inserted into the I/O rack under power, without affecting any other I/O modules in the rack.
    g. Install 20% spare I/O points for each type.
3. Input/output connection requirements:
    a. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the I/O enclosure.
    b. Prewire I/O modules to terminal blocks.
    c. Provide terminal blocks with continuous marking strip.
    d. Size terminals to accommodate all active data base points and spares.
    e. Provide terminals for individual termination of each signal shield.
    f. Field wiring shall not be disturbed when removing or replacing an I/O module.
4. Discrete I/O modules:
    a. Interface to ON/OFF devices.

b. I/O status indicator on module front.
c. Voltage rating to match circuit voltage.
d. Output module current rating:
1) Match maximum circuit current draw.
2) Minimum 1.0 continuous A/point for 120 VAC applications.
e. Isolated modules for applications where one module interfaces with devices utilizing different sources of power.

5. Discrete outputs shall be wired to interposing relays.
6. Discrete outputs shall be fused:
a. Provide one fuse per common or per isolated output.
b. Provide blown fuse indication.
c. External fusing shall be provided if output module does not possess internal fusing.
d. Fuses provided external to output model shall:
1) Be in accordance with module manufacturer's specifications.
2) Be installed at terminal block.
7. Analog I/O modules:
a. Input modules to accept signals indicated on Drawings or Specifications.
b. Minimum 12 bit resolution.
c. I/O chassis supplied power for powering connected field devices.
d. Differential inputs and outputs.
e. User configurable for desired fault-response state.
f. Provide output signals as indicated on Drawings and Specifications.
g. Individual D/A converter for each output module.
h. Individual A/D converter for each input module.
8. Communications Modules:
a. Provide communications modules as-shown on Drawings.
b. Provide communications modules for each protocol required for a complete communications system as shown on drawings.
c. Multi-port Ethernet modules may not be utilized as a network switch or to bridge networks..
9. Manufacturer and Models:
a. Discrete Input Module: Allen-Bradley 1769-IQ16.
b. Discrete Output Module: Allen-Bradley 1769-OB16.
c. Analog Input Module: Allen-Bradley 1769-IF4I.
d. Analog Output Module: Allen-Bradley 1769-OF4CI.

C. Power Supply Units:

1. Provide regulated power units:
a. Designed to operate with PLC system and shall provide power to:
1) All components of PLC system.
2) All two-wire field instruments.
3) Other devices as indicated on Drawings or Specifications.
b. Capable of supplying PLC system when all of the specified spare capacity is utilized.
c. Each power supply shall be sized such that it will carry no more than 75% of capacity under normal loads.
2. Electrical service to PLC system is 120 VAC, 60 Hz.
3. Separate AC circuit breakers shall be provided for each power supply.

4. If the PLC system is field expandable beyond the specified spare capacity, and if such expansion requires power supply modification, note such requirements in the submittals and allow room for power supply modification in the PLC system enclosure.
5. Capable of meeting or exceeding electrical noise tests, NEMA ICS 1-109.60-109.66.
6. Power distribution:
    a. Immune to transients and surges resultant from noisy environment.
    b. Shall provide constant voltage level DC distribution to all devices.
7. Manufacturer and Model:
    a. Allen-Bradley ControlLogix 1769-PA4.
8. Provide uninterruptible power supply (UPS) to sustain full power to UPS powered loads listed below for a minimum of 30 minutes following loss of primary power and to ensure that the transient power surges and dips do not affect the operation of the PLC system.
    a. UPS powered loads:
        1) All rack mounted PLC components.
        2) Local operator consoles.
        3) All power supplies furnished with the PLC and associated loads.
    b. Reference Section 40 67 63 - Uninterruptible Power Supply, for UPS Specificaions.

D. PLC System Enclosure:

1. In accordance with Specification Section 40 67 00 - Control Panels.
2. Component placement:
    a. Mount all controller components vertically within the enclosure to allow maximum convection cooling.
    b. Either install power supplies above all other equipment with at least 10 inches of clearance between the power supply and the enclosure top, or adjacent to other components, but with sufficient spacing for circulation of cooling air.
    c. Do not place I/O racks directly above the CPU or power supply.
    d. Locate incoming line devices (isolation or constant voltage transformers, local power disconnects, surge suppressors, etc.) so as to keep power wire runs within an enclosure as short as possible.
    e. If items such as magnetic starters, contactors, relays, and other electromagnetic devices must be located within the same enclosure as the PLC system components, place a barrier with at least 6 inches of separation between the magnetic area and the control area.
    f. Place circulating fans close to major heat generating devices.
    g. Segregate input/output modules into groups of identical type.
3. Wiring and grounding to be in accordance with Specification Section 40 67 00.
4. Termination requirements:
    a. In accordance with Specification Section 40 67 00.
    b. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the enclosure.
    c. Prewire I/O modules to terminal blocks.
    d. Size terminals to accommodate all active database points and spares.
    e. Provide terminals for individual termination of each signal shield.
    f. Field wiring shall not be disturbed when removing or replacing an I/O module.

E. PLC System Software and Programming:

1. Provide all hardware and programming required to provide communication between the PLC and the human-machine interface.

2. Coordinate with HMI programmer to allow modification of all setpoint through the HMI utilizing appropriate security considerations..
3. All communications logic shall include a watch-dog timer and alarm for loss of communications. Coordinate communications failure response with Owner.
4. Provide programming to accomplish all control and monitoring requirements of the Drawings and Specifications.
5. Full documentation capability.
6. Online and offline programming.
7. Offline simulation prior to download.
8. Program over network capability.
9. Two-step commands requiring PLC programmer verification prior to modification of any programming.

2.6 ACCESSORIES

A. Provide all accessories required to install and test a complete PLC control system to accomplish the requirements of the Drawings and Specifications.

B. Provide all programming cables required to configure the PLC logic.

2.7 SOURCE QUALITY CONTROL

A. Perform Factory Acceptance Testing in accordance with Specification Section 40 61 21 - Process Control System Testing.

2.8 MAINTENANCE MATERIALS

A. Furnish Owner with the following extra spares:

1. One spare CPU for every four field CPUs or fraction thereof installed.
2. One spare communication module by type installed in the Plant.
3. One spare I/O card of each card type for every 10 cards or fraction thereof installed.
4. One spare power supply for every 10 power supplies or fraction thereof installed.
5. A set of 5 spare fuses of each installed type per panel.

B. Include a complete bill of materials itemizing each line item with make and model (part) number.

C. Include a complete set of all special tools required to install, maintain and test the PLCs.

PART 3 - EXECUTION

3.1 FUNCTIONALITY

A. Complete System.

1. Provide all graphics and logic programming, configuration, coordination, integration, and testing required for furnishing a fully functioning system.
2. Provide interface support with all foreign device interfaces (FDI) communicating with the PLC system.

3.2 INSTALLATION

A. Install PLC control system in accordance with manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Test system in accordance with Specification Section 40 61 21 - Process Control System Testing.

B. Demonstrate system in accordance with Specification Section 01 75 00 - Checkout and Start-Up Procedures.

3.4 TRAINING

A. Employee of the manufacturer or certified representative to provide one week of operation and maintenance training at the Project site after the system has successfully undergone all field testing and acceptance procedures.

B. As a minimum, training shall cover:

1. Hardware overview.
2. Software overview.
3. Documentation.
4. Maintenance.
5. Trouble shooting.
6. Operation, e.g., changing set points, passwords, etc.

3.5 DOCUMENTATION

A. Update O&M manuals to reflect as-built conditions.

3.6 SUPPORT

A. Provide on-call technical support for a period of one year after substantial completion. Include a minimum of two site visits to work with Owner on any final modifications to the logic.

END OF SECTION

SECTION 40 66 05
NETWORK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer network requirements, which include, but are not necessarily limited to:
   a. Ethernet Switches.
   b. Firewalls.
   c. SFP Fiber Transceiver
   d. Cellular Modem

B. Related Sections include but are not necessarily limited to:

1. Section 40 61 13 - Process Control Systems General Requirements.
2. Section 40 61 21 - Process Control System Testing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 802.3, Information Technology - Local and Metropolitan Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
      1) 802.3u: IEEE Standards for Local and Metropolitan Area Networks: Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation, Type 100BASE-T.
      2) 802.3x: IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex Operation.
2. National Institute of Standards and Technologies (NIST):
   a. 800-82, Guide to Industrial Control Systems (ICS) Security.

B. Preinstallation Conference:

1. See Section 01 31 19 - Project Meetings.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 40 61 13 - Process Control System General Requirements.

B. Product Data:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Network requirements verification plan.

C. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed within the following Articles are acceptable.

2.2 ETHERNET SWITCHES

A. Accessories: “Stack Module” as required to create logical switches and reduce network latency.

B. Provide Ethernet switches as shown on the Drawings and the Schedule herein.

C. Layer 2 –Panel Mounted Ethernet Switches:

1. Manufacturers:
   a. FortiGate FSR108F .
2. Design and fabrication:
   a. Layering: Managed Layer 2 switch.
   b. Topology: Configured in redundant fiber ring structure using Ring technology with multiple VLANs, where shown on project Drawings.
   c. Mounting: DIN rail mounted.
   d. Power: 24 volts DC.
   e. Ports:
   f. Fiber: Two 1 Gbps ports, minimum.
   g. Copper: 6 Fast Ethernet ports, minimum.
   h. Spare: 2 minimum.
   i. Warranty: 5 years warranty.
   j. Accessories:
      1) Software: Provide Full Software option.
      2) SFP Modules: 1 Gbps, 850 nm multimode, LC connectors, If noted.

D. Layer 3 – Rack Mounted Ethernet Switches:

1. Owner Furnished

E. Small Form-Factor Pluggable (SFP) Modules:

1. Provide SFPs as required to support the communication capability shown on the Drawings. Use SFPs instead of media converters. Media converter use is prohibited unless approved in writing.
2. Manufacturers:
   a. Field Network Switches: 10Gtek AXS85-192-M3 (SFP+ SR).
3. Design:
   a. Core Network Switches:
      1) Connector: LC duplex.
      2) Fiber Type: Multimode, 62.5 and 50 micron at 850nm OM1 through OM4.
      3) Speed: 10 GBps.
      4) Warranty: 5 years extended warranty.
   b. Field Network Switches:
      1) Connector: LC duplex.
      2) Fiber Type: Multimode, 62.5 and 50 micron at 850nm OM1 through OM4.
      3) Speed: 10 GBps.
      4) Warranty: 5 years extended warranty.
   c. Hyperconverged Appliances:

1) Connector: LC duplex.
2) Fiber Type: Multimode, 50 micron at 850nm OM3 only.
3) Speed: 10 GBps.
4) Warranty: 5 years extended warranty.

d. Firewalls:
1) Connector: LC duplex.
2) Fiber Type: Multimode, 850nm.
3) Speed: 1 GBps.
4) Warranty: 5 years extended warranty.

2.3 FIREWALLS

A. Owner Furnished

2.4 SERVER RACKS

A. As specified in section 40 62 05 - Computer System Hardware and Ancillaries.

2.5 WIDE AREA NETWORKNETWORKNETWORK CELLULAR BACKUP

A. Manufacturers:
1. Cell Modem: Cradlepoint, COR-IBR650B-LP4-NA / TA5-650BLP4-N0N.
2. Antenna: Wilson Electronics, Omni Plus Building Antenna 304422 / 303466 / 901117.

B. Design
1. Topology: Category 4, 4G LTE on Verizon Wireless carrier. Dual SIM slots.
2. Mounting: Shelf mounted in network rack.
3. Power: 12 volts DC.
4. Ports:
a. Ethernet: One RJ45 10/100/1000 Mbps, and One RJ45 10/100 Mbps.
b. USB: USB 2.0.
5. Antenna: 2 SMA connections (cellular).
6. Security:
a. Remote Authentication: RADIUS, TACACS+.
b. Filtering: Inbound and Outbound Port Filtering and IP MAC Address Filtering.
c. Updates: Latest published Firmware Updates must be applied prior to commissioning and again at Substantial Completion.
7. Accessories:
a. AC Adapter: 120 volts AC to 12 volts DC, unless otherwise noted.
b. Enterprise Cloud Management (ECM): NetCloud Essentials for IoT, 5 Years.
c. External antenna: 4G LTE outdoor antenna, N-Female connector.
d. Coax Extension Cable: 30 foot low loss coax N-Male to SMA-Male, or as required for proper cable routing.
e. Antenna Mounting Bracket: Pole mount bracket for antenna.

2.6 SOURCE QUALITY CONTROL

A. Provide Factory testing if required in section 40 61 21 - Process Control System Testing.

2.7 ACCESSORIES AND MAINTENANCE MATERIALS

A. Provide all accessories required to furnish a complete computer-based network for the control system to accomplish the requirements of the Drawings and Specifications.

B. Furnish Owner with the following extra materials:

1. One spare Ethernet switch of each type utilized.

PART 3 - EXECUTION

3.1 DEMONSTRATION

A. Demonstrate system in accordance with Section 01 75 00 - Checkout and Start-Up Procedures.

3.2 FIELD QUALITY CONTROL

A. Verify network is configured per requirements herein.

B. Submit verification plan.

3.3 INSTALLATION AND CHECKOUT

A. Provide installation and checkout in accordance with Section 40 61 13 - Process Control System General Requirements and Section 40 61 21 - Process Control System Testing.

END OF SECTION