

**SECTION 00 91 13**

**ADDENDUM NO. 2**

This Addendum modifies, amends, and supplements designated parts of the Bidding Documents and are hereby made a part thereof by reference. It shall be the responsibility of each Bidder to be familiar with the contents of this addendum and to notify, if necessary any Subcontractors and Suppliers they propose to use for various parts of the services of any changes or modifications contained in this Addendum. No claims for compensation, due to lack of knowledge of the contents hereof, will be considered. Bidders must acknowledge receipt of this Addendum in the Bid Form and comply with the requirements for submission of Bids as set forth in the Bidding Documents.

**The answers below are provided in response to questions and comments submitted by prospective Bidders.**

*Is Section 09 96 12 Secondary Containment Lining System to be included within the bid of Section 09 90 00 Painting*

Answer: Section 09 96 12 Secondary Containment Lining System is part of the painting filed sub-bid. This is outlined in the Painting Filed Sub-Bid Requirements, Section 01 11 20, page 4.

*Regarding insulation, the TW and TWR piping that exists is painted blue and stenciled for identification. The painting of this insulated pipe is clear in the painting section, but the labeling does not seem as clear. Please clarify if stenciling is by plumbing or elsewhere.*

Answer: The labeling shall be done by the Painting Contractor. Refer to pipe identification in Section 09 90 00 Painting and Coating.

*There is no balancing specification in the plumbing section, but the plans show several in-line balancing valves for the tepid water return branches. Should these valves be factory preset type and no balancer needed or should these be field set and balancer required?*

Answer: Balancing valves shall be calibrated and field set.

*Regarding the balancing valves for the hot water heater, the schematic shows one "Calibrated Balancing Valve" on the pump discharge and ball valves on the inlets of the mixing valves. The plan view of this same piping shows 3 balancing valves – one at the pump discharge and one at each mixing valve. Please provide clarity to the balancing needs and products required.*

Answer: Only one balancing valve is required. It is at the pump discharge. The ball valves indicated are for servicing of the mixing valves.

*There are sloped roofs on this project. Are the curbs to be sloped for the fans?*

Answer: Sloped roof curbs are required for any roof fans installed on a sloping roof. Refer to drawing modifications to H-501 as part of Addendum No. 2.

*The Fan (F-3) in the Low Lift Pump Building has a wiring diagram on E-602 showing the electrician's wiring of the related components. No other fan is shown to have control components wired by the EC. Are the line voltage control components for Fan F-3 the only to be required by the EC? Please note that Fan F-1 shown on the Main Floor in sheet H-202 is labeled as F-3 on sheet E-206.*

Answer: Refer to electrical drawings reissued as part of Addendum No. 1 to clarify the wiring requirements. Refer to drawing modifications for E-206 as part of Addendum No. 2.

*Regarding Section 23 11 23 Facility Natural Gas Piping, please clarify the proper section for this work since gas piping demolition and re-piping needs to be by plumbers.*

Answer: Section 23 11 23 Facility Natural Gas Piping is plumbing work and is part of the Plumbing Filed Sub-bid. Refer to changes in Section 23 11 23 Facility Natural Gas Piping and Section 01 11 20 Summary of Filed Sub-Bids, attached as part of this Addendum No. 2.

*Regarding the request for removal of Section 00 43 37 Proposed Suppliers Form and Section 00 45 05.01 Sub-Bidders Representations and Certifications via addendum:*

Answer: Section 00 43 37 Proposed Suppliers Form is not intended to be a "product submittal" nor prevent "or equals." Or equals are covered under Article 11 of the Instructions to Bidders (Section 00 21 13). This section is intended to provide the Owner with the identity of Suppliers (especially for key equipment) to further evaluate experience and qualifications of Suppliers in accordance with Article 12 of the Instructions to Bidders (Section 00 21 13).

Section 00 45 05.01 Sub-Bidders Representations and Certifications does not require Sub-Bidders to warrant anything except in 1.04.B. warranting compliance with AIS requirements. This section is intended to provide representation and certification that Sub-Bidders have complied with/will comply with the requirements in the Instructions to Bidder and Supplementary Instructions to Bidders. The items listed in 1.01 of 00 45 05.01 reflect the requirements specified in 4.07 of section 00 21 13 and are typical bidding requirements. The requirements do not force Sub-Bidders (or General Bidders) to correct and/or complete the design; it only requires the Sub-Bidders give notice of all conflicts, errors, ambiguities, or discrepancies discovered in the Bidding Documents and to represent the sub-bidder has done so.

**NOTICE is hereby given that the Bidding Documents have been modified and replacement pages are issued herewith.**

**SPECIFICATIONS**

- Specification replacement pages identified in the following table are included as an attachment to this Addendum (Addendum No. 2), have an Issue Date of October 24, 2014 and contain reference to “ADDENDUM NO. 2” in the footers. Text changes are identified by double-underline for additions and ~~strikeout~~ for deletions.

<b>Replacement pages (with text changes)</b>	<b>Provided for purposes of double-sided printing only - no changes (front or back of replacement page)</b>
01 11 00-2	01 11 00-1
01 11 20-6, 01 11 20-8	01 11 20-7, 01 11 20-9
09 90 00-6	09 90 00-5
23 05 53-1, 23 05 53-2	
23 11 23-1, 23 11 23-2, 23 11 23-3, 23 11 23-4, 23 11 23-5, 23 11 23-6, 23 11 23-7	23 11 23-8
26 05 00-2, 26 05 00-4	26 05 00-1, 26 05 00-3
40 91 00-4, 40 91 00-7, 40 91 00-16	40 91 00-3, 40 91 00-8 40 91 00-15
46 33 00-18, 46 33 00-30, 46 33 00-38	46 33 00-17, 46 33 00-29, 46 33 00-37
46 66 00-1, 46 66 00-5, 46 66 00-8, 46 66 00-9, 46 66 00-12, 46 66 00-13, 46 66 00-14	46 66 00-2, 46 66 00-6, 46 66 00-7, 46 66 00-10, 46 66 00-11

**DRAWINGS**

- Drawing replacement pages/sheets are identified in the following table and are included as an attachment to this Addendum (Addendum No. 2) with changes encircled by “clouds” and designated as “D”.

<b>Replacement pages/sheets</b>
H-101 Raw Water Building HVAC Floor Plan
I-216 SCADA Panel (MCP) PLC Analog Inputs

- Drawing modifications are identified in the following table and do **NOT** involve replacement pages/sheets. Text changes are identified by double-underline for additions and ~~strikeout~~ for deletions.

Sheet No.	Modifications
E-208	<ul style="list-style-type: none"><li>- Revise Keyed Note 3 as follows; “3. PROVIDE A120V, 20A CIRCUIT WITH 2#12, 1#12G IN ¾”C TO EXISTING PANEL “A” LOCATED IN THE MAIN ELECTRIC ROOM. CIRCUIT TO POWER CHLORINE ANALYZER <del>AND—SLUDGE BLANKET TRANSMITTERS</del>”</li><li>- Delete “LIT 6001” and “LIT 6000” callouts</li></ul>
H-501	<ul style="list-style-type: none"><li>- Add to notes under FAN SCHEDULE as follows “<u>9. PROVIDE SLOPED ROOF CURBS TO MATCH ROOF SLOPES</u>”</li><li>- Revise Remarks for Fan No. F-1 as follows: “1,2,3,4,<u>9</u>”</li><li>- Revise Remarks for Fan No. F-2 as follows: “1,2,3,4,5,<u>9</u>”</li><li>- Revise Remarks for Fan No. F-3 as follows: “1,2,6,<u>9</u>”</li></ul>
E-206	<ul style="list-style-type: none"><li>- Revise label as follows “<del>F-3</del> <u>F-1</u>”</li></ul>

This Addendum is provided to Bidders in a single Portable Document Format (.PDF) posted on the City’s website and will be available for examination at the Issuing Office. It is each Bidder’s responsibility to check the website for Addenda per the Instructions to Bidders.

Bidders must comply with the requirements for submission of Bids in the Instructions to Bidders and the Bidding Documents remain unchanged except as indicated above.

**Prepared and Issued by Woodard & Curran (Engineer) on behalf of:**  
*City of Marlborough, MA (Owner)*  
*Department of Public Works*

**END OF SECTION**

**SPECIFICATIONS  
REPLACEMENT PAGES**

## SECTION 01 11 00

### SUMMARY OF WORK

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Project Description
- B. Description of the Work
- C. Work Sequence and Coordination
- D. Special Requirements

##### 1.02 PROJECT DESCRIPTION

- A. The Project is to upgrade equipment throughout the Millham Water Treatment Plant including but not limited to pumps, chemical feed systems, clarifiers, filters, HVAC, instrumentation, SCADA, electrical systems and security.

##### 1.03 DESCRIPTION OF THE WORK

- A. The Work includes labor, material and equipment, services required for construction, testing, and commissioning of the Project in accordance with the Contract Documents and as more specifically described in the Specifications and Drawings and includes, but is not limited to, the following principal features:
  - 1. Install a new ultraviolet (UV) disinfection system in a stand-alone building adjacent to the water treatment plant.
  - 2. Convert existing sodium aluminate feed system to bulk liquid caustic; convert sodium bicarbonate feed system to soda ash; and, convert alum feed system to PACl.
  - 3. Replace Clarifier Blower No. 1.
  - 4. Replace filter underdrain nozzles and regROUT plates, replace filter media, replace filter influent valves and drain valves.
  - 5. Replace spent backwash pump and add VFD.
  - 6. Replace high lift pump no. 2 and add a VFD to pump no. 1.
  - 7. Replace existing sump pumps and controls.

8. Upgrade HVAC system equipment in the Raw Water Pump Station, chemical storage room, fluoride room, chemical room and chlorine room.
  9. Install instrumentation, SCADA, electrical and security upgrades.
- B. Work Site locations: generally as shown on the Drawings.
- C. Existing conditions and Site data: per the Drawings and Section 01 15 00.

#### 1.04 WORK SEQUENCE AND COORDINATION

- A. The Work will extend over multiple seasons and must be sequenced to limit impacts to the Millham Water Treatment Plant operations and adjacent areas from construction.
- B. Access to businesses and residences must be maintained during prosecution of the Work.
- C. The Millham Water Treatment Plant may be shut down for two scheduled periods during construction to complete portions of the work as described below. During the remainder of the construction period, except for very short durations, the plant must remain in operation. Shut downs shall be coordinated with the Owner, Engineer, ~~and~~ Plant Operations Staff and Sub-Contractors a minimum of ~~one-two~~ weeks prior to the required shut down. All shut downs must be approved in writing by the Owner.
- D. A plant shutdown shall be conducted prior to starting work on the UV building. The duration of the shutdown shall be a maximum of 14 calendar days. The following work shall be performed during this shut down:
1. Excavation of the test pit, determination of the size of the existing thrust block, and enlargement of the existing thrust block on the plant's 16-inch finish water main as indicated on the Drawings.
  2. Installation of the 18-inch tees and gate valves on the existing 18-inch clearwell effluent pipe. Installation of temporary plugs on the new valves leading to the UV system. Provide temporary restraint for the temporary plugs. The clearwell will be drained to approximately the level of the bottom of the existing pipes (EL. 241.92) between the exterior clearwell and the treatment plant building by the Plant Operators. This work shall be coordinated with the Plant Operations Staff a minimum of one week in advance. Any remaining water in the exterior clearwell that needs to be drained will have to be pumped by the Contractor.
  3. Installation of the power monitoring instruments in the Main Switchboard. The power monitor can be installed in the main electric room along with all wires and conduits run between the Switchboard/SCADA panel and the wall mounted power monitor device

**PLUMBING  
FILED SUB-BID REQUIREMENTS**

- A. The Work listed below requires a single filed sub-Bid in accordance with MGL c149, §44A through 44J, inclusive, as amended.
- B. The Contracting Requirements in Division 00 and the General Requirements in Division 01 apply to the Work of this Section(s).
- C. Examine all Drawings and Specifications for requirements that affect the Work of this Section(s).
- D. Coordinate the Work of this Section(s) with related Work of other trades and cooperate with such trades to assure the steady progress of the Work under the Contract Documents.
- E. The term “Contractor” in this Section(s) and all referenced Drawings and Specifications shall mean the Plumbing Subcontractor except where “General Contractor” is specified.
- F. The Work under the Plumbing sub-Bid is specified in the following Specification sections:

22 00 00 Plumbing  
23 11 23 Facility Natural Gas Piping

and on the following Drawings:

All M (Mechanical) series Drawings  
All H (HVAC) series Drawings  
All P (Plumbing) series Drawings

This listing of Drawings shall not limit the responsibility of the Heating, Ventilation and Air-Conditioning Subcontractor to determine the full extent of the Work required by the complete set of Drawings.

- G. Requirements for Submitting Sub-Bids
1. Sub-Bids for Work covered by the Specifications and Drawings listed above shall comply with the requirements of MGL c149, §44F.
  2. Sub-Bids shall be filed on the forms furnished by the Awarding Authority in the Bidding Requirements in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and in accordance with the procedures and requirements set forth in the Bidding Requirements.
- H. Sub sub-Bids are required for the following Work per paragraph E of the Form for Sub-Bid – Plumbing which is customarily performed under subcontract with the Plumbing Subcontractor.

NONE

**END OF SECTION**

**HEATING, VENTILATION AND AIR-CONDITIONING  
FILED SUB-BID REQUIREMENTS**

- A. The Work covered by the Specifications and Drawings listed below requires a filed sub-Bid in accordance with MGL c149, §44A through 44J, inclusive, as amended.
- B. The Contracting Requirements in Division 00 and other General Requirements in Division 01 apply to the Work covered by the Specifications and Drawings listed below.
- C. Examine all Drawings and Specifications for requirements that affect the Work identified.
- D. Coordinate the Work covered by the Specifications and Drawings listed below with related Work of other trades and cooperate with such trades to assure the steady progress of all Work under the Contract Documents.
- E. The term “Contractor” used herein and in Specifications and Drawings listed below shall mean the Heating, Ventilation and Air-Conditioning Subcontractor except where “General Contractor” is used.
- F. The Work under the Heating, Ventilation and Air-Conditioning sub-Bid is specified in the following Specification sections:

- 23 05 00 Common Work Results for HVAC
- 23 05 10 HVAC Demolition
- 23 05 29 Hangers and Supports for HVAC Piping and Equipment
- 23 05 53 Identification for HVAC Piping and Equipment
- 23 05 93 Testing, Adjusting and Balancing for HVAC
- ~~23 11 23 Facility Natural Gas Piping~~
- 23 34 00 HVAC Fans
- 23 82 39 Unit Heaters
- 23 84 16 Dehumidifiers
- 23 90 00 Louvers and Vents

and on the following Drawings:

All H (HVAC) series Drawings

This listing of Drawings shall not limit the responsibility of the Heating, Ventilation and Air-Conditioning Subcontractor to determine the full extent of the Work required by the complete set of Drawings.

- G. Requirements for Submitting Sub-Bids
1. Sub-Bids for Work covered by the Specifications and Drawings listed above shall comply with the requirements of MGL c149, §44F.
  2. Sub-Bids shall be filed on the forms furnished by the Awarding Authority in the Bidding Requirements in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and in accordance with the procedures and requirements set forth in the Bidding Requirements.
- H. Sub sub-Bids are required for the following Work per paragraph E of the Form for Sub-Bid – Heating, Ventilation and Air-Conditioning which is customarily performed under subcontract with the Heating, Ventilation and Air-Conditioning Subcontractor.

NONE

**END OF SECTION**

3. Manufacturer's stock number and date of manufacture
  4. Contents by volume, for pigment and vehicle constituents
  5. Thinning instructions
  6. Application instructions
  7. Color name and number
- C. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and Work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### **1.08 SITE CONDITIONS**

- A. Existing Conditions: per Division 01 General Requirements.

### **PART 2 – PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Tnemec, Sherwin Williams (S-W), or Devoe per Paint Schedules attached and on the Drawings.

#### **2.02 PAINT MATERIALS**

- A. Provide materials designated by item or area to be painted in Paint Schedules attached and on Drawings. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
- B. Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- C. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- D. Material Quality: manufacturer's best-quality trade sale paint material of the various coating types specified. Ensure paint material containers display manufacturer's product identification.

- E. Colors: From the manufacturer's full range of standard colors.

## 2.03 PIPE IDENTIFICATION

A. Identify piping according to the fluid carried, with assistance by the Engineer, as needed.

1. For additional detail on HVAC and Plumbing pipe identification labels, refer to Section 23 05 53 Identification for HVAC Piping and Equipment.

B. Piping Color

1. Provide color selections from the manufacturer's full range of standard colors.
2. Band all new chemical pipes and containment pipes using the same color system. Color coding shall follow MassDEP Guidelines for Public Water Systems Chapter 6: Chemical Application and section 2.14: Piping Color Code of the "Ten State Standards – Recommended Standards for Water Works (2012 Edition)". For process fluids not listed in the referenced standards, a unique color scheme and labeling should be used as approved by the Engineer. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be on one of the pipes at approximately 30 inch intervals as approved by the Engineer. Banding shall be at 30 inch intervals of continuous straight pipe, or at changes in direction of the pipe.

C. Pipe Labels

1. Pipe labeling shall include, but not be limited to, the following locations:
  - a. New chemical pipes
  - b. New insulated water pipes, including tempered water
  - c. New and existing process piping, including insulation, where specified
  - d. New service water pipes
  - e. New vacuum priming system
  - f. New spent backwash water pipes
  - g. New sludge pipes
2. Pipes shall be labeled on two sides with pipe markers and direction of flow labels at 30 inch intervals of continuous pipe according to the Ten State Standards. A flow direction arrow shall follow the label legend and be of the same color. The labels shall meet or exceed ASME A13.1 standards. The legend letters shall be CAPITALIZED and be black or white, depending on the background color. The labels shall be KWIK KOIL labels, with snap-around style for pipes under 6" outer diameter (O.D.) and spring fastened for pipes 6" O.D. and larger, or approved

## SECTION 23 05 53

### IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT (FILED SUB-BID REQUIRED)

#### PART 1 – GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. Painted Identification Materials.
2. Plastic Pipe Markers.
3. Valve Tags.
4. Plastic Equipment Markers.
5. Plasticized Tags.

B. Related Sections

1. Division 22 and 23 Sections which specify Pipe and Valve marking and identification.

+2. Section 09 90 00 – Painting and Coating

##### 1.02 REFERENCES

- A. ANSI Standards - Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

##### 1.03 SUBMITTALS

- A. Manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples of each color, lettering style and other graphic representation required for each identification material or system.

##### 1.04 QUALITY ASSURANCE

- A. Mechanical identification materials shall be provided by firms regularly engaged in manufacture of identification devices of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.

## 1.05 MAINTENANCE

### A. Extra materials

1. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
2. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

## PART 2 – PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide mechanical identification materials of one of the following or an approved equal:
1. Allen Systems, Inc.
  2. Brady (W.H.) Co.; Signmark Div.
  3. Seton Name Plate Corp.

### 2.02 MATERIALS

#### A. Mechanical Identification Materials

1. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selections is Installer's option, but provide single selection for each product category.

#### B. Painted Identification Materials

1. Provide standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4 inch high letters for ductwork and not less than 3/4 inch high letters for access door signs and similar operational instructions. Provide 1 inch high letters for labeling tanks between 0-20 gallons.

~~2. Utilize standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray can form and grade.~~

~~3. Utilize standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.~~

## SECTION 23 11 23

### FACILITY NATURAL GAS PIPING (FILED SUB-BID REQUIRED)

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Section Includes
  - 1. Distribution piping systems for Propane gas to the Boiler Room and piping in the boiler room including:
    - a. Pipes, fittings, and specialties
    - b. Special duty valves
    - c. Gas vents to atmosphere
  - 2. Gas pressures for systems specified in this Section are limited to 10 psig.
- B. Related Sections
  - 1. Section 230500 – Common Work Results for HVAC
  - 2. Section 230515 – Mechanical Identification
  - 3. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

##### 1.02 DEFINITIONS

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
- B. Gas Distribution Piping - A pipe within the building that conveys gas from the point of delivery to the points of usage.
- C. Gas Service Piping - The pipe from the gas main, storage tank or other source of supply including the meter, regulating valve, or service valve to the gas distribution system of the building served.

##### 1.03 SUBMITTALS

- A. Product data for each gas piping specialty and special duty valves. Include rated capacities of selected models, furnished specialties and accessories, and installation instructions.

- B. Shop drawings detailing dimensions, required clearances, for connections to gas meter.
- C. Coordination drawings for gas distribution piping systems.
- D. Maintenance data for gas specialties and special duty valves for inclusion in operating and maintenance manual.
- E. Welders' qualification certificates, certifying that welders comply with the quality requirements specified under "Quality Assurance" below.

#### 1.04 QUALITY ASSURANCE

- A. Regulatory Requirements - Comply with the requirements of the following codes:
  - 1. NFPA 54 - National Fuel Gas Code, for gas piping materials and components, gas piping installations, and inspection, testing, and purging of gas piping systems.
  - 2. ASME Code for Pressure Piping B31.3, Normal Fluid Service.
- B. Product Qualifications - All products (piping, valves, equipment) for use on gas system shall be Underwriters Laboratory listed for its actual installation in this project.

#### 1.05 SEQUENCING AND SCHEDULING

- A. Notification of Interruption of Service - Except in the case of an emergency, notify all affected users when the gas supply is to be turned off.
- B. Work Interruptions - When interruptions in work occur while repairs or alterations are being made to an existing piping system, leave the system in safe condition.
- C. Coordinate the installation of pipe sleeves for foundation wall penetrations.

### PART 2 – PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturer - Provide gas piping system products from one of the following or an approved equal:
  - 1. Gas Cocks:
    - a. Jenkins Bros.
    - b. Lunkenheimer Co.
    - c. NIBCO, Inc.

- d. Powell Co.
- e. Stockham
- f. Watts
- 2. Gas Check Valves:
  - a. Eclipse
  - b. Spencer
  - c. Air Power of New England

## 2.02 PIPE AND TUBING MATERIALS

- A. Above ground, inside the building,
  - 1. Steel Pipe - ASTM A-106, Grade B, seamless, Schedule 40
    - a. ½ inch to 2 ½ inch - Screwed Fittings
    - b. 3 - inch and larger - Buttweld Fittings
- B. Underground outside the building
  - 1. HDPE – Conforming to ASTM D 2513 per NFPA 54.

## 2.03 FITTINGS

- A. Screwed Fittings - 3000#, ASTM A-105, dimensional standards in accordance with ANSI B16.11.
- B. Socketweld Fittings - 3000#, ASTM A-105, dimensional standards in accordance with ANSI B16.11.
- C. Buttweld Fittings - ASTM A-234 WPB, seamless, dimensional standards in accordance with ANSI B16.9.
- D. Flanges - 150# RF, ASTM A-105, screwed or weldneck, dimensional standards in accordance with ANSI B16.5.
- E. Unions - ½ inch to ¾ inch 6000#, 1 inch to 1½ inch 3000#, ASTM A-105, socketweld or screwed.
- F. Bolting - Stud bolts with two heavy hex nuts, ASTM A-193, Grade B7 continuously threaded stud bolt, ASTM A-194 Grade 2H nuts, dimensional standards in accordance with ANSI B16.5.
- G. Gaskets - 1/8 inch thick, 150# spiral wound 304SS with asbestos filler.

## 2.04 JOINING MATERIALS

- A. Joint Compound - suitable for natural gas.
- B. Gasket Material - thickness, material, and type suitable for gas to be handled, and for design temperatures and pressures.

## 2.05 PIPING SPECIALTIES

- A. Dielectric Unions - ANSI B16.39, Class 250; malleable iron and cast bronze; with threaded or soldered end connections suitable for pipe to be joined; designed to isolate galvanic and stray current corrosion.
- B. Protective Coating - When piping will be in contact with material or atmosphere exerting a corrosive action and for buried pipe, pipe and fittings shall be factory-coated with polyethylene tape, having the following properties:
  - 1. overall thickness; 20 mils;
  - 2. synthetic adhesive;
  - 3. water vapor transmission rate, gallons per 100 square inch - 0.10 or less.
  - 4. water absorption, percent – 0.02 or less.

Prime pipe and fittings with a compatible primer prior to application of tape.

## 2.06 VALVES

- A. General duty valves (i.e., gate, globe, check, and ball valves) are specified in Section 15110. Special duty valves are specified in this Article by their generic name. Refer to Part 3 below, Article "VALVE APPLICATION" for specific uses and applications for each valve specified.
- B. Gas Cocks less than 2 inch - 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.
- C. Gas Cocks – 2 inch and Larger - MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
- D. Gas Line Pressure Regulators - single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 1½ inch and smaller, flanged ends for 2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

## **PART 3 – EXECUTION**

### **3.01 PREPARATION**

- A. Precautions - Before turning off the gas to the premises, or section of piping, turn off all equipment valves. Perform a leakage test as specified in "FIELD QUALITY CONTROL" below, to determine that all equipment is turned off in the piping section to be affected.
- B. Conform to the requirements in NFPA 54, for the prevention of accidental ignition.

### **3.02 PIPE APPLICATIONS**

- A. Install steel pipe with threaded joints and fittings for 1½ inch and smaller, and with welded joints for 2 inch and larger, for gas lines operating less than or equal to 3 psig. All steel pipe operating greater than 3 psig shall be installed with butt weld and socket weld connections.

### **3.03 PIPING INSTALLATION**

- A. General - Conform to the requirements of NFPA 54 - National Fuel Gas Code.
- B. Use fittings for all changes in direction and all branch connections.
- C. Tubing shall contain no joints underground.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted.
- E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- F. Locate groups of pipes parallel to each other, spaced to permit servicing of valves.
- G. Install gas piping at a uniform grade of ¼ inch in 15 feet, upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.
- H. Adapt HDPE to steel pipe using adapters specifically designed for that purpose.
- I. Connect branch outlet pipes from the top or sides of horizontal lines, not from the bottom.
- J. Supports and hangers are specified in Section 15060. Conform to the table below for maximum spacing of supports:

1. Steel Pipe:

<u>Spacing Size (NPS)</u>	<u>Min. Rod In Feet</u>	<u>Size-Inches</u>
1/2	5	-
3/4 - 1 1/4	6	-
1 1/2 - 3 (horizontal)	12	1/2
all sizes (vertical)	10' or every floor level, whichever is less	

K. Install unions in pipes 2 inch and smaller, at final connections for each piece of equipment. Unions are not required on flanged devices.

L. Anchor piping to ensure proper direction of expansion and contraction. Install expansion loops and joints as indicated and specified.

### 3.04 PIPE JOINT CONSTRUCTION

A. Threaded Joints - Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.
2. Align threads at point of assembly.
3. Apply appropriate tape or thread compound to the external pipe threads.
4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
5. Damaged Threads - Do not use pipe with threads which are corroded, or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

### 3.05 VALVE APPLICATION

A. General - The Drawings indicate valve types, locations, and arrangements.

B. Shut-off duty - Use gas cocks specified in Part 2 above.

### 3.06 VALVE INSTALLATIONS

- A. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.
- B. Install a gas cock upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.
- C. Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position.

### 3.07 ELECTRICAL BONDING AND GROUND

- A. Install above ground portions of gas piping systems, upstream from equipment shutoff valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."
- B. Do not use gas piping as a grounding electrode.
- C. Conform to NFPA 70 - "National Electrical Code," for electrical connections between wiring and electrically operated control devices.

### 3.08 FIELD QUALITY CONTROL

- A. Piping Tests - Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

### 3.09 PIPE MARKING AND VALVE IDENTIFICATION

- A. Pipe marking and valve identification is included in the work of this Section. All identification systems applied to the work of this Section shall comply with the requirements of Section 15075.
- B. Marking of Elevated Pressure gas piping both inside and underground shall comply with the requirements of NFPA 54.

**END OF SECTION**

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**SECTION 26 05 00**

**COMMON WORK RESULTS FOR ELECTRICAL  
(FILED SUB-BID REQUIRED)**

**PART 1 – GENERAL**

**1.01 SUMMARY**

A. Sections Includes

1. Provide electrical work in accordance with this section and applicable reference standards listed in Article 1.03.
2. Examine all Drawings and Specifications for requirements that affect the Work of this section.
3. Coordinate the Work of this section with related Work of other trades and cooperate with such trades to assure the steady progress of the Work.
4. The term “Contractor” in this Section(s) and all referenced Drawings and Specifications shall mean the ELECTRICAL Subcontractor except where “general Contractor” is specified.
5. Electrical Work includes, but is not limited to, the following.
  - a. Motor wiring, safety disconnects, and motor starters unless integral with equipment
  - b. Power distribution equipment
  - c. Power outlets and equipment connections
  - d. Wiring devices
  - e. Motor controls and control wiring not provided under other Specifications (other than Division 26 sections of the Specifications)
  - f. Complete grounding system
  - g. Motor control center
  - h. Service entrance work
  - i. Building interior and exterior lighting
  - j. Raceways.
  - k. Support material and hardware for raceway and electrical equipment
  - l. Branch circuit wiring

- m. Furnish only manholes, handholes, conduit, and conduit spacers/supports for underground electrical systems for installation by the general Contractor.
- n. Installation and termination of control and signal wiring for instrumentation and process control equipment. Installation and mounting of new control panel hardware and mounting and connection of panels and instruments furnished under Division 40 sections of the Specifications
- o. Building wall, floor and roof penetrations for raceways
- p. Start up, acceptance testing, test reports and instruction of systems operation

B. Related Requirements

~~6.1.~~ Section 01 11 00 - Summary of Work

**1.02 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and payment requirements: per Division 01 General Requirements.

**1.03 REFERENCES**

- A. Reference Standards
  - 1. National Electrical Code (NEC)
  - 2. Massachusetts Electrical Code (MEC)
  - 3. Underwriters' Laboratories (UL)
  - 4. Institute of Electrical and Electronics Engineers (IEEE C2)
  - 5. American National Standards Institute, Inc. (ANSI)
  - 6. National Fire Protection Association (NFPA)
  - 7. National Electrical Manufacturers Association (NEMA)
  - 8. Insulated Power Cable Engineers Association (IPCEA)
  - 9. Association of Edison Illuminating Companies (AEIC)
  - 10. Occupational Safety Health Act (OSHA)
  - 11. Americans with Disabilities Act (ADA)

ADDENDUM NO. 2

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling: per Division 01 General Requirements.

#### 1.05 SUBMITTALS

- A. Submit in accordance with Division 01 General Requirements.
1. Shop Drawings: submit to general Contractor for review and approval prior to submittal to the Engineer.
    - a. specific equipment and material being supplied
    - b. quantity being supplied
    - c. list of accessories, dimensions, and descriptions
    - d. mounting and connection details, wiring diagrams, elementary control diagrams, equipment interface diagrams
  2. Manufacturer's product data, test reports, and materials certifications
  3. Electrical Work plan
  4. Reports, permits, and easements necessary for installation, use, and operation
  5. Test reports, inspections, and meter readings
- B. Closeout and Maintenance Material Submittals: per Division 01 General Requirements.

#### 1.06 SITE CONDITIONS

- A. Existing Conditions: per Division 01 General Requirements.
1. Prior to performing electrical Work, carefully inspect the installed Work of other trades and verify that Work of other trades is complete to allow electrical Work to properly commence.
  2. Verify that electrical Work may be performed in accordance with pertinent codes and Regulations and the original design.

B. Coordination

1. Coordinate electrical Work with schedules for Work of other trades to prevent unnecessary delays in the total Work.
- 1.2. Coordinate electrical Work required to be completed during periods of approved plant shutdown per Section 01 11 00, paragraph 1.04 WORK SEQUENCE AND COORDINATION.
- 2.3. Coordinate with local utility companies and ensure installations for utility services are in accordance with utility company requirements.
- 3.4. Provide required supports and wiring to clear encroachments for a complete installation where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment.

C. Accuracy of Data

1. The Drawings are diagrammatic and functional only, and are not intended to show exact circuit layouts, number of fittings and components. Install additional circuits, components and material where needed to support the specific requirements of the equipment of the Work, whether or not indicated or specified.
2. Check with Engineer before installation of Work for outlets not specified as to location or for Work that interferes with other trades.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Provide in accordance with Division 01 General Requirements.
- B. Protect the Work of other trades. Restore any damage caused to Work of other trades to the condition existing prior to damage at no additional cost to the Owner.
- C. Investigate locations in the building through which equipment must pass to reach its final location to identify space limitations. Require manufacturers to ship equipment and material in sections sized to accommodate space limitations in the building.

**PART 2 – PRODUCTS**

**2.01 MATERIALS**

- A. Materials and equipment: listed by UL unless it can be demonstrated that no UL standards exist for a specific item or class of equipment.
- B. Provide material and equipment not specified but required for a complete installation.

**ADDENDUM NO. 2**

2. All submittal information listed in paragraph 1.05 above

## **PART 2 – PRODUCTS**

### **2.01 INSTRUMENTATION - GENERAL**

- A. Instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals that are established standards for the water and wastewater industries.
- B. Instrumentation requiring power supplied from a source other than the control panel to which it is connected shall operate on 120VAC, single phase, 60 HZ current, unless specifically indicated otherwise. This power shall be supplied from the closest local electrical distribution panel with a breaker for each circuit.
- C. Electronic instrumentation shall be of the solid-state type. Analog control signals shall be linear and be industry standard currents of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current), or the like. No zero based signals shall be allowed.
- D. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standards signals for remote transmission. No zero-based signals shall be allowed.
- E. Instruments shall be provided with stainless steel mounting hardware and/or galvanized steel floor stands, wall brackets, or instrument racks as appropriate for each location.
- F. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Contract Electrical Drawings, to comply with the National Electrical Code.
- G. Indicators and recorder readouts shall be linear in the process units.
- H. Transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to  $\pm 2$  percent.
- I. Electronic equipment shall be of the manufacturer's latest design. Circuit boards and associated components shall have suitable conformal coating to prevent contamination by dust, moisture, and fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over normally anticipated atmospheric conditions of temperature, pressure and humidity. The field-mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

- J. Instruments furnished herein shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.
- K. Lightning/Surge Suppression - Provide individual surge protection means for each field instrument mounted outside the building from the control panel to which they are connected. Instruments mounted inside the same building as the control panel to which they are connected shall not require surge protection.
- L. Instruments shall be provided as indicated on the Instrument Index and in the Instrument Data Sheets, included as an attachment at the end of this Section. These documents include the instrument tag names, physical requirements, control requirement, and basis of design manufacturer and model number information.

## 2.02 FLOW INSTRUMENTATION

- A. Magnetic Flow Meter (12") – Refer to Instrument Data Sheet 2.02A.
- B. Magnetic Flow Meter (16") – Refer to Instrument Data Sheet 2.02B.
- C. Magnetic Flow Meter (6") – Refer to Instrument Data Sheet 2.02C.
- D. Positive Displacement Flow Meter (4") – Refer to Instrument Data Sheet 2.02D.
- E. Shower / Eyewash Flow Switch – Refer to Instrument Data Sheet 2.02E.

## 2.03 LEVEL INSTRUMENTATION

- A. Flood Switch – Refer to Instrument Data Sheet 2.03A.
- B. Ultrasonic Level Transmitter – Refer to Instrument Data Sheet 2.03B
- ~~C. Sludge Blanket Level Transmitter – Refer to Instrument Data Sheet 2.03C.~~
- ~~D.C.~~ Submersible Level Transducer – Refer to Instrument Data Sheet 2.03D.

## 2.04 PRESSURE INSTRUMENTATION

- A. Pressure Transmitter- Refer to Instrument Data Sheet 2.04A.

## 2.05 TEMPERATURE INSTRUMENTATION

- A. Temperature Transmitter- Refer to Instrument Data Sheet 2.05A.

INSTRUMENT INDEX				
Drawing Number	Instrument Tag	Data Sheet	Instrument Description	Notes
E-301	FE/FIT-1000	2.02A	UV Train 12" Magnetic Flow Meter	
E-301	FE/FIT-1001	2.02A	UV Train 12" Magnetic Flow Meter	
E-301	FE/FIT-1002	2.02A	UV Train 12" Magnetic Flow Meter	
E-204	FE/FIT-2000	2.02B	Raw Water 16" Magnetic Flow Meter	
E-202	FE/FIT-7000	2.02B	Finished Water 16" Magnetic Flow Meter	
E-202	FE/FIT-6000	2.02C	Backwash Water 6" Magnetic Flow Meter	
E-202	FE/FIT-6001	2.02D	Process Water 4" Single-Jet Flow Meter	
E-204	FS-3000	2.02E	Caustic Area Eyewash/Shower Flow Switch	
E-204	FS-5000	2.02E	PACL Area Eyewash / Shower Flow Switch	
E-206	FS-8000	2.02E	Permanganate Area Eyewash / Shower Flow Switch	
E-301	LSHH-1000	2.03A	UV Building Flood Switch	
E-204	LSHH-3000	2.03A	Caustic Containment Flood Switch	
E-204	LSHH-5000	2.03A	PACL Containment Flood Switch	
E-204	LSHH-6000	2.03A	Soda Ash Containment Flood Switch	
E-206	LSHH-8000	2.03A	Permanganate Containment Flood Switch	
E-204	LIT-3000	2.03.B	Caustic Day Tank Ultrasonic Level Transmitter	
E-204	LIT-3001	2.03.B	Caustic Bulk Tank Ultrasonic Level Transmitter	
E-204	LIT-5000	2.03.B	Alum Day Tank Ultrasonic Level Transmitter	
E-204	LIT-5001	2.03.B	Alum Bulk Tank Ultrasonic Level Transmitter	
E-206	LIT-8000	2.03.B	Permanganate Day Tank Ultrasonic Level Transmitter	
E-206	LIT-8001	2.03.B	Permanganate Bulk Tank Ultrasonic Level Transmitter	
E-205	LIT-9000	2.03.B	Fluoride Bulk Tank 1 Ultrasonic Level Transmitter	
E-205	LIT-9001	2.03.B	Fluoride Bulk Tank 2 Ultrasonic Level Transmitter	
E-005	LIT-10000	2.03.B	Chemical Wastewater Tank Ultrasonic Level Transmitter	
<del>E-208</del>	<del>LIT-6000</del>	<del>2.03.C</del>	<del>Sludge Blanket Level 1 Transmitter</del>	
<del>E-208</del>	<del>LIT-6001</del>	<del>2.03.C</del>	<del>Sludge Blanket Level 2 Transmitter</del>	
E-101	LT-2000	2.03.D	Reservoir Water Level Transducer	

E-101	LT-2001	2.03.D	Raw Water Wet Well Level Transducer	
E-204	LT-4000	2.03.D	Sludge Holding Tank Level 1 Transducer	
E-204	LT-4001	2.03.D	Sludge Holding Tank Level 2 Transducer	
E-206	PIT-6000	2.04.A	Blower Discharge Pressure Transmitter	
E-202	PIT-7000	2.04.A	Suction Water Pressure Transmitter	
E-202	PIT-7001	2.04.A	Discharge Water Pressure Transmitter	
E-301	TS-1000	2.05.A	UV Building Temperature Switch	
E-208	AIT-7000	2.06.A	Finished Water Quality (Chlorine) Analyzer	
E-202	AIT-7001	2.06.B	UV Transmittance Analyzer 1	
E-202	AIT-7002	2.06.B	UV Transmittance Analyzer 2	
E-202	AIT-7003	2.06.C	Clearwell Free Chlorine Analyzer	
E-204	xxx	2.07.A	Caustic Fill Station Strobe Light/Horn	
E-204	xxx	2.07.A	Alum Fill Station Strobe Light/Horn	
E-206	xxx	2.07.A	Permanganate Fill Station Strobe Light/Horn	

**ULTRASONIC LEVEL TRANSMITTERS - INSTRUMENT DATA SHEET 2.03B**

 <p>LEVEL TRANSMITTER - ULTRASONIC</p>	TAG NO: <i>LIT-3000, 3001, 5000, 5001, 8000, 8001, 9000, 9001, 10000</i>		PAGE: <i>7 of 15</i>		
	DRAWING #: <i>See Instrument Index</i>		PRINTED: <i>5/2/2014</i>		
	SPEC. NO: <i>40 91 00, 2.03B</i>				
	PROJECT NUMBER: <i>223811</i>				
DESCRIPTION:	<i>Millham Water Treatment Plant Improvements</i>	REV	REVISION DESCRIPTION	BY	DATE
		<i>0</i>	<i>FINAL</i>	<i>DC</i>	<i>5/2/2014</i>
SERVICE: <i>Tank Ultrasonic Level Transmitters</i>					
<b>GENERAL</b>	Type:	<i>Ultrasonic</i>	Beam Angle:	<i>12°</i>	
	Mounting:	<i>2" NPT</i>	Process Connection:	<i>Flange adapter</i>	
	Measuring Element:	<i>-</i>	Signal Connection:	<i>N/A</i>	
	Ref. Connection:	<i>-</i>	Mat'l Body / Flange:	<i>PVDF</i>	
	Span Range Min/Max:	<i>0.8-16.4 Ft.</i>	Housing Material (Wet):	<i>PVDF</i>	
	Press/Temp Rating:	<i>0-140°F</i>	Housing Mat'l (Non-Wet):	<i>PVC</i>	
	Accuracy:	<i>0.25% of Range</i>	Transmitter Mounting:	<i>Integral</i>	
	Area Classification:		Power Supply:	<i>24VDC, 2 wire, loop powered</i>	
	Enclosure Rating:	<i>IP65</i>	Cable Length:	<i>NA</i>	
	Output Signal:	<i>4-20mA</i>	Local Indicator/Style:	<i>LCD</i>	
	Drain & Vent:	<i>N/A</i>			
<b>PROCESS DATA</b>	Proc Fluid / State:	<i>Treated Water/ Liquid</i>	Level (Min/Oper/Max):		Notes
	Specific Gravity:	<i>-</i>	Level Units:	<i>XX.X FT</i>	
	Density:	<i>-</i>	Pressure (Min/Oper/Max):		
	Conductivity:	<i>-</i>	Pressure Units:	<i>Psi</i>	
	Viscosity:	<i>-</i>	Temperature (Min/Oper/Max):	<i>40</i>	<i>100</i>
	Line Size / Schedule:	<i>-</i>	Temperature Units:	<i>°F</i>	
<b>ACCESSORIES</b>	Device Tag:	<i>Yes- SS, Engraved. See above for tag number</i>	Option-1:	<i>- Include bulkhead adapter</i>	
<b>MANUFACTURER OR APPROVED EQUAL</b>	Manufacturer 1:	<i>Siemens - The Probe 7ML1201 Series (Basis of Design)</i>			
	Manufacturer 2:	<i>Siemens - Sitran LU Series</i>			
	Manufacturer 3:				
<b>NOTES</b>	<ol style="list-style-type: none"> <li>1. LIT-3000 – Caustic Day Tank Level, span 0-6.0'</li> <li>2. LIT-3001 – Caustic Bulk Tank Level, span 0-10.0'</li> <li>3. LIT-5000 – PACI Day Tank Level, span 0-6.0'</li> <li>4. LIT-5001 – PACI Bulk Tank Level, span 0-10.0'</li> <li>5. LIT-8000 – Permanganate Day Tank Level, span 0-6.0'</li> <li>6. LIT-8001 – Permanganate Bulk Tank Level, span 0-10.0'</li> <li>7. LIT-9000 – Fluoride Bulk Tank 1 Level, span 0-10.0'</li> <li>8. LIT-9001 – Fluoride Bulk Tank 2 Level, span 0-10.0'</li> <li>9. LIT-10000 – Chemical Wastewater Tank Level, span 0-10.0'</li> </ol>				

**SLUDGE BLANKET LEVEL TRANSMITTERS--INSTRUMENT DATA SHEET 2.03C**

	<b>LEVEL TRANSMITTER--ULTRASONIC</b>		TAG NO: <u>LIT-6000, 6001</u>	PAGE: <u>8</u> of <u>15</u>
			DRAWING #: <u>See Instrument Index</u>	PRINTED: <u>5/2/2014</u>
			SPEC. NO: <u>40-91-00, 2.03C</u>	
PROJECT NUMBER: <u>223811</u>	REV: <u>0</u>	REVISION DESCRIPTION: <u>FINAL</u>	BY: <u>DC</u>	DATE: <u>5/2/2014</u>
DESCRIPTION: <u>Millham Water Treatment Plant Improvements</u>				
SERVICE: <u>Sludge Blanket Level Transmitters</u>				
<b>GENERAL</b>	Type:	<u>Ultrasonic</u>	Beam Angle:	
	Mounting:	<u>Fixed pole mount</u>	Process Connection:	<u>NA</u>
	Measuring Element:	<u>-</u>	Signal Connection:	<u>12VDC to remote controller</u>
	Ref. Connection:	<u>-</u>	Mat'l Body / Flange:	<u>SS</u>
	Span Range Min/Max:	<u>0.6-40.0 Ft.</u>	Housing Material (Wet):	
	Press/Temp Rating:	<u>35-122°F</u>	Housing Mat'l (Non-Wet):	
	Accuracy:	<u>0.09 Ft.</u>	Transmitter Mounting:	<u>Pole Mounted</u>
	Area Classification:		Power Supply:	<u>120-VAC</u>
	Enclosure Rating:		Cable Length:	<u>33-Ft</u>
	Output Signal:	<u>4-20mA</u>	Local Indicator/Style:	<u>NA</u>
	Drain & Vent:	<u>N/A</u>		
	<b>CALIBRATION</b>	Input (0% / 100%):		Output (0% / 100%):
Process (0% / 100%):			Span & Zero:	
<b>PROCESS DATA</b>	Proc Fluid / State:	<u>Untreated Water/</u>	Level (Min/Oper/Max):	<u>10.0</u>
	Specific Gravity:	<u>-</u>	Level Units:	<u>FT</u>
	Density:	<u>-</u>	Pressure (Min/Oper/Max):	
	Conductivity:	<u>-</u>	Pressure Units:	<u>psi</u>
	Viscosity:	<u>-</u>	Temperature (Min/Oper/Max):	<u>40 100</u>
	Line Size / Schedule:	<u>-</u>	Temperature Units:	<u>°F</u>
	Line No.:	<u>-</u>		
<b>ACCESSORIES</b>	Ind. Scale/Range:		Option-1:	<u>Integral wiper assembly for sensor face</u>
	Device Tag:	<u>Yes-SS, Engraved. See above for tag number</u>	Option-2:	<u>-</u>
<b>MANUFACTURER OR APPROVED EQUAL</b>	Manufacturer-1:	<u>Hach Sonotax SC with SC200 controller (Basis of Design)</u>		
	Manufacturer-2:			
	Manufacturer-3:			
<b>NOTES</b>	<u>1- LIT-6000--Clarifier 1 Level, span 0-10.0'</u>			
	<u>2- LIT-6001--Clarifier 2 Level, span 0-10.0'</u>			

- c. Manufacturer Field Services
  - d. Coordination of Other Tests and Inspections
9. Motor: Provide one (1) motor for each metering pump. Motor shall be AC with adjustable speed range capability; Inverter Ready meeting NEMA MG 1 Part 31.4.4.2; operated from a remote mounted VFD drive controller; standard totally enclosed non-ventilated or totally enclosed fan cooled AC units of the frame size selected by the pump manufacturer to prevent overheating when continuously operated at low speeds; suitable for continuous operation over a 20 to 1 speed range providing constant torque over this range; thermal switch in each drive motor field wired to the VFD controller specified below to stop motor on high temperature. Motors shall be. 1/2HP, Inverter Duty 3 Phase 208/460 VAC 56 C-Face 1750 RPM motor
- a. Manufacturer: Motor shall be Model LM90T033 by Leeson, or approved equal.
- B. Soda Ash Chemical Metering Pumps:
- 1. Quantity: Provide a total of three (3) metering pumps and motors for the Soda Ash chemical feed system.
  - 2. Type: Pumps shall be of the following design;
    - a. Polar crank design with all moving parts submerged in oil
    - b. Front end scavenging such that the plunger is always set to top dead center with each stroke.
  - 3. Accuracy: Steady state accuracy of  $\pm 1.0\%$  over a 10:1 turndown ratio.
  - 4. Suction and discharge connections shall be 1" FNPT.
  - 5. Capacity: 151 gph at 190 psig total dynamic head with a 2" diameter metal, single ball standard plunger.
  - 6. Controls: Capacity control shall be variable speed control via remote control station, specified below.
  - 7. Pump Materials: High performance diaphragm liquid end with diaphragm head, port connection, ball seats, ball checks, and ball guide made of type 316 stainless steel and diaphragm made of PTFE.
  - 8. Spare Parts: Provide spare part kits as recommended by manufacturer to include, at a minimum, the following for each pump;
    - a. Check balls, seats, gaskets, additional oil (sufficient for one change of oil per pump, at a minimum), and a spare diaphragm.

- b. Further spare parts shall be furnished as necessary and per manufacturer's recommendations. Spare parts shall be made of the appropriate materials as recommended by the manufacturer and previously specified above.
9. Motors: Provide one (1) motor for each metering pump. Motor shall be AC with adjustable speed range capability; Inverter Ready meeting NEMA MG 1 Part 31.4.4.2; operated from a remote mounted VFD drive controller; standard totally enclosed non-ventilated or totally enclosed fan cooled AC units of the frame size selected by the pump manufacturer to prevent overheating when continuously operated at low speeds; suitable for continuous operation over a 20 to 1 speed range providing constant torque over this range; thermal switch in each drive motor field wired to the VFD controller specified below to stop motor on high temperature. Motors to be 2 H.P., 208/460 VAC, 60 Hz, 3 Phase, 1755RPM, TEBC.
- a. Manufacturer: Motor shall be Model IDNM3587T ~~IDM3587T~~ as manufactured by Baldor, or approved equal.

C. Control Panel

1. Control panel shall be DEP Chapter 6 compliant.
2. Quantity: Provide one (1) control panel for each metering pump.
3. The Control Panel enclosure shall be constructed of fiberglass and rated NEMA 4X.
4. Power provided to each Control Panel shall be as needed for individual system.
5. Each AC VFD Drive Control Panel shall include but not be limited to the following:
  - a. Incoming Power Fusible Disconnect Switch.
  - b. Control Power Transformer with primary and secondary fusing.
  - c. VFD Drive Unit (specified below).
  - d. All required relays, terminals, etc. to provide a complete operational metering pump variable speed drive control panel.
  - e. 4-20MA speed control signal. 4-20MA signal shall be completely isolated and boosted as necessary utilizing current to current converters.
  - f. Timer to shut down pump after adjustable time has expired in the hand position only
  - g. The following operator controls & indicators shall be mounted on the Control Panel enclosure door:

10. Finishes

- a. All pipe shall be permanently imprinted with the manufacturer's brand name, pipe size, product standard, ASTM specification, recommended working pressure and production code. The letters shall be at least 3/16 inches high and repeated on the pipe at intervals of no less than every five (5) feet.

11. Source Quality Control

- a. Provide in accordance with Division 01 General Requirements and as follows.

E. Backpressure Valve

1. Provide diaphragm type backpressure regulation valves suitable for use as shown on the Drawings and as specified herein. The valve shall be designed to apply positive discharge pressure to a metering pump system to prevent siphoning and eliminate varying dosage rates caused by fluctuating downstream pressure. The diaphragm shall be held against the valve seat by an internal spring. When the preset pressure is exceeded, the diaphragm shall be forced up and the process fluid shall flow through the valve to the injection point. All valves shall be designed for field adjustment from 5 to 150 psig via an adjustment screw.
2. Install all valves as close to the injection point as possible to prevent line drainage. All auxiliary system equipment such as pulsation dampeners and pressure gauges shall be installed between the metering pump and back pressure valve. All backpressure valves shall be designed and constructed in accordance with the following criteria:
  - a. Size: Match to piping size on drawings
  - b. End Connection(s): Union
  - c. Pressure Adjustment Range:
    - 1) Chemicals Injected into Raw Water: 5 to 150 psi
    - 2) Chemicals Injected into Finish Water: 10 to 250 psi
  - d. Maximum Temperature: 140°F
  - e. Maximum Operating Pressure (Plastic Valves): 375 psi
  - f. Maximum Operating Pressure (Metallic Valves): 2,000 psi
  - g. Diaphragm: PTFE/Viton
  - h. Valve Top: Noryl

- i. Valve Body: PTFE-PVC
    - j. Adjustment Screw: Noryl or HDPE
  3. Provide diaphragms with materials of construction as follows based on the piping system fluid service:
    - a. Aluminum Sulfate: PTFE/EPDM
    - b. PACI: PTFE/EPDM
    - c. Soda Ash: PTFE/EPDM
    - d. Sodium Hydroxide (Caustic): PTFE/EPDM
    - e. Sodium Permanganate: PTFE/EPDM
  4. All backpressure regulating valves shall be supplied by a single Manufacturer. All backpressure valves shall be a product of the following Manufacturer:
    - a. Griffco Valve, Inc.
    - b. Plast-O-Matic Valves, Inc.
    - c. Neptune Chemical Pump Company
    - d. Engineer Approved Equal
- F. Pressure Relief Valve
  1. All Pressure Relief Valves shall be of Thermoplastic PVC construction and have no metal part that comes in contact with the process fluid. The PVC shall conform to ASTM D 1784 standards, Cell Classification 12454-A. All PVC pressure relief valves shall be in designed and constructed in accordance with the following criteria:
    - a. Size: Match to Piping Size as Shown on Drawings
    - b. End Connection: Union
    - c. Valve Body: PVC
    - d. Valve Seat: PVC
    - e. Seal: Viton
    - f. Maximum Line Pressure:
      - 1) Raw Water: 110 psi
      - 2) Finish Water: 250 psi
    - g. Pressure Setting Range:
      - 1) Raw Water: 5 to 110 psi
      - 2) Finish Water: 10 to 250 psi

order to assure proper thermal balance between the piping and associated fitting.

3. A minimum of two (2) coats of solvent shall be applied when recommended by the pipe, fitting, or solvent cement Manufacturer. All piping system joints four (4) inches and larger shall use a primer and finished solvent cement coating prior to assembly. The Contractor shall apply the solvent cement to the socket while keeping both the surface and applicator wet and in motion for approximately 5 to 15 seconds. The Contractor shall take care so as not to add excess solvent cement. Joints shall not be cramped.
4. The atmospheric and weather conditions affect the solvent welding procedure. In cold weather sufficient time shall be allowed for proper penetration of the solvent cement. Joining of PVC pipe and fittings shall not be conducted in atmospheric conditions below 40°F, above 90°F, or when exposed to direct sunlight. The Contractor shall allow for a minimum of 48 hours of drying time before moving the socket welded joint or subjecting any internal or external pressure/force.
5. When solvent welding piping to valves or other appurtenances the Contractor shall take specific care so as not to allow solvent cement to enter the valve. Solvent cement shall not be allowed to run free from joints. All valves shall be solvent welded in strict accordance with the recommendations of the valve Manufacturer.
6. All solvent welded joints shall remain undisturbed for a minimum of 48 hours so as to allow for the development of complete strength.

### **3.07 REPAIR/RESTORATION**

- A. Any damage found to the equipment upon inspection after delivery shall be repaired or replaced at no cost.
- B. Remove anchor bolts from concrete floors and concrete pads for the chemical feed pumps, transfer pumps, control panels, chemical feed piping supports, and appurtenances to be demolished. Patch holes flush with Sikatop122 Plus by Sika Corp. or equal.

### **3.08 FIELD QUALITY CONTROL**

- A. Provide in accordance with Division 01 General Requirements.

### **3.09 STARTUP & COMMISSIONING**

- A. Provide in accordance with Division 01 General Requirements.

- B. The manufacturers shall provide a trained and qualified manufacturer's field representative onsite ~~for a total of four (4) eight hour days~~ to provide the following services;
1. Examination and acceptance of equipment installation to verify that installation was performed according to manufacturer's instructions.
  2. Startup, testing, and commissioning according to manufacturer's instructions.
  3. Training for operators of equipment.
  4. Dry Feed System Supplier – two (2) days
  - 3-5. Chemical Metering Pump Manufacturer – two (2) days

### 3.10 CLEANING

- A. Provide in accordance with Division 01 General Requirements.
- B. Clean surfaces of floors, pads and walls in the areas of equipment installation. Clean equipment, piping and supports. Flush out piping systems with clean water before proceeding with tests.

### 3.11 CLOSEOUT ACTIVITIES

- A. Provide in accordance with Division 01 General Requirements.

### 3.12 ATTACHMENTS

- A. Table 1, as referenced throughout the specification section. For establishing a minimum standard for the chemical feed pumps, Table 1 describes components predominately from Milton Roy.

## SECTION 46 66 00

### ULTRAVIOLET DISINFECTION EQUIPMENT

#### PART 1 – GENERAL

##### 1.01 SUMMARY

A. Furnish all labor, materials, equipment and appurtenances required to provide a closed vessel, pressurized flow, high intensity medium pressure lamp, ultraviolet (UV) disinfection system complete with an automatic mechanical/chemical cleaning system or mechanical cleaning and UV intensity monitoring. The UV system shall be complete and operational with all control equipment and accessories specified herein and as shown on the contract drawings.

1. The Owner has determined that specifying proprietary control equipment for the Project is in the public's best interest. The Owner would like to standardize on Allen Bradley control and instrumentation equipment due to the plant's standardization to Allen Bradley.

##### 1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment requirements: per Division 01 General Requirements.

##### 1.03 REFERENCES

A. Reference Standards

1. American National Standards Institute (ANSI)
2. American Society for Testing Materials (ASTM)
3. National Sanitation Foundation (NSF)
  - a. Standard 60
  - b. Standard 61
4. Institute of Electrical and Electronic Engineers (IEEE)
5. National Electric Code (NEC)
6. Standards of the National Electrical Manufacturers Association (NEMA)
7. Environmental Protection Agency (EPA)
  - a. EPA 815-R-06-007, Ultraviolet Disinfection Guidance Manual For The Final Long Term 2 Enhanced Surface Water Treatment Rule
8. The Commonwealth of Massachusetts Department of Environmental Protection Bureau of Resource Protection Drinking Water Program (MassDEP)

- a. Guidelines for Public Water Systems

#### 1.04 ADMINISTRATION REQUIREMENTS

- A. Coordination, Sequencing, and Scheduling: per Division 01 General Requirements.

#### 1.05 SUBMITTALS

- A. Submit in accordance with Division 01 General Requirements.

- B. Product Data

- 1. Complete description in sufficient detail to permit comparison with the specifications.

- a. Manufacturer and model
- b. Design Flow Rate
- c. Design UVT
- d. Validated Design RED
- e. Headloss at design flow and at 1,250 gpm
- f. Lamp orientation to flow
- g. Number of individual lamps
- h. Lamp arrangement (number of rows, etc.)
- i. Individual lamp output
- j. Rated maximum flow rate for each individual unit (assuming 98% transmittance)
- k. Location, orientation, and number of baffles (if any)
- l. Minimum flow require for cooling with all lamps active
- m. Iron and manganese concentration limits at which sleeve fouling is anticipated to become a problem.
- n. Normally-supplied inlet/outlet flange size
- o. Power requirements (peak and operating levels) of the complete UV system, as well as individual power requirements of each reactor and each control panel (voltage and amps).
- p. Special tools required
- q. Anticipated life and cost of replacement parts and consumables including but not limited to the following:
  - 1) Lamps
  - 2) Sleeves

- B. All ultraviolet disinfection equipment furnished under this Section shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings
- C. Contractor shall confirm that proposed UV equipment meets the design requirements listed in Article 2.02.C, the contract specifications and the drawings. Disinfection equipment shall be:
1. Trojan Technologies, Inc.
  2. Calgon Carbon Corporation
  3. Aquionics, Inc.
  4. Or approved equal.
- D. The UV Manufacturer shall be regularly engaged in the manufacture of UV systems with a proven track record of at least twenty-five (25) comparably sized municipal drinking water application for disinfection credits, each with a flow rate of at least 1.0 USMGD (158 m<sup>3</sup>/hr.). The manufacturer shall provide documentation of their experience with UV disinfection systems in municipal drinking water applications.
- E. The UV Manufacturer shall submit a Bioassay Validation Report for the proposed reactor. The bioassay testing and results shall have been validated by a qualified independent third (3<sup>rd</sup>) party in full compliance with EPA 815-R-06-007, *Ultraviolet Disinfection Guidance Manual For The Final Long Term 2 Enhanced Surface Water Treatment Rule*, released November 2006 and MassDEP's Guidelines and Policies. Bioassay testing shall evaluate reactor performance over the range of flow rates from 0.20.3 to 6.54.8 USMGD, UV Transmittance (UVT) from 70% to 98% (measured at 254 nm, 1 cm path length) and MS2 Reduction Equivalent Dose (RED) ranging from 10 to +10-80 mJ/cm<sup>2</sup>, or T1 Reduction Equivalent Dose (RED) ranging from 2 to 24 mJ/cm<sup>2</sup>. The bioassay testing must encompass the range of design and operating conditions described herein. ***Extrapolations to flow rates, UV Transmittance values, or UV doses outside the range actually tested, shall not be permitted.*** Bioassay testing shall also verify that the headloss generated by the proposed reactor is less than or equal to the specified limits.
- F. Submittals from the UV manufacturer shall include a complete and detailed proposal of equipment offered, including the number of lamps proposed and a detailed description of any exceptions taken to the specification as well as documentation of the UV manufacturer's service capabilities including location and experience.

- G. Regulatory Approvals
  - 1. The equipment must be approved for this use by the Massachusetts Department of Environmental Protection prior to finalizing the equipment purchase.
- H. Pre-Construction Testing
  - 1. As required under “Independent Testing” below.
- I. Independent Testing
  - 1. Validation and reporting shall be performed in accordance with the EPA Ultraviolet Disinfection Guidance Manual and the MassDEP Guidelines for Public Water Systems. It is the Contractor’s responsibility to supply and/or develop all supporting documentation on the specific equipment proposed for this project necessary for the equipment to be approved by the MassDEP.
- J. Certifications
  - 1. National Sanitation Foundation (NSF) Standard 61 approved for use in potable water applications for complete reactor and all appurtenant wetted components.
  - 2. National Sanitation Foundation (NSF) Standard 60 approved for use in potable water applications for chemical reagents and/or solution.
- K. Samples
  - 1. None required.
- L. Mockups
  - 1. None required.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Provide in accordance with Division 01 General Requirement
- B. Acceptance at Site
  - 1. Upon delivery to the site, equipment packages shall be opened, inspected and accounted for.
  - 2. Confirm spare parts and length of cables are provided as specified. Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.

C. Storage and Protection

1. Contractor shall store all equipment delivered to the site in accordance with manufacturer's instruction. Electrical equipment shall be stored in weatherproof, ventilated enclosures.

**1.08 SITE CONDITIONS**

- A. Existing Conditions: per Division 01 General Requirements.

**1.09 MAINTENANCE**

- A. Spare parts as required in Part 2.

**1.10 WARRANTY**

A. Equipment

1. The equipment furnished under this section (excluding UV lamps, ballasts, sleeves and intensity sensors) shall be free of defects in materials and workmanship, including damages that may be incurred during shipping for a period of one (1) year from substantial completion.
2. Manufacturers must provide a performance guarantee that the equipment will be capable of meeting the stated design dose for a minimum of three (3) years from the state of substantial completion.

B. UV Lamps

1. The UV lamps shall be warranted for 5,000 hours of operation (prorated after 3,000 hours) or 36 calendar months from substantial completion.

C. Ballasts

1. The ballasts shall be warranted for a period of ten (10) years from substantial completion. Warranty shall include equipment, materials, labor and installation as necessary.

D. Sleeves

1. The sleeves shall be warranted for ten (10) years from substantial completion.

E. Intensity Sensors

1. The intensity sensors shall be warranted for a period of five (5) years from substantial completion.

- F. Parts replaced under warranty shall carry the original part warranty.

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. The physical layout of the system shown on the contract drawings and the equipment specified herein are based upon the Trojan UVSwift™, as manufactured by Trojan Technologies, London, Ontario, Canada.
- B. The UV system must operate in a closed vessel, use high intensity medium pressure UV lamps, use fully electronic or electromagnetic ballasts with multiple power settings, and incorporate an automatic on-line mechanical/chemical or mechanical sleeve cleaning system for both lamp sleeves and sensor sleeves/windows.

### 2.02 UV DISINFECTON EQUIPMENT

- A. UV Reactor:
  - 1. The UV Manufacturer shall provide equipment to disinfect water with the following characteristics:

Max Facility Flow:	2,500	gpm (US)
Peak (Design) Flow per reactor:	1,250	gpm(US)
Design UVT:	85	% (at 254 nm, 1 cm path length)
Water Temperature:	1°C to 30°C	
Turbidity:	<5 NTU	
Iron:	0.3 ppm	
Manganese	0.3 ppm	

- 2. Design Dose:
  - a. The UV disinfection system shall be designed to deliver the Reduction Equivalent Dose (RED) specified in Article 2.02.C, Performance Requirements. To ensure the UV system can deliver the RED at the end of lamp life, with fouled sleeves, the RED shall incorporate a Combined Aging and Fouling Factor (CAF) calculated as  $CAF = EOLL \times FF$ , where EOLL is the ratio of the lamp output at the end of the lamp life relative to the new lamp output, and FF is the Fouling Factor. The FF shall be 0.5 for UV Systems with no sleeve wiping system, ~~0.75~~0.95 for UV Systems with mechanical only sleeve wiping system, or 0.95 for UV Systems with an on-line combined chemical and mechanical sleeve wiping system. EOLL (End Of Lamp Life) output shall be 80% of the specified new lamp output. A higher value shall be permitted only if the EOLL output has been validated by 3<sup>rd</sup> Party witnessed testing of the output at the end of the warranted lamp life.

- b. The RED shall be delivered by each unit under the Peak (Design) Flow and Design UVT condition specified in 2.02.A.1.
- c. The minimum dose shall conform to the current guidelines of the Low Wavelength UV Disinfection Work Group to address medium-pressure UV action spectra validation issues. The manufacturer shall provide a statement regarding the actions taken through equipment design, validation or correction factors, if necessary, to address these issues. In the event that revalidation has not been conducted or irradiation at wavelengths below 240nm is allowed to penetrate the water, a blanket correction factor of 1.3 shall be applied to the sizing calculations to account for action spectra and other validation factors. Sizing calculation demonstrating the use of this correction factor, if require, shall be provided with the submittal.

~~d. Systems without an automatic on-line mechanical and chemical cleaning system shall include provisions to automatically chemically clean the lamps.~~

e.d. RED must be verified by third party witnessed bioassay testing per Article 1.06.

3. Hydraulics:

- a. Headloss through each UV reactor shall not exceed 5 inches of water at 1,250 gpm.

B. System Components:

1. The UV system shall be comprised of the following components:

- a. UV Reactors: 3 total (2 duty + 1 standby)
- b. Number of lamps per reactor: As necessary to meet specified RED requirements
- c. Expandability: Reactors shall be configured to accept additional lamps after installation to address future demands.
- d. Control Power Panel(s): 1 per reactor
- e. UV Intensity Sensor(s): 1 per lamp
- Automatic Cleaning System: On-line Mechanical/Chemical or Mechanical

C. Performance Requirements:

1. Each UV Reactor shall be capable of providing the RED necessary for 1 log of Cryptosporidium at the Peak (Design) Flow and Design UVT condition specified in 2.02.A.1.
2. The selected reactor shall be configured to accept additional lamps (the maximum number of lamps for the selected reactor) to provide expandability for future demand and treatment capabilities.
3. The system shall be able to continue providing disinfection while the automatic cleaning system is in operation. The system shall be capable of operating without disruption due to fouling at manganese concentrations of 0.5 mg/L or less.
4. The system shall be able to continue providing disinfection while the UV intensity sensor calibration is being checked.
5. System shall be designed to operate in an environment with ambient relative humidity of 5-90% and ambient air temperature of 0-40°C.
6. The UV Reactor shall be of welded construction manufactured from Type 316L stainless steel. The UV Reactor shall be pickled, passivated and bead blasted for uniform external finish.
7. UV Reactor shall occupy a plan footprint no greater than 6 ft<sup>2</sup>. To be considered as an alternate, UV Manufacturers whose reactors occupy greater than 6 ft<sup>2</sup> shall demonstrate to the satisfaction of the Engineer the proper placement of the reactor within the current design layout.
8. The UV Reactor shall be designed to handle a maximum operating pressure of 150 psig, and shall be fully assembled and hydrostatically tested to 1.5 times the rated operating pressure, for at least 10 minutes without leakage, in the factory prior to shipment.
9. Each UV Reactor shall be a nominal 12 inches in diameter. Each UV Reactor shall be supplied with 12 inch ANSI 150 lb. flanged inlet/outlet connections. To be considered as an alternate, UV Manufacturers whose reactor diameter is greater than 12 inches shall demonstrate to the satisfaction of the Engineer the placement of the reactor within the current design layout meets the required geometric validation conditions and any applicable MassDEP installation requirements and that adequate space for operations and maintenance is available. Any additional costs, including construction and engineering costs, associated with use of reactor diameters greater than 12 inches shall be the responsibility of the Contractor.
10. The UV system design length, including EPA and MassDEP required upstream and downstream piping and reactor operations and maintenance areas, shall fit within the building footprint and piping system as shown on

the Drawings. To be considered as an alternate, UV Manufacturers whose UV system design length differs from the length shown on the Drawings shall demonstrate to the satisfaction of the Engineer the design layout meets required geometric validation conditions, the EPA and MassDEP installation requirements (noted below) and that adequate space for operations and maintenance is available. Any additional costs, including construction engineering costs, associated with an alternate design that requires a larger building footprint and piping system and is approved by the Engineer, shall be the responsibility of the Contractor.

a. Minimum Installation Requirements

- 1) Required Upstream Stream Straight Length: validation straight length plus five (5) pipe diameters.
  - 2) Required Downstream Straight Length: five (5) pipe diameters.
  - 3) Neither control valves nor changes in pipe diameter shall be allowed within the upstream and downstream straight length.
11. Each UV reactor shall consist of high intensity medium pressure UV lamps.
  12. Each lamp shall be enclosed in an individual quartz sleeve, one end of which shall be closed and the other sealed with compressed O-rings.
  13. Each quartz sleeve shall be independently sealed within the reactor.
  14. The UV reactor shall be designed such that operating personnel at the plant can change the lamps without draining the reactor.
  15. The UV reactor shall be provided with access ports for easy access to the quartz sleeves and cleaning system.
  16. All access for reactor components, including lamps, sleeves and cleaning system shall be from the same side. Designs requiring access from more than one side of the reactor are not permitted.
  17. Piping shall be designed so that the reactor will be full of water at all times. Air trapped in the reactor shall result in reactor shut down to avoid overheating.
  18. UV reactor shall be provided with a drain port.
  19. The UV Lamps shall reach maximum UV output within three (3) minutes (defined as the warm-up period).

20. All wetted components within the reactor shall be NSF 61 certified.

D. UV Lamps:

1. The UV lamps shall be high intensity, medium pressure type.
2. The filament shall be significantly rugged to withstand shock and vibration.
3. The lamp bases shall be resistant to UV and ozone.
4. The lamps shall be operated by variable output electronic or electromagnetic ballasts with 1% power increments or stepped power, from 40% to 100% of full rated output.

E. UV Lamp Sleeves:

1. The UV lamp sleeves shall fully annealed clear fused quartz tubing.
2. Lamp sleeves shall be domed at one end.
3. The open end of the lamp sleeve shall be sealed by means of an O-ring and Type 316 stainless steel compression plate.

F. UV Intensity Sensor(s):

1. The UV Intensity Sensor(s) shall be located inside the reactor and contained within protective quartz sleeves.
2. One (1) sensor shall be provided per lamp.
3. Sensor(s) shall incorporate SiC diodes, and provide NIST-traceable measurement with a total absolute uncertainty of 15% or less at an 80% confidence level. Provide documentation that sensors meet NIST.
4. Sensor(s) must meet the requirements of the EPA 815-R-06-007. Sensor(s) must filter out wavelengths below 240 nm, and have a spectral response peaking between 250 nm and 280 nm with less than 10% coming from wavelengths greater than 300 nm.
5. The complete Sensor assembly and the internal circuit board containing the diode shall each be serialized.

~~6. For units equipped with more than one sensor, the meter shall display the average percent intensity based on the point source summation (PSS) method.~~

7.6. The sensors shall be calibrated to account for lamp geometry.

G. Ballasts:

1. Ballasts may be either electronic or electromagnetic.
2. Ballasts shall have a variable operation range of 40% to 100% of full rated output and be adjustable in 1% increments or stepped power increments.
3. The maximum allowable total current harmonic distortion (current THD) shall not exceed 10% at the maximum power level. Harmonics created by the UV equipment shall not exceed IEEE 519 guidelines at the line side of the UV main disconnect.
4. Ballasts shall have a mean design life expectancy of at least 10 years.

H. Control Power Panel (CPP):

1. Power distribution and control for each UV Reactor shall be through the associated CPP. The CPP shall house all power supplies and control hardware.
2. Coordinate with selected UV Vendor for final wiring configuration. The CPP ~~shall be currently~~ designed to operate with the following electrical supply:
  - a. 480/277 VAC 3 phase 60Hz, 4 wire + ground
- ~~3. The maximum total power consumption rating per CPP shall be no greater than 5 amps maximum current per phase (unbalanced load).~~
- ~~4.3.~~ The CPP enclosure shall be epoxy painted carbon steel.
- ~~5.4.~~ The CPP enclosure shall be Type 12 (IP54), ventilated.
- ~~6.5.~~ The CPP enclosure shall be forced-air cooled.
- ~~7.6.~~ The CPP shall include an Ethernet switch
- ~~8.7.~~ The CPP shall include a battery backup to power all the SCADA equipment in the CPP panel (PLC, OIT, Ethernet switch, etc.)
- ~~9.8.~~ Signal wiring interfacing the UV Reactor with the CPP, shall be as shown on the contract drawings.
- ~~10.9.~~ The cable length between the CCP and the UV Reactor shall be provided as necessary based on the system layout shown on the Drawings.
- ~~11.10.~~ Each CPP shall be provided with a lockable disconnect handle that shall shut down the reactor/cabinet power when the cabinet door is opened.

I. Control and Instrumentation:

1. General

- a. One (1) Control Power Panel (CPP) is provided for each UV Reactor. All control hardware and software for a given reactor is contained within the associated CPP.
- b. Each UV reactor shall be controlled independently.
- c. Each UV reactor shall be controlled by an Allen Bradley Compact Logix ~~L35~~ which continuously monitors and controls the UV reactor's functions. Custom electronics, an input flow signal (supplied by others), and the UV sensor(s), provide the PLC with the necessary indications of system parameters.
- d. Control of multiple reactors shall be accomplished through SCADA (by Owner).

2. Operator Interface

- a. Complete control and monitoring of each UV reactor shall be accomplished through the operator interface located on the CPP.
- b. The operator interface shall be the Allen Bradley Panelview+~~700~~.
- c. The operator interface shall be menu driven, and shall display the following system information when prompted: reactor status, individual lamp status, lamp operating hours, RED (dose), UV Intensity, power level, alarms, alarm history.
- d. The most recent alarms shall be displayed on the operator interface when prompted, recorded by alarm type, date and time of occurrence, and date and time of correction.

3. Remote Monitoring/Control

- a. The communication between the UV reactors and the plant control center shall be through the following protocol:
  - Allen Bradley – Ethernet
- b. Each reactor shall be capable of being placed in either Local or Remote mode.
- c. Submit to Engineer program addresses for sending/receiving data via the Ethernet network.
- d. The most recent alarms shall be displayed on the operator interface when prompted, recorded by alarm type, date and time of occurrence, and date and time of correction

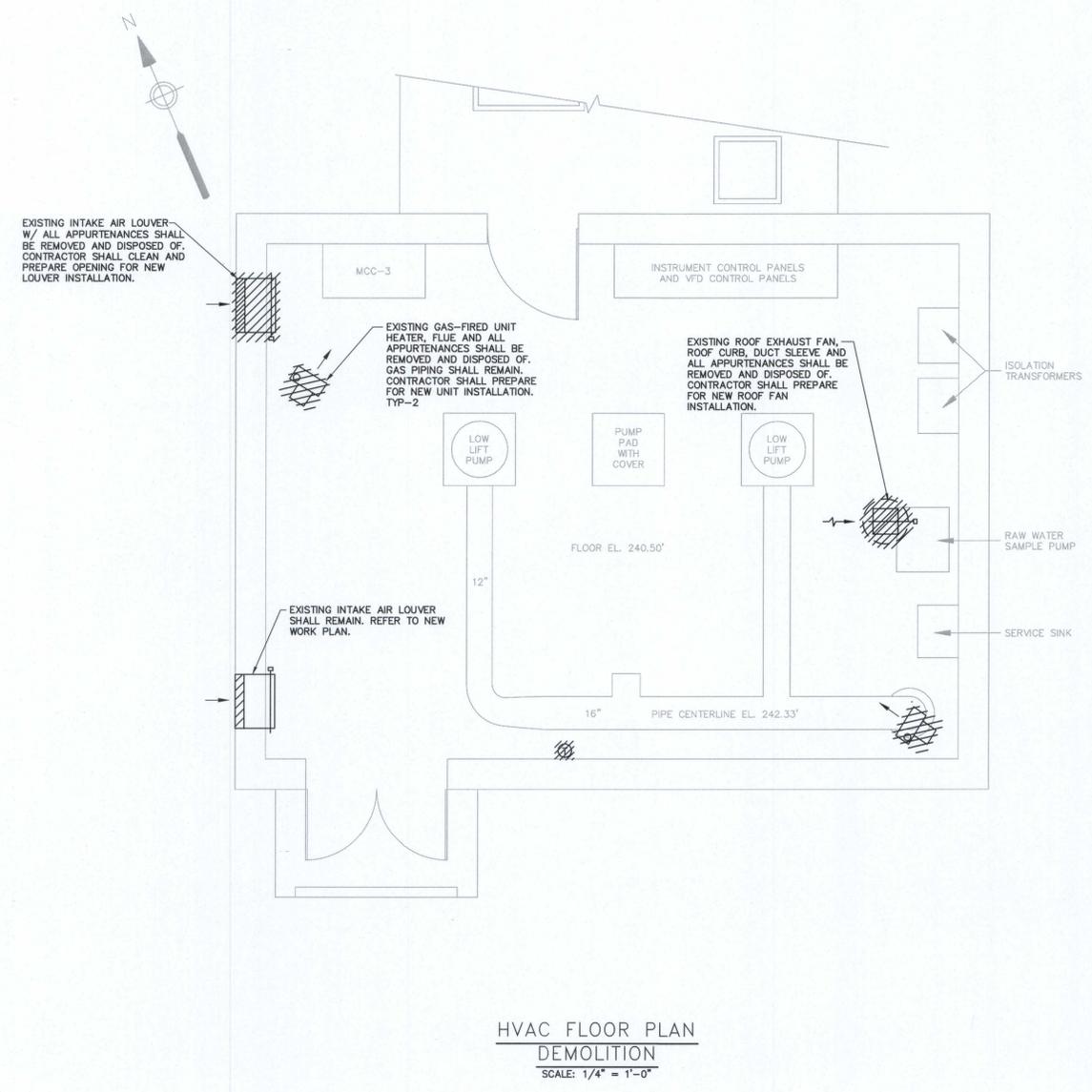
**DRAWINGS  
REPLACEMENT SHEETS**

**HVAC DEMOLITION NOTES:**

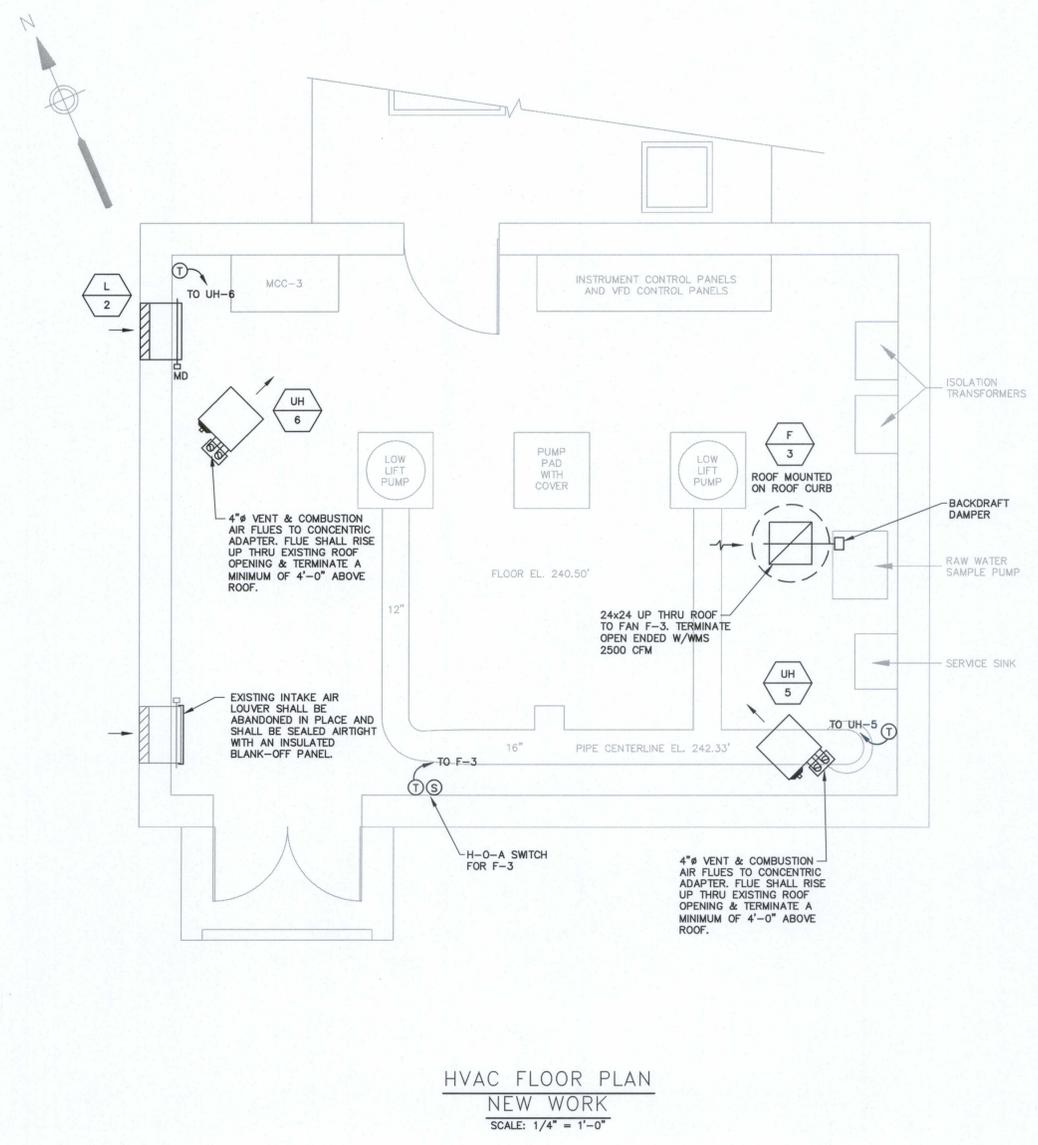
1. THE INTENT OF THE DEMOLITION PLANS IS TO IDENTIFY EXISTING CONDITIONS. HOWEVER, ALL HVAC DEVICES MAY NOT NECESSARILY BE INDICATED ON THE DRAWINGS. FIELD VERIFY AND ADJUST WORK TO SUIT ALL CONDITIONS FOUND.
2. ALL ITEMS SHOWN HATCHED ARE ITEMS TO BE REMOVED AND DISPOSED.
3. ALL ITEMS INDICATED FOR REMOVAL SHALL BE REMOVED WITH ALL ASSOCIATED HARDWARE AND ACCESSORIES COMPLETE BACK TO THE SOURCE. ALL FLOOR AND WALL PENETRATIONS NOT BEING RE-USED SHALL BE IN-FILLED AND BROUGHT TO A FINISHED APPEARANCE.

**HVAC GENERAL NOTES:**

1. THERMOSTATS INSTALLED ON PERIMETER WALLS SHALL BE MOUNTED ON INSULATED BACKPLATES.
2. CONTRACTOR SHALL RE-CONNECT EXISTING GAS PIPING TO NEW UNIT HEATERS.



**HVAC FLOOR PLAN  
DEMOLITION**  
SCALE: 1/4" = 1'-0"



**HVAC FLOOR PLAN  
NEW WORK**  
SCALE: 1/4" = 1'-0"

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REV	DESCRIPTION	DATE	CHECKED BY: MJ	DATE
D	ADDENDUM NO. 2 (EXISTING EQUIPMENT SHOWN)	10/23/14		
C	ADDENDUM NO. 1 (NO MODIFICATIONS TO THIS SHEET)	10/21/14		
B	ISSUE FOR BID	10/17/14		
A	FOR MASSDP REVIEW	6/20/14		

DESIGNED BY: JF  
DRAWN BY: JF  
CHECKED BY: MJ  
DATE: 2/28/11 H-101/06

**RAW WATER BUILDING  
HVAC FLOOR PLAN**

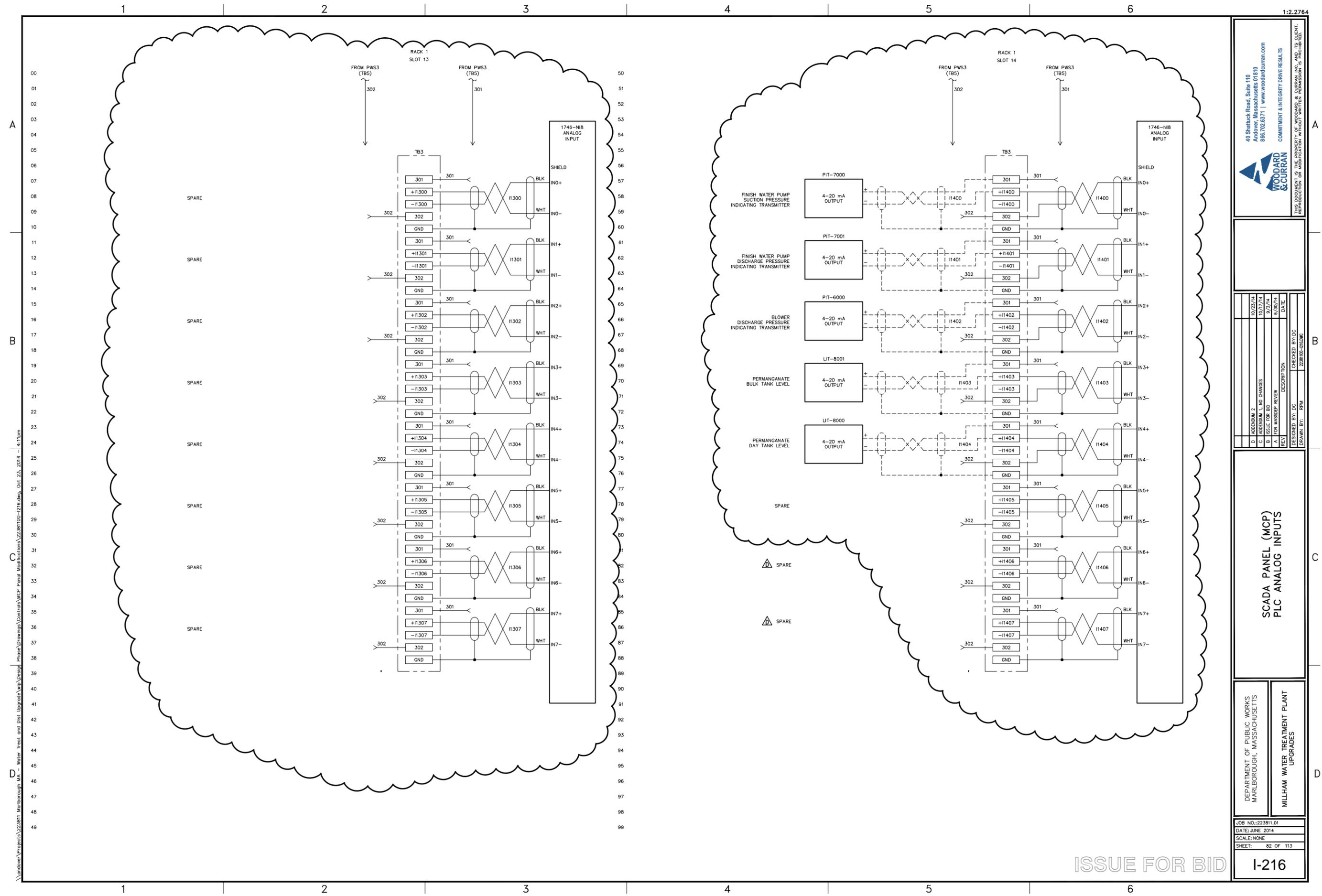
DEPARTMENT OF PUBLIC WORKS  
MARLBOROUGH, MASSACHUSETTS  
MILLHAM WATER TREATMENT PLANT  
UPGRADES

JOB NO.: 223811.01  
DATE: OCTOBER 2014  
SCALE: AS NOTED  
SHEET: 30 OF 71

**H-101**

ISSUE FOR BID

\\andover\projects\223811\marlborough.ma - water treat and dist upgrade\wp\design\phases\Drawings\HVAC\223811 H-101.dwg, Oct 20, 2014 - 2:15pm



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ADDENDUM 2	10/23/14		
ADDENDUM 1, NO CHANGES	10/17/14		
B ISSUE FOR BID	9/23/14		
A FOR MASSEP REVIEW	8/29/14		
REV	DESCRIPTION	DATE	
DESIGNED BY: DC	CHECKED BY: DC		
DRAWN BY: RHM			

**SCADA PANEL (MCP)  
 PLC ANALOG INPUTS**

DEPARTMENT OF PUBLIC WORKS  
 MARLBOROUGH, MASSACHUSETTS

MILLHAM WATER TREATMENT PLANT  
 UPGRADES

JOB NO.: 223811.01  
 DATE: JUNE 2014  
 SCALE: NONE  
 SHEET: 82 OF 113

\\andover\Projects\223811\_Marlborough\_MA\_-\_Water\_Treat\_and\_Dist\_Upgrade\WP\_Design\_Phase\Drawings\Controls\MCP\_Panel\_Modifications\22381101-1216.dwg, Oct 23, 2014, 4:11pm