



11 North Water St.  
Suite 10290, Office 1080  
Mobile AL, 36602

[www.GarverUSA.com](http://www.GarverUSA.com)

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## **ADDENDUM NO. 1**

**Date:** September 9, 2026  
**Project Name:** MAWSS C.C. Williams Headworks Rehabilitation and Odor Control  
**Owner:** Mobile Area Water and Sewer System  
**Garver Project No.** W10-2402007

This addendum shall be a part of the Plans, Contract Documents and Specifications to the same extent as though it were originally included therein, and it shall supersede anything contained in the Plans, Contract Documents, and Specifications with which it might conflict. This addendum, including all attachments, shall become part of the Contract and all provisions of the Contract shall apply thereto, with exception of any items listed under "Other Project Information" at the end of this Addendum No. 1, which are supplements provided for the Contractor's convenience. The time provided for completion of the Contract has not been changed as noted in this addendum. Acknowledgement of receipt of this addendum must be noted in the appropriate section of the Proposal and included with the Contract Documents.

### **A. PART 1 – CONTRACT DOCUMENTS**

1. Remove the following Part 1 sections in their entirety and replace with the same, attached hereto:
  - a. Part 1 – 6 Proposal
    - i. Proposal bid form Items 9 and 10 updated units from CY to SY.
    - ii. Proposal bid form Item 12 updated cost for the pre-negotiated Headcell inlet chute materials.

### **B. PART 3 - TECHNICAL SPECIFICATIONS**

1. Remove the following specification sections in their entirety and replace with the same, attached hereto:
  - a. 01 14 00 Work Restrictions
  - b. 23 33 00 Air Duct Accessories
  - c. 31 63 16 Auger Cast Grout Piles
  - d. 31 66 13 Aggregate Pier Ground Improvement
  - e. 40 05 07 Hangers and Supports for Process Piping
  - f. 40 23 39.61 Fiber Reinforced Pipe and Fittings Data Sheet
  - g. 40 73 26 Differential and Gauge Pressure Transmitters
  - h. 44 11 29 Bio-Trickling Filter Odor Control System

- i. 44 61 16 Carbon Adsorber Odor Control System
- j. 46 23 23.16 Stacked Tray Vortex Grit Removal Equipment
- 2. Remove certain sections in the following Specifications:
  - a. 40 05 57 Actuators for Process Valves and Gates section 2.3.F.2

C. DRAWINGS

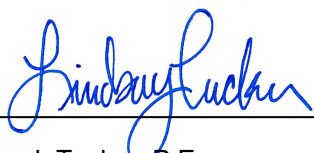
- 1. Remove and replace the drawing sheet and replace with the same, attached hereto:
  - a. 01-G007
  - b. 20-X102
  - c. 20-S101

D. STANDARD DETAILS

- 1. Add the following standard detail, attached hereto:
  - a. D22 0529-012
- 2. Remove the following standard details and replace with the same, attached hereto:
  - a. D22 0529-001
  - b. D22 0529-002

E. OTHER PROJECT INFORMATION (uploaded to the Q&A section of the plan room)

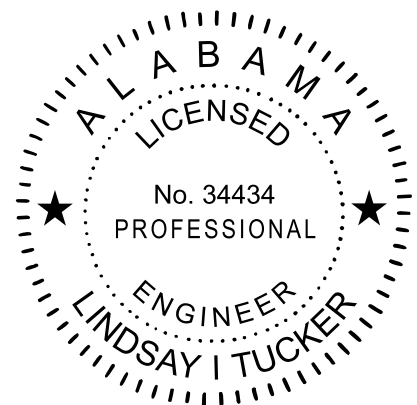
- 1. Geotechnical Report
- 2. Record Drawings for Headworks Facility
- 3. Question and Answer Log

By: 

Lindsay I. Tucker, P.E.  
Project Manager

Attachments:

- A. Specifications
  - 1. Proposal
  - 2. 01 14 00 Work Restrictions
  - 3. 23 33 00 Air Duct Accessories
  - 4. 31 63 16 Auger Cast Grout Piles
  - 5. 31 66 13 Aggregate Pier Ground Improvement
  - 6. 40 05 07 Hangers and Supports for Process Piping
  - 7. 40 23 39.61 Fiber Reinforced Pipe and Fittings Data Sheet
  - 8. 40 73 26 Differential and Gauge Pressure Transmitters
  - 9. 44 11 29 Bio-Trickling Filter Odor Control System
  - 10. 44 61 16 Carbon Adsorber Odor Control System
  - 11. 46 23 23.16 Stacked Tray Vortex Grit Removal Equipment



- B. Drawings
  - 1. 01-G007
  - 2. 20-X102
  - 3. 20-S101
- C. Standard Details
  - 1. INDEX
  - 2. D22 0529-001
  - 3. D22 0529-002
  - 4. D22 0529-012

END OF ADDENDUM NO. 1

## **PROPOSAL**

**TO: BOARD OF WATER AND SEWER COMMISSIONERS OF THE CITY OF MOBILE  
ALABAMA**

Submitted: \_\_\_\_\_  
(Date)

The undersigned, as Bidder, hereby declares that he has examined the site of the Work and informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that he has examined the Plans and Specifications for the Work and all Contract Documents relative thereto, and has read the Board's Standard Specifications and all General Conditions and Special Provisions furnished; and that he has satisfied himself relative to the Work to be performed.

The Bidder proposes and agrees, if this Proposal is accepted, to contract with the Board of Water and Sewer Commissioners of the City of Mobile, Alabama, in the form of contract specified to furnish all materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the following Work:

**CC WILLIAMS HEADWORKS REHABILITATION AND ODOR CONTROL  
GARVER PROJECT NO. W10-2402007**

in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Plans, Specifications and all other Contract Documents to the full and entire satisfaction of the Board of Water and Sewer Commissioners of the City of Mobile, Alabama with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and other Contract Documents for the lump sum or unit prices listed opposite each item.

It is agreed that the description under each item, being briefly stated, implies, although it does not mention, all incidentals and that the prices stated are intended to cover all such work, materials and incidentals as constitute Bidder's obligations as described in the Specifications and any details not specifically mentioned, but evidently included in the Contract shall be compensated for the item in which it most logically is included.

The quantities for bid items listed on the Proposal sheet are estimated quantities only for the purpose of comparing bids. Any differences between these estimated quantities and actual quantities required for this Contract shall not be taken as a basis for claims

by the Contractor for extra compensation. Compensation will be based on the lump sum or unit prices and actual construction quantities.

The Bidder further proposes and agrees hereby to commence the Work with an adequate force, plant and equipment at the time stated in the notice to the Contractor from the Engineers to proceed and reach Substantial Completion of the work within 270 consecutive calendar days from and after the date stated in said notice and to achieve Final Completion of the work within an additional 30 days after Substantial Completion.

The undersigned further agrees that, in case of failure on his part to execute the said Contract and the bond within 10 consecutive calendar days after written notice being given of the award of the Contract, the check or bid bond in the amount of 5 percent of this bid accompanying this bid, and the monies payable thereon, shall be paid into the funds of the Board of Water and Sewer Commissioners of the City of Mobile, Alabama as liquidated damages for such failure; otherwise the check or bid bond accompanying this Proposal shall be returned to the undersigned:

Attached hereto is a certified check on the

\_\_\_\_\_ Bank of  
\_\_\_\_\_ or a Bid Bond for the  
sum of \_\_\_\_\_ Dollars  
(\$\_\_\_\_\_) made payable to the Board of Water and Sewer  
Commissioners of the City of Mobile Alabama.

By \_\_\_\_\_  
(Legal Signature)

\_\_\_\_\_  
(Printed Name and Title)

Witness: \_\_\_\_\_  
(Legal Signature)

Witness: \_\_\_\_\_  
(Legal Signature)

ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_

CONTRACTOR'S LICENSE NO:

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BIDDER acknowledges receipt of the following ADDENDA:

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**BID FORM****MAWSS CC WILLIAMS HEADWORKS REHABILITATION AND ODOR CONTROL****BASE BID**

| <b>Base Bid No.</b> | <b>Item</b>                                                                                                                             | <b>Unit</b> | <b>Qty</b> | <b>Unit Price</b> | <b>Total Item Price</b> |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|-------------------|-------------------------|
| 1                   | Mobilization and Demobilization (not to exceed 5% of total base bid)                                                                    | 1           | LS         | N/A               |                         |
| 2                   | All Work as defined in the Contract Documents for the Facility 05 – Site Civil improvements except for those listed separately below.   | 1           | LS         | N/A               |                         |
| 3                   | All Work as defined in the Contract Documents for the Facility 10 – Odor Control improvements except for those listed separately below. | 1           | LS         | N/A               |                         |
| 4                   | All Work as defined in the Contract Documents for the Facility 20 – Headworks improvements except for those listed separately below.    | 1           | LS         | N/A               |                         |
| 5                   | All Work to furnish and install Toxic Gas Detection System as specified in Section 40 76 20.                                            | 1           | LS         | N/A               |                         |
| 6                   | All Work to furnish and install Stacked Tray Vortex Grit Removal improvements as specified in Section 46 23 23.16.                      | 1           | LS         | N/A               |                         |
| 7                   | Additional System 2 submerged metal coating above the quantity required by the Contract Documents as specified in Section 09 96 00.     | 100         | SF         |                   |                         |
| 8                   | Additional System 3 exposed metal coating above the quantity required by the Contract Documents as specified in Section 09 96 00.       | 100         | SF         |                   |                         |
| 9                   | Additional Concrete Paving including compacted base above the quantity required by Contract Documents.                                  | 10          | SY         |                   |                         |
| 10                  | Additional Asphalt Paving including compacted base above the quantity required by Contract Documents.                                   | 10          | SY         |                   |                         |

|    |                                                                                                                                   |    |    |     |           |
|----|-----------------------------------------------------------------------------------------------------------------------------------|----|----|-----|-----------|
| 11 | Additional Fencing above amount quantity required by Contract Documents as specified in Section 32 31 13.                         | 20 | LF |     |           |
| 12 | Pre-negotiated firm price for the Head-cell Inlet Chutes as defined by Section 46 23 23.16 for the lump sum of: \$195,360 Dollars | 1  | LS | N/A | \$195,360 |
| 13 | Owner Contingency Allowance                                                                                                       | 1  | LS | N/A | \$200,000 |

**TOTAL BASE BID AMOUNT \$ \_\_\_\_\_**

**ADDITIVE ALTERNATES**

| <b>Alter-<br/>nate No.</b> | <b>Item</b>                                                                                                                     | <b>Unit</b> | <b>Qty</b> | <b>Unit Price</b> | <b>Total Item Price</b> |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------|------------|-------------------|-------------------------|
| 1                          | All Work as defined in the Contract Documents for the Facility 30 – Primary Effluent Pump Station improvements.                 | LS          | 1          | N/A               |                         |
| 2                          | Work as defined in the Contract Documents for the Facility 25 – Primary Clarifiers improvements concrete coating repairs        | LS          | 1          | N/A               |                         |
| 3                          | Work as defined in the Contract Documents for the Facility 25 – Primary Clarifiers improvements mechanism center column coating | LS          | 1          | N/A               |                         |

**BASE BID PLUS ADDITIVE ALTERNATES AMOUNT \$ \_\_\_\_\_**

All bid alternate prices shall be filled in. The acceptance or rejection of any or all these bid alternates is at the option of the Owner.

**FAILURE TO FULLY COMPLETE THIS PAGE AND INCLUDE A HANDWRITTEN  
SIGNATURE MAY BE CAUSE FOR REJECTION OF BID.**

**SSO AND UNPERMITTED DISCHARGE PREVENTION NOTIFICATION:**

Sanitary Sewer Overflows (SSOs) and unpermitted discharges of wastewater to the environment are a violation of Federal and State laws, as well as a breach of this Contract. The Contractor and associated subcontractors, vendors, and other entities and persons chosen to complete this Work shall not, through act or omission, discharge untreated wastewater to the environment or cause wastewater to back up into a building. The Contractor hereby agrees to indemnify the Owner if the Owner is assessed penalties or fines, receives regulatory actions, or has claims, actions, or suits filed against it by any person or entity as a result of SSOs or unpermitted discharges caused by act or omission of the Contractor and/or any entity or person performing Work in the Contractor's behalf under this Contract. The Contractor shall reimburse the Owner for all damages, losses, penalties, fines, judgments, interest, costs, and expenses of every nature incurred by the Owner, including but not limited to reasonable attorney's fees, arising from or associated with each SSO or unpermitted discharge. In addition, the Contractor shall pay the following penalties to the Owner for SSOs and unpermitted discharges caused by the Contractor or any entity or person performing Work in the Contractor's behalf, regardless of whether such SSOs or discharges reach waters of the State.

| <u>ESTIMATED VOLUME SPILLED</u> | <u>PENALTY AMOUNT</u> |
|---------------------------------|-----------------------|
| 0 to 10,000 gallons             | \$1,000               |
| 10,001 to 25,000 gallons        | \$2,000               |
| 25,001 to 50,000 gallons        | \$2,500               |
| 50,001 to 150,000 gallons       | \$3,000               |
| More than 150,000 gallons       | \$6,000               |

I, having authority to execute this document, have reviewed the above Notification, therein.

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Contractor Name

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Street

City

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Signature

## SECTION 01 14 00 – WORK RESTRICTIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Work restrictions
  - 2. Work sequencing
- B. Related Section:
  - 1. Section 01 20 00 – Price and Payment Procedures
  - 2. Section 01 32 16 – Construction Progress Schedule
  - 3. Section 01 50 00 – Temporary Facilities and Controls
  - 4. Section 01 70 00 – Execution Requirements
  - 5. Section 01 77 00 – Closeout Procedures

#### 1.2 GENERAL WORK RESTRICTIONS

- A. Wastewater Treatment Facilities:
  - 1. The existing facility is the Mobile Area Water and Sewer Service's only means of treating domestic and industrial wastewater prior to discharging to the Alabama River. Impairing the operational capabilities of this facility will result in serious environmental damage and monetary fines.
  - 2. Contractor shall bear the cost of penalties imposed on the Owner for discharge violations or other violations caused by actions of the Contractor.
  - 3. Conduct work in a manner that WILL NOT impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
  - 4. The status of the treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit.
- B. Time Restrictions for Performing Work:
  - 1. Regular operating hours as determined by the Owner.
  - 2. Special accommodations may be made during specific portions of the work to be performed outside of regular operating hours, as needed and prior approved by Owner.
- C. Onsite Workday Restrictions:
  - 1. DO NOT perform Work on Site during Work blackout days specified by Owner.
- D. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- E. Provide safe, continuous access to process control equipment for plant operations personnel.
- F. Noise, Vibration, Dust, and Odors:
  - 1. Coordinate with Owner operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy.
  - 2. Notify Engineer or Owner NOT less than five days in advance of proposed disruptive operations.
  - 3. Obtain Engineer's or Owner's written permission before proceeding with disruptive operations.

- G. Smoking and Controlled Substance Restrictions:
  - 1. Use of tobacco products, alcoholic beverages, marijuana, and other controlled substances on Project Site, premises, or on Owner's property is NOT permitted.
- H. Employee Identification:
  - 1. Provide identification tags for Contractor personnel working on Project Site. Require personnel to use identification tags at all times.
- I. Employee Screening:
  - 1. Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project Site.
  - 2. Maintain list of approved screened personnel with Owner's representative.

### 1.3 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site:
  - 1. Contractor shall have limited use of Project Site for construction operations as specified in Drawings by the Contract limits and as specified in this Section.
- B. Limits on Use of Site:
  - 1. Limit use of Project Site to Work in areas specified.
  - 2. DO NOT disturb portions of Project Site beyond areas in which the Work is specified.
- C. Limits on Use of Site:
  - 1. Limit use of Site and premises to allow:
    - a. Owner occupancy
    - b. Work by Owner
    - c. Work by Others
    - d. Use by the public where required
  - 2. Driveways, Walkways, and Entrances:
    - a. Keep driveways, parking areas, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. DO NOT use these areas for parking or for storage of materials.
    - b. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on Site.
- D. Construction Operations:
  - 1. Limited to areas specified in Drawings.
  - 2. Noisy and Disruptive Operations (such as Use of Jack Hammers and Other Noisy Equipment):
    - a. NOT allowed in close proximity to existing building during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.
- E. Sound Level Restrictions:
  - 1. Sound pressure level measured at boundary of Site SHALL NOT exceed levels required by local ordinances or codes, and at NO time shall exceed 50 dBA

### 1.4 FACILITY OPERATIONS

- A. Existing Utility Interruptions:

1. DO NOT interrupt utilities serving facilities occupied by Owner or others unless permitted under the conditions, and only after arranging for temporary utility services as specified:
    - a. Notify Engineer and Owner NOT less than seven days in advance of proposed utility interruptions.
    - b. Submit outage request plan to Engineer and Owner itemizing dates, times, and duration of each requested outage.
    - c. Obtain Owner's written permission before proceeding with utility interruptions.
- B. Existing Operations Interruptions:
1. DO NOT shutdown, interrupt, or otherwise impair the operational capability of treatment facilities or processes unless permitted under the following conditions. A facility or process shall be considered operational when it can achieve its defined treatment or process objective as defined by the Owner or Engineer.
  2. Specify required shutdowns of existing facilities or interruptions of existing operations on Construction Progress Schedule.
  3. Where required to minimize interruptions or impairments to systems operations while complying with specified work constraints, provide temporary treatment equipment, pumping, bypass systems, connections, power, lighting, controls, instrumentation, and safety devices.
  4. DO NOT remove or demolish systems required to keep the existing facilities operational at the capacities specified until the existing systems are replaced by temporary or new systems.
- C. Shutdown Constraints:
1. Perform work within critical operational constraints:
    - a. No more than two headworks channels shall be offline at a given time. Preference is to only have one channel down at a time unless common wall repairs require both to be offline.
    - b. Shutdown of headworks channels can only be done with half of the facility offline at a time, so only Channels 1 and 2 can be down, or Channels 3 and 4.
    - c. A detailed schedule of proposed shutdowns is required from the Contractor and to be approved by the Engineer and MAWSS prior to initiating any shutdown activities.
- D. Shutdown Definitions:
1. Minor Shutdown:
    - a. Any shutdown requiring less than 2 hrs.
  2. Major Shutdown:
    - a. Any shutdown other than a minor shutdown.
  3. Dry Weather Period:
    - a. Generally, June 15 – October 1
    - b. Final determination made by Owner based on weather, flows entering the plant, and plant operation requirements.
  4. Wet Weather Period:
    - a. Any time NOT within the defined dry weather period.
  5. Low Flow Period:
    - a. 2:00am – 6:00am

- E. Shutdown Procedures:
1. Notify Engineer and Owner NOT less than fifteen (15) days in advance of proposed minor shutdowns.
  2. Notify Engineer and Owner NOT less than thirty (30) days in advance of proposed major shutdowns.
  3. Contractor shall schedule a shutdown coordination meeting with Owner and Engineer one week prior to each shutdown.
  4. Any and all plant shutdowns shall require a shutdown plan, including detailed schedule, backup tools and equipment, personnel involved, contingency plan, and any procedures involved in restarting the process or facility.
  5. Obtain Engineer's or Owner's written permission before proceeding with proposed shutdowns.
  6. Shutdowns may be limited to low flow periods.

## 1.5 WORK SEQUENCE

- A. Use identified work sequences in this section as a guideline for scheduling and performing work. Perform work in a manner that WILL NOT prevent the facility from achieving the final treated water quality requirements established by regulation. It is ultimately the responsibility of the Contractor to execute the work in a sequence that meets all requirements of the contract documents.
- B. Work sequence and constraints presented DO NOT include all items affecting completion of the Work. They are intended to describe critical events necessary to minimize disruption to existing operations and to ensure compliance with treatment regulations and permit requirements.
- C. Construct Work in phases in order to accommodate Owner's occupancy requirements during construction period. Coordinate construction schedule and operations with Engineer and Owner:
1. Phase 1: Headworks Concrete Restoration
    - a. Mobilization
    - b. Empty Screen Channels 3 and 4 and west side of influent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - c. Empty Screen Channels 1 and 2 and east side of influent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - d. Empty Discharge Boxes to Clarifiers **3 and 4 (REVISED BY ADDENDUM NO.1)** and west side of effluent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - e. Empty Discharge Boxes to Clarifiers **1 and 2 (REVISED BY ADDENDUM NO.1)** and east side of effluent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - f. Empty Headcells 1 and 2 and east side of effluent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - g. Empty Headcells 3 and 4 and west side of effluent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - h. Empty Headcells 2 and 3 and middle of effluent channel
      - 1) Complete cleaning and repairs
      - 2) Install duct connections for odor control
    - i. Install handrail around head cell area
    - j. Install employee gas monitoring system at headworks area

2. Phase 2: PCEPS
  - a. Sequence 1: Install elevated catwalk as noted
3. Phase 3: Odor Control
  - a. Relocate plant drain
  - b. Construct pipe support system and footers for ductwork
  - c. Construct pad for BTF, fans, and carbon adsorber
  - d. Install fans, BTF, carbon adsorber, and other equipment.
  - e. Electrical, plumbing for BTF at pad.
  - f. Install ductwork at headworks and aerial piping to connect to BTF pad.
4. Phase 4: Primary Clarifier Effluent Box and Center Column
  - a. Coordinate sequencing shutdown plan with MAWSS on Primary Clarifier draining. Coordinate work with Phase 1 Sequence 5 and 6 for Primary Clarifier isolation and draining.
  - b. Prep and repair concrete surfaces of all four clarifier effluent boxes.
  - c. Sequentially drain primary clarifiers as needed to access center column for cleaning and coating.
5. Final Site Restoration
  - a. Final grading, pavement, and site cleanup
  - b. Demobilization

#### 1.6 SEQUENCING OF CONSTRUCTION PLAN

- A. Before start of construction, post electronic file to Project website of construction plan regarding phasing of project and new Work for acceptance by Owner.
- B. After acceptance of plan, comply with accepted plan when coordinating construction sequencing unless deviations are accepted by Owner in writing.

#### PART 2 - PRODUCTS (NOT USED)

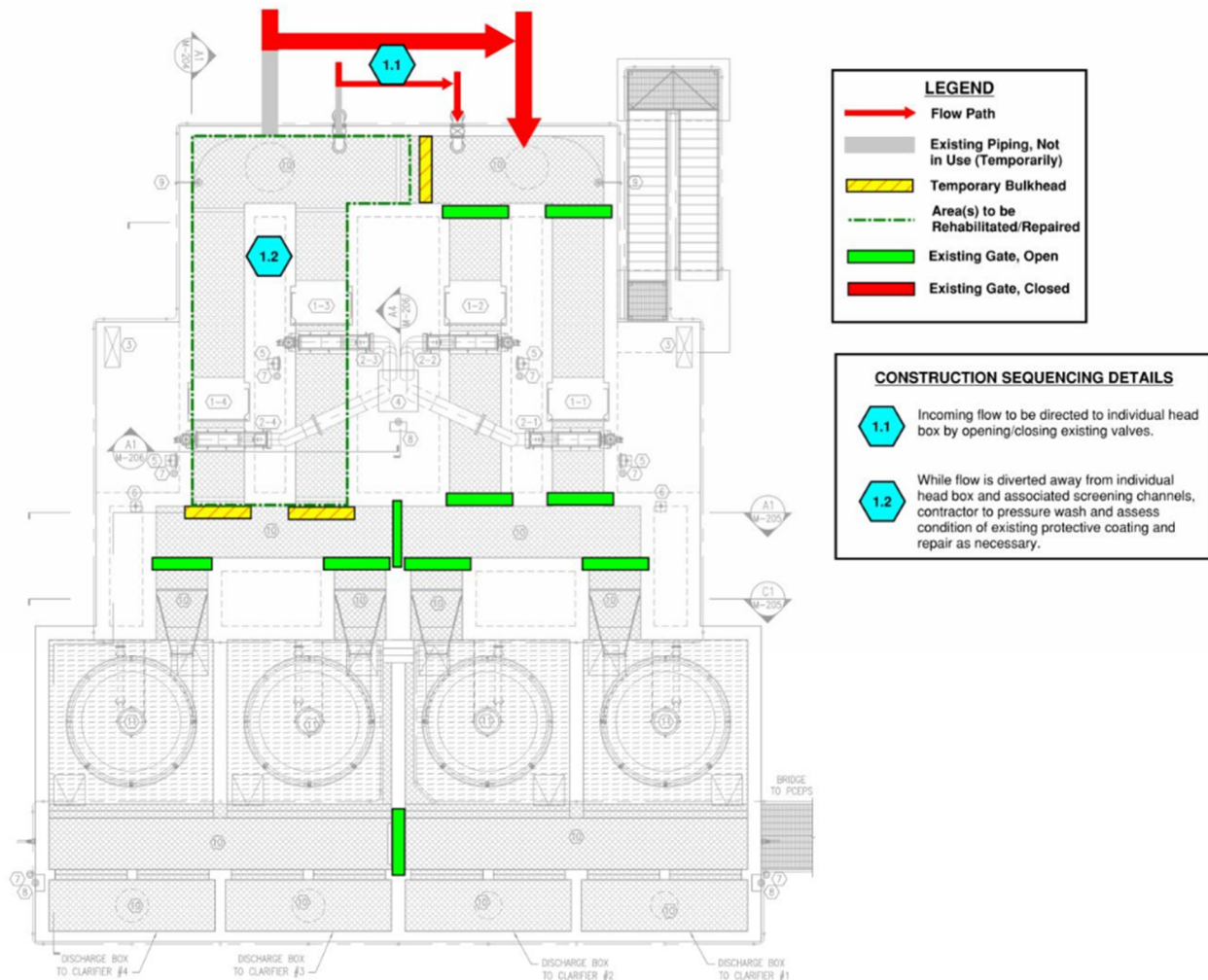
#### PART 3 - EXECUTION

##### 3.1 GENERAL

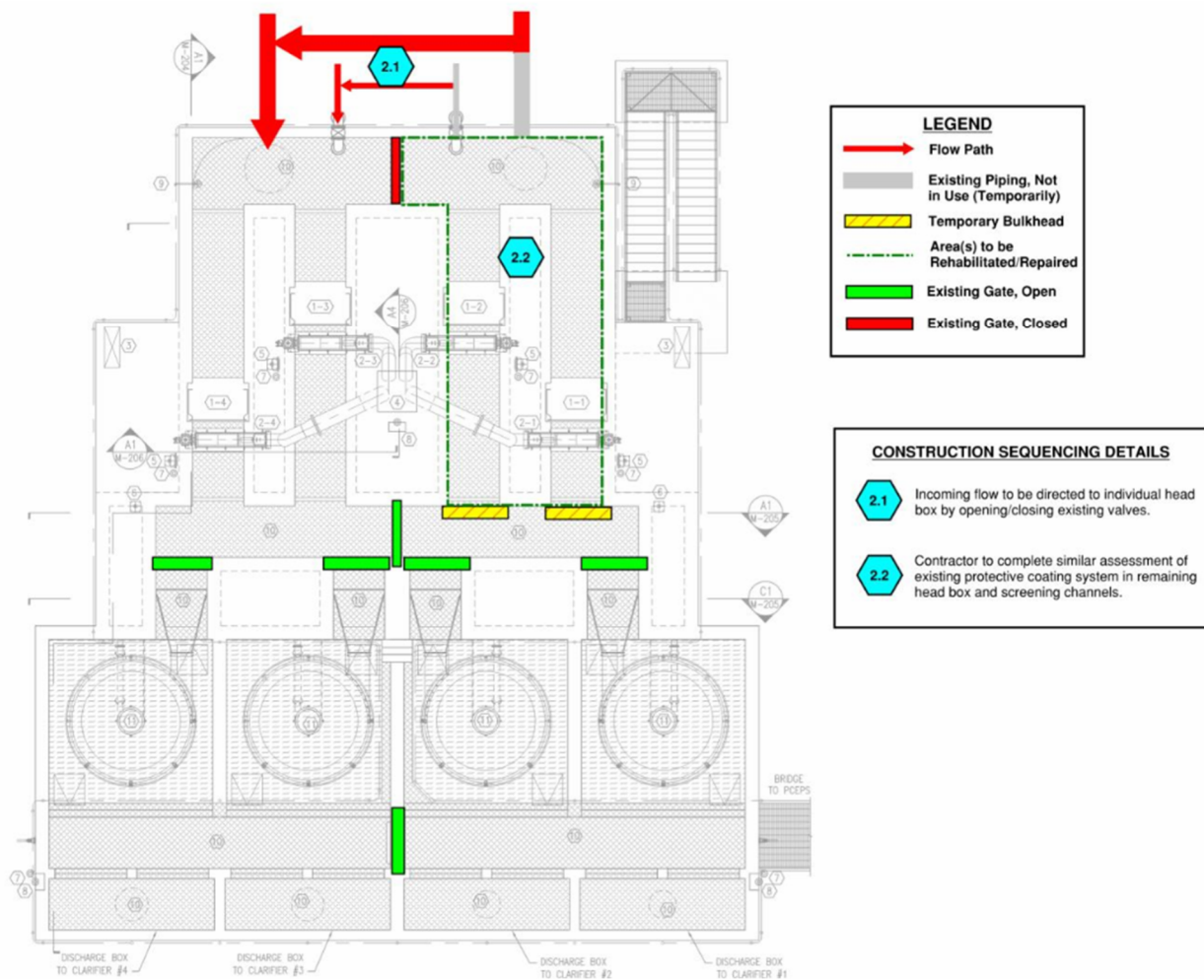
- A. Use identified work sequences in this section as a guideline for scheduling and performing work. Perform work in a manner that WILL NOT prevent the facility from achieving the final treated water quality requirements established by regulation. It is ultimately the responsibility of the Contractor to execute the work in a sequence that meets all requirements of the contract documents.
- B. Work sequence and constraints presented DO NOT include all items affecting completion of the Work. They are intended to describe critical events necessary to minimize disruption to existing operations and to ensure compliance with treatment regulations and permit requirements.

### 3.2 PROPOSED PHASE 1 SEQUENCE

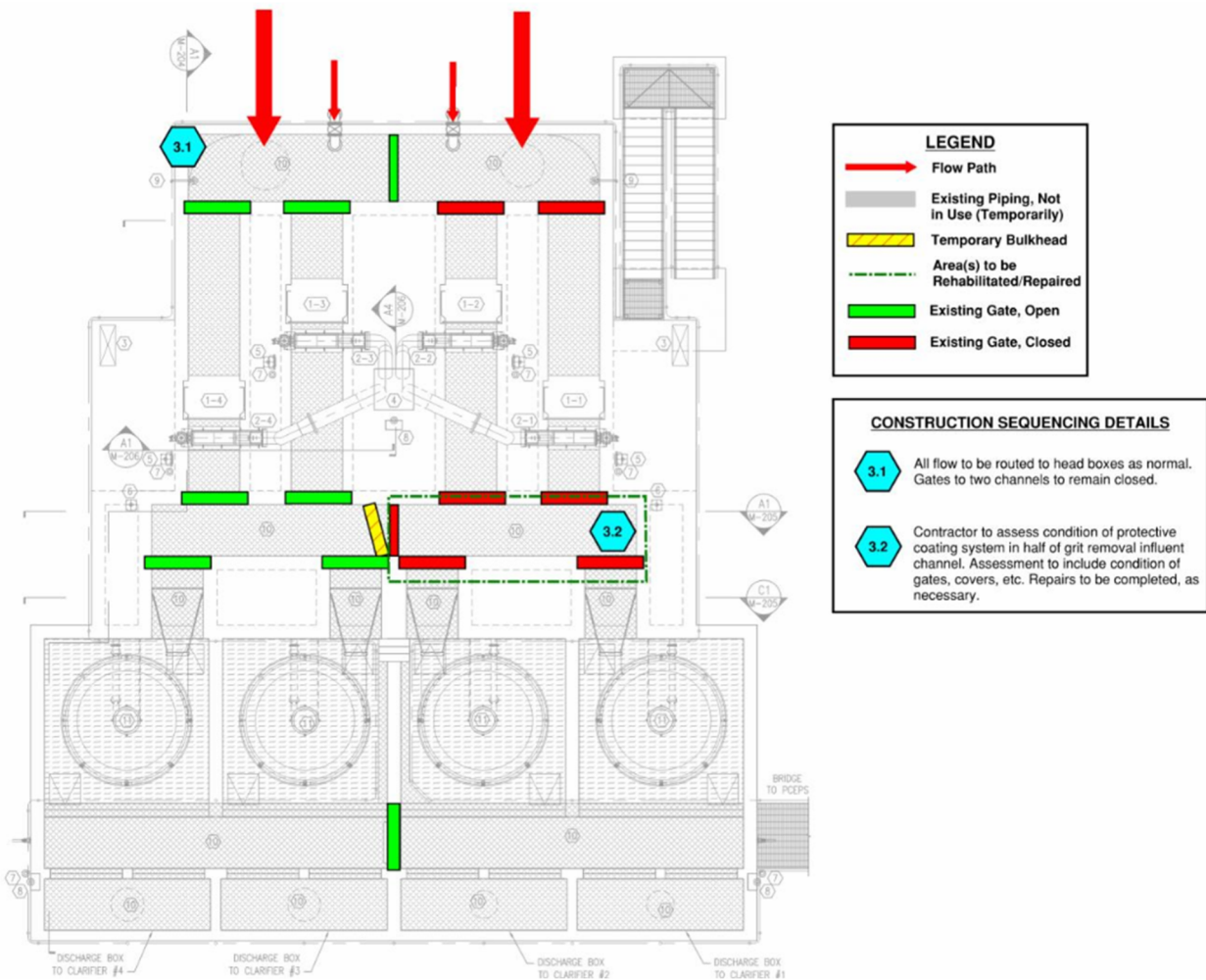
|                                         |                                                            |
|-----------------------------------------|------------------------------------------------------------|
| Sequence                                | Headworks Channel Restoration Sequence 1                   |
| Description                             | Headworks Channel Concrete Restoration                     |
| Work to be Completed                    | Rehabilitate/repair influent channel and screen channels   |
| Shutdowns Required During Sequence      | West Chamber of Influent Pump Station Splitter Box         |
| Equipment and Facilities Out of Service | Screens No. 3 and No. 4                                    |
| Isolation Locations                     | Influent Channel, Screen No. 3, and Screen No. 4 Bulkheads |
| Dewatering Locations                    | West Side of Influent Channel and Screens No. 3 and No. 4  |
| Construction Duration during Shutdown   | 2 weeks                                                    |
| Total Shutdown                          | 2.5 weeks                                                  |



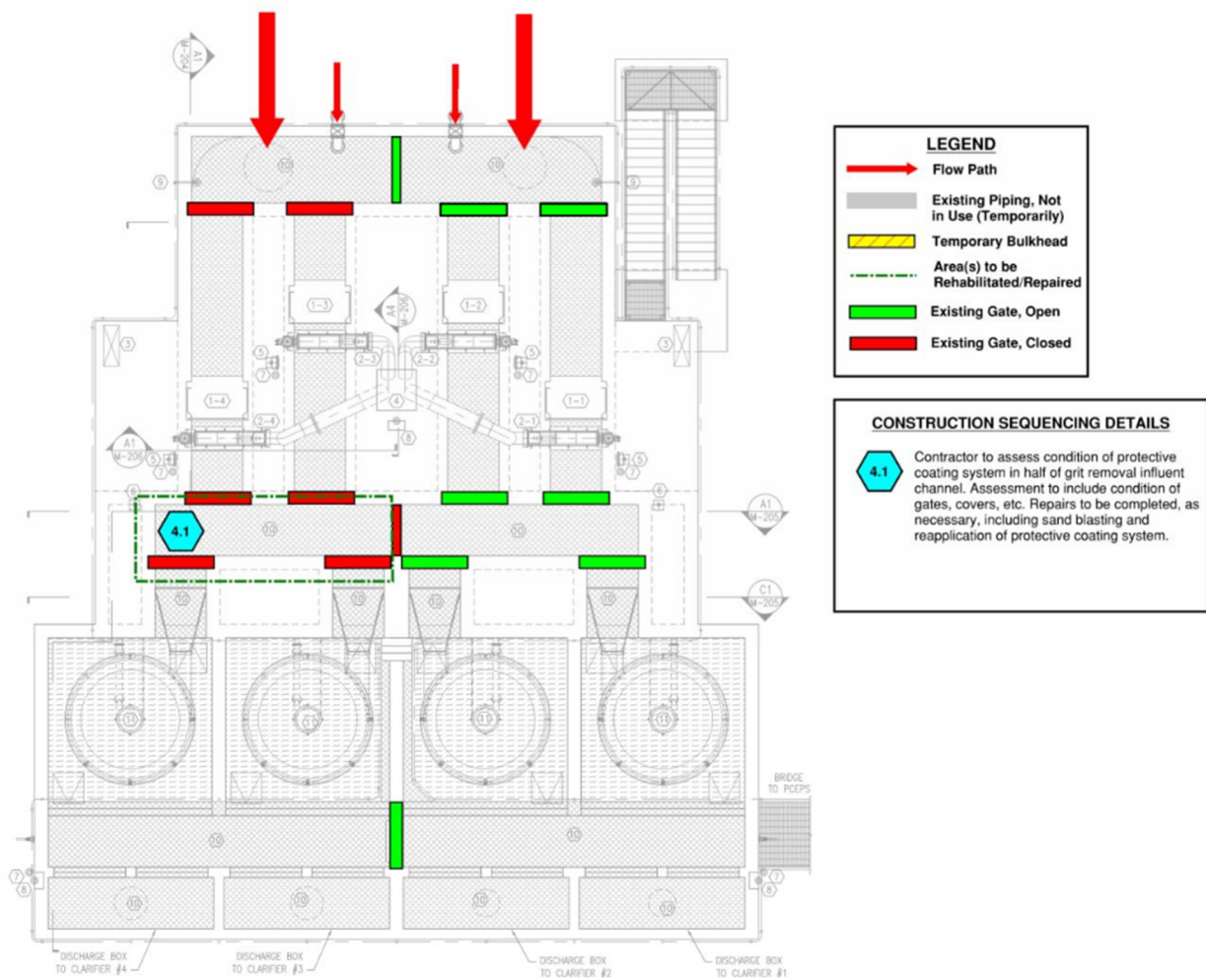
|                                         |                                                                      |
|-----------------------------------------|----------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 2                            |
| Description                             | Headworks Concrete Restoration                                       |
| Work to be Completed                    | Rehabilitate/repair influent channel and screen channels             |
| Shutdowns Required During Sequence      | East Side of Influent Channel and Screens No. 1 and No. 2            |
| Equipment and Facilities Out of Service | Screens No. 1 and No. 2                                              |
| Isolation Locations                     | Influent Channel Slide Gate, Screen No. 1 and Screen No. 2 Bulkheads |
| Dewatering Locations                    | East Side of Influent Channel and Screens No. 1 and No. 2            |
| Construction Duration during Shutdown   | 2 weeks                                                              |
| Total Shutdown                          | 2.5 weeks                                                            |



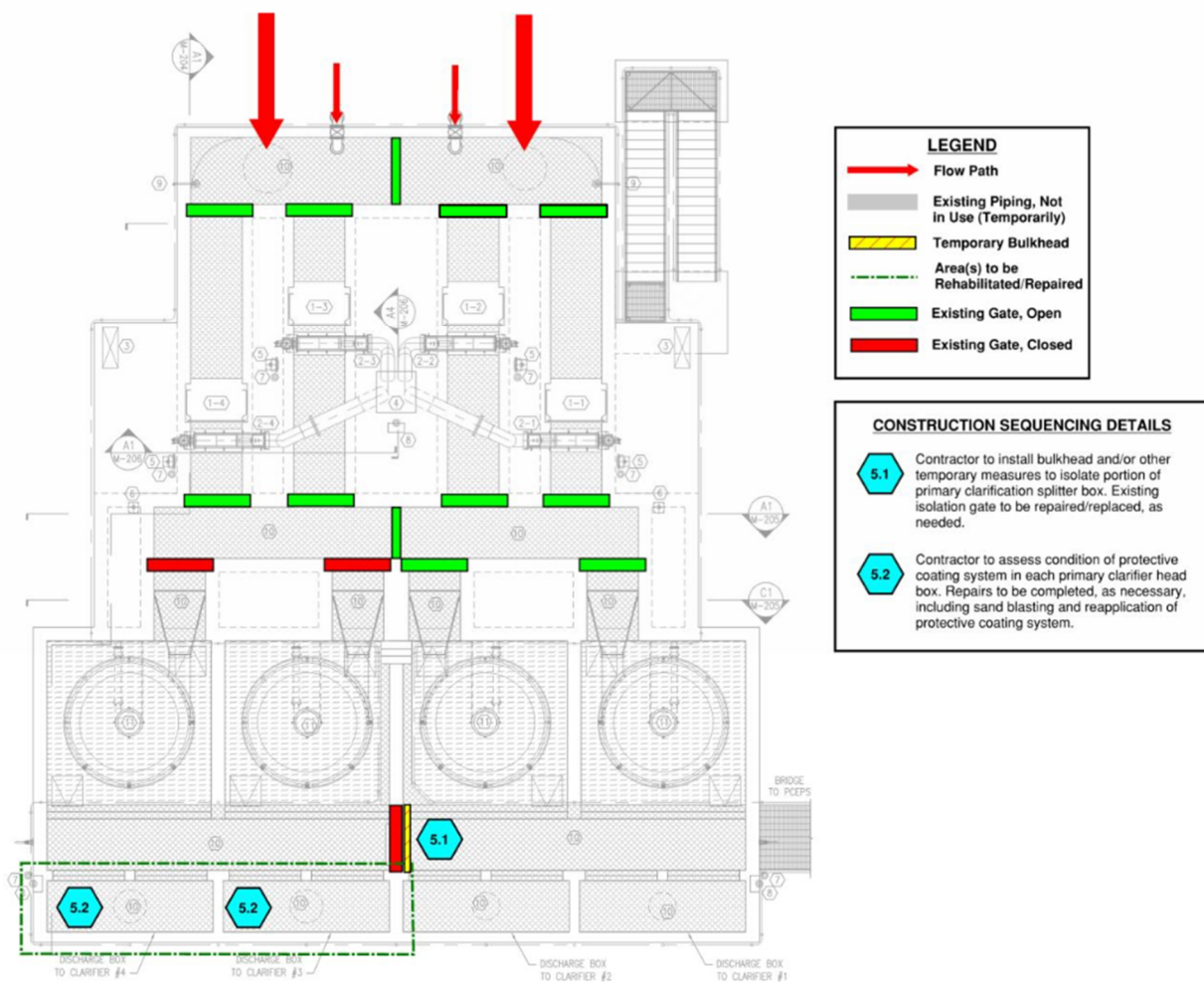
|                                         |                                                                                                                                |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 3                                                                                      |
| Description                             | Headworks Concrete Restoration                                                                                                 |
| Work to be Completed                    | Rehabilitate/repair grit headcell influent channel                                                                             |
| Shutdowns Required During Sequence      | East Side of Grit Headcell Influent Channel and Screens No. 1 and No. 2                                                        |
| Equipment and Facilities Out of Service | Screens No. 1 and No. 2, Grit Headcells No. 1 and No. 2                                                                        |
| Isolation Locations                     | Screen No. 1 and Screen No. 2 Slide Gates, Grit Headcells No. 1 and No. 2 Slide Gates, Grit Headcell Influent Channel Bulkhead |
| Dewatering Locations                    | East Side of Grit Headcell Influent Channel and Screens No. 1 and No. 2                                                        |
| Construction Duration during Shutdown   | 2 weeks                                                                                                                        |
| Total Shutdown                          | 2.5 weeks                                                                                                                      |



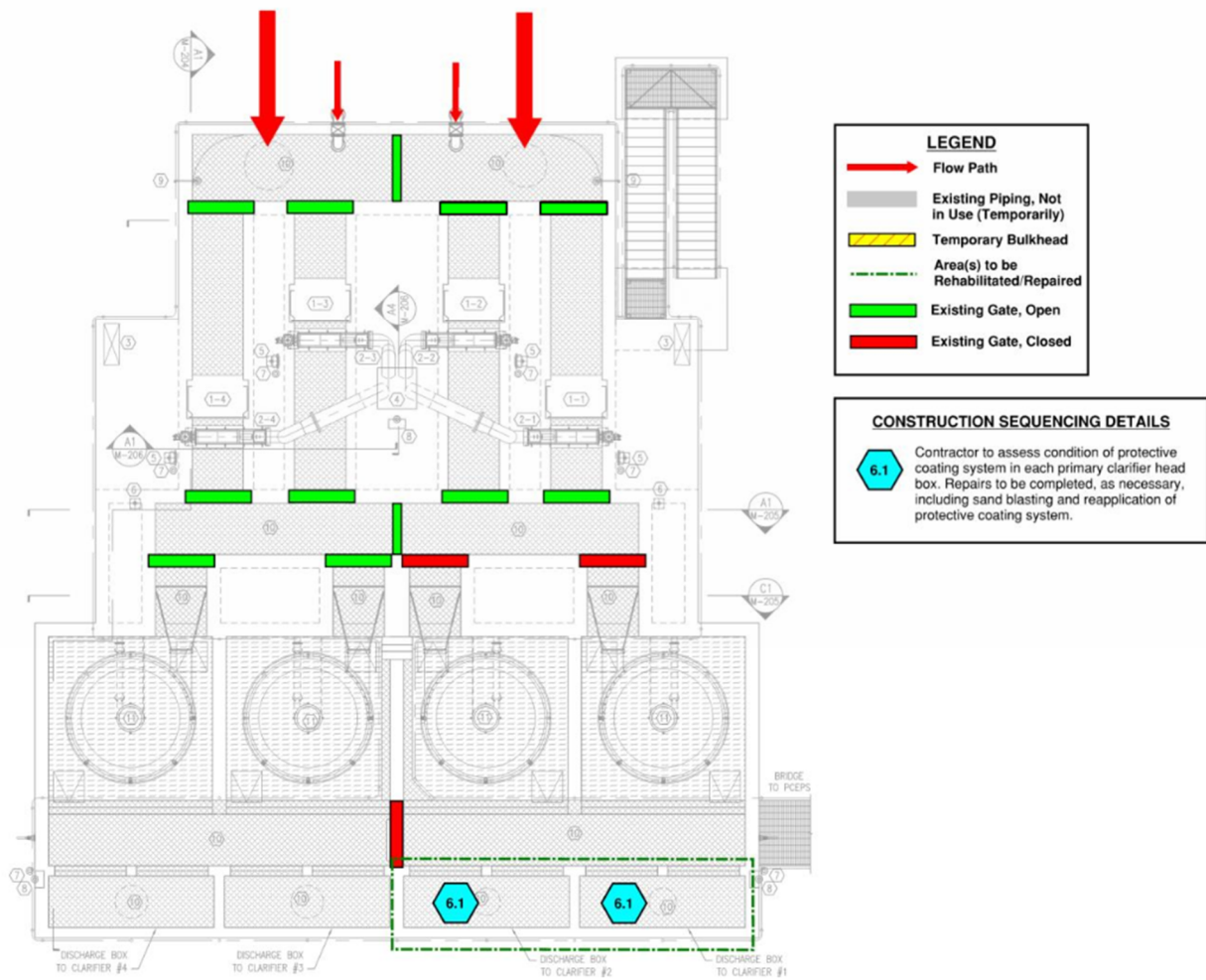
|                                         |                                                                                                                                  |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 4                                                                                        |
| Description                             | Headworks Concrete Restoration                                                                                                   |
| Work to be Completed                    | Rehabilitate/repair grit headcell influent channel                                                                               |
| Shutdowns Required During Sequence      | West Side of Grit Headcell Influent Channel and Screens No. 3 and No. 4                                                          |
| Equipment and Facilities Out of Service | Screens No. 3 and No. 4, Grit Headcells No. 3 and No. 4                                                                          |
| Isolation Locations                     | Screen No. 3 and Screen No. 4 Slide Gates, Grit Headcells No. 3 and No. 4 Slide Gates, Grit Headcell Influent Channel Slide Gate |
| Dewatering Locations                    | West Side of Grit Headcell Influent Channel and Screens No. 1 and No. 4                                                          |
| Construction Duration during Shutdown   | 2 weeks                                                                                                                          |
| Total Shutdown                          | 2.5 weeks                                                                                                                        |



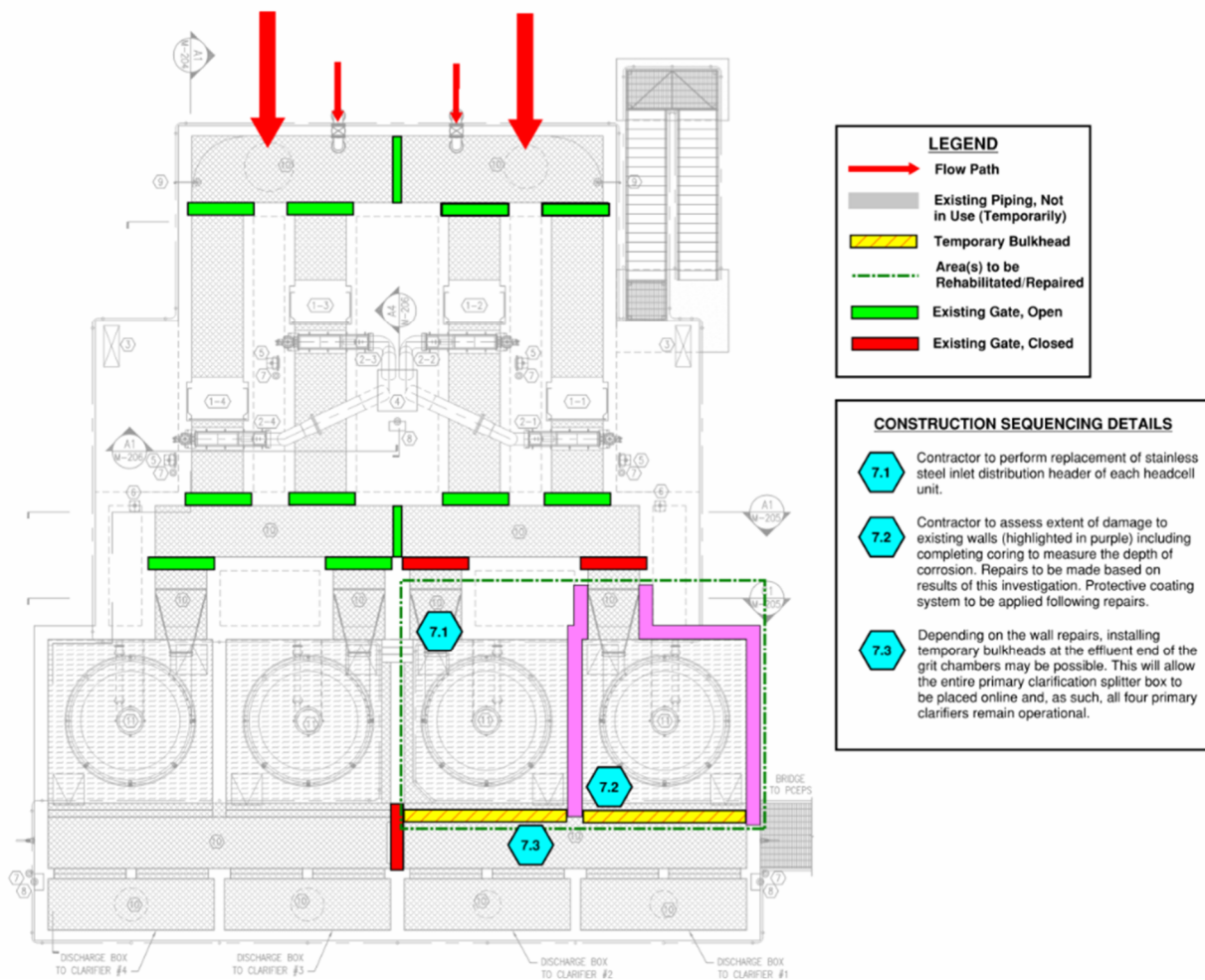
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|-----------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 5                                                                    |
| Description                             | Headworks Concrete Restoration                                                                               |
| Work to be Completed                    | Rehabilitate/repair discharge boxes to clarifiers                                                            |
| Shutdowns Required During Sequence      | Grit Headcells No. 3 and No. 4, Discharge Boxes to Clarifiers No. 3 and No. 4, West Side of Effluent Channel |
| Equipment and Facilities Out of Service | Grit Headcells No. 3 and No. 4, Discharge Boxes to Clarifiers No. 3 and No. 4                                |
| Isolation Locations                     | Grit Headcells No. 3 and No. 4 Slide Gates, Effluent Channel Bulkhead                                        |
| Dewatering Locations                    | West Side of Effluent Channel, Discharge Boxes to Clarifiers No. 3 and No. 4                                 |
| Construction Duration during Shutdown   | 2 weeks                                                                                                      |
| Total Shutdown                          | 2.5 weeks                                                                                                    |



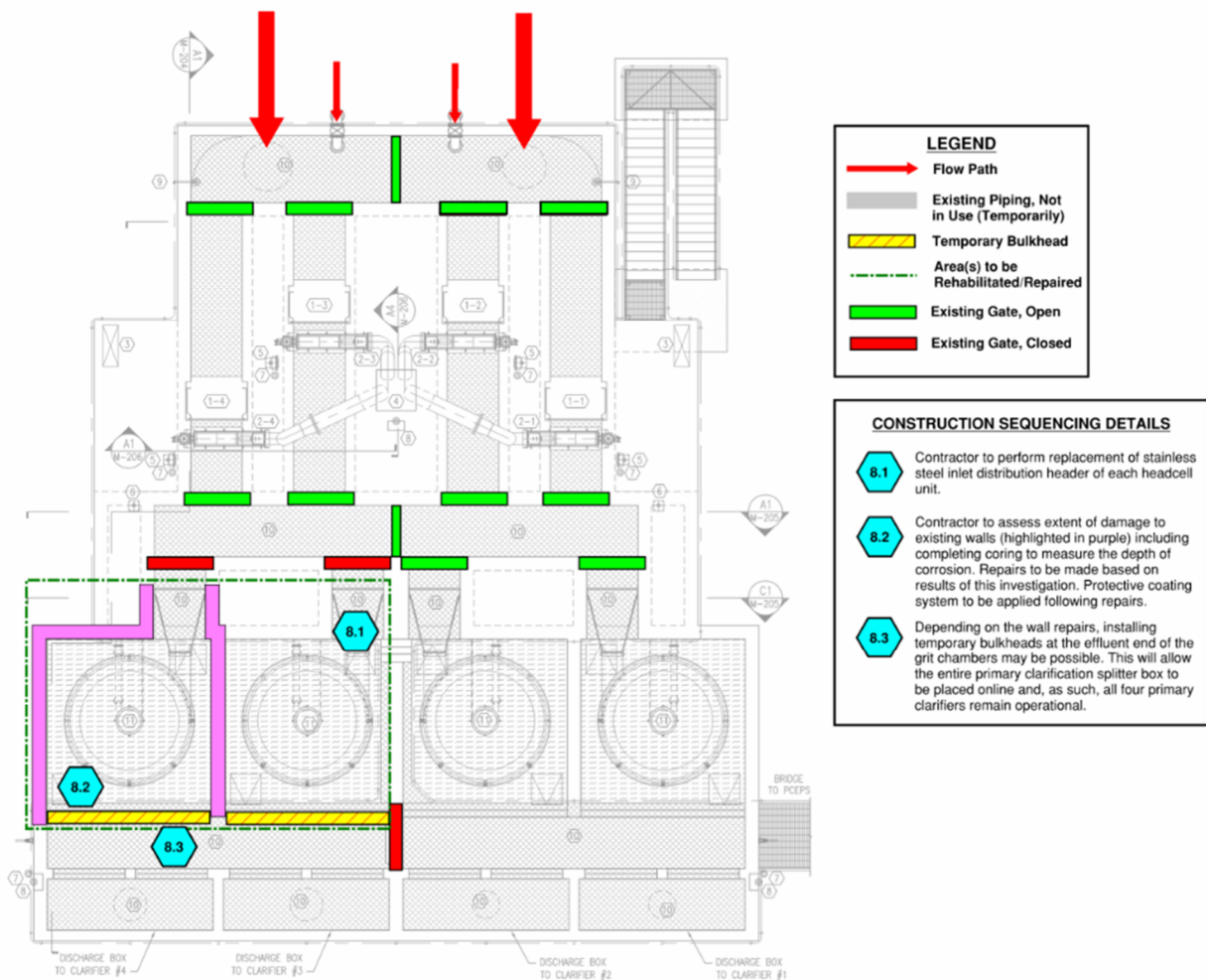
|                                         |                                                                                                              |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 6                                                                    |
| Description                             | Headworks Concrete Restoration                                                                               |
| Work to be Completed                    | Rehabilitate/repair discharge boxes to clarifiers                                                            |
| Shutdowns Required During Sequence      | Grit Headcells No. 1 and No. 2, Discharge Boxes to Clarifiers No. 1 and No. 2, East Side of Effluent Channel |
| Equipment and Facilities Out of Service | Grit Headcells No. 1 and No. 2, Discharge Boxes to Clarifiers No. 1 and No. 2                                |
| Isolation Locations                     | Grit Headcells No. 1 and No. 2 Slide Gates, Effluent Channel Slide Gate                                      |
| Dewatering Locations                    | East Side of Effluent Channel, Discharge Boxes to Clarifiers No. 1 and No. 2                                 |
| Construction Duration during Shutdown   | 2 weeks                                                                                                      |
| Total Shutdown                          | 2.5 weeks                                                                                                    |



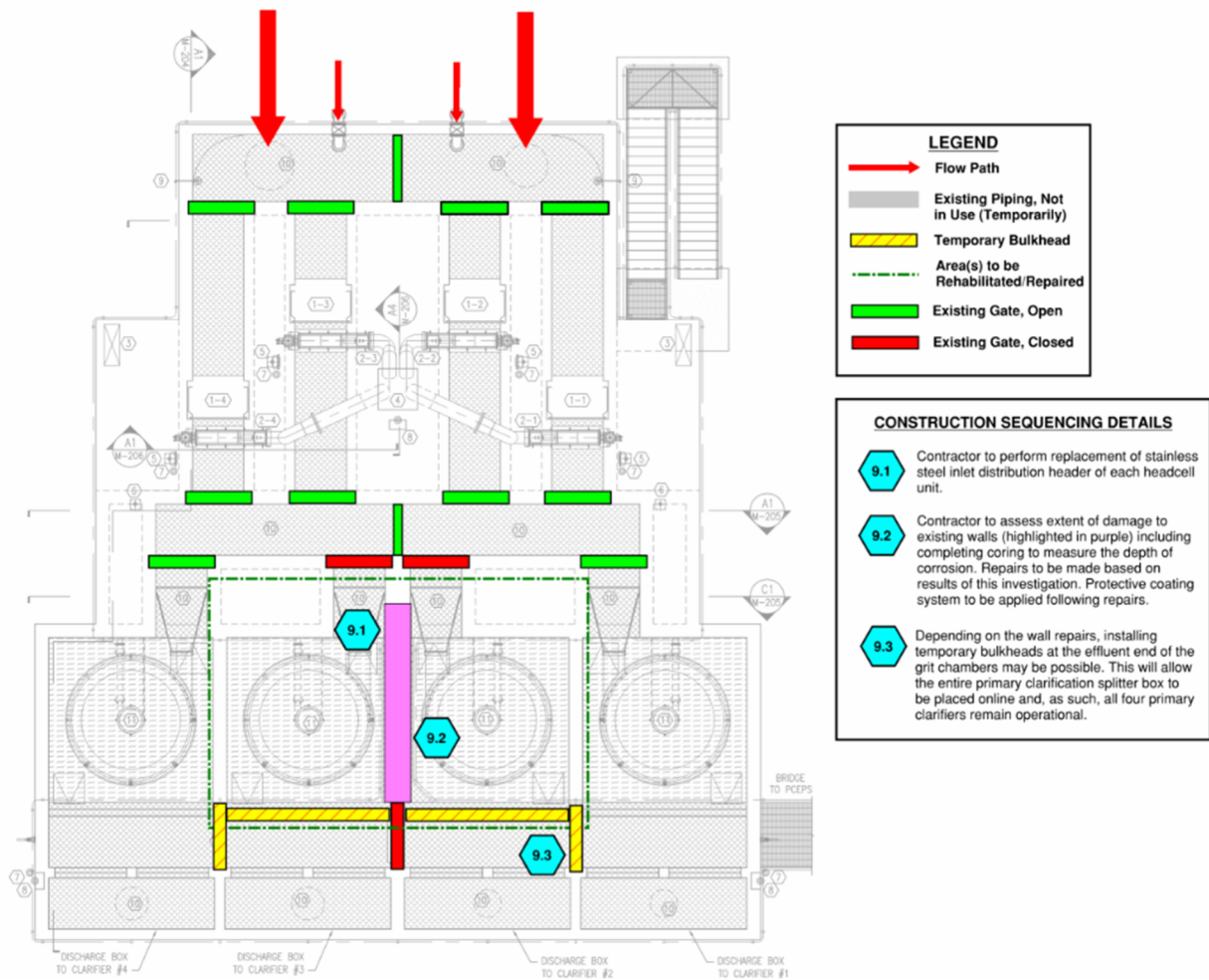
|                                         |                                                                                                                   |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 7                                                                         |
| Description                             | Headworks Concrete Restoration                                                                                    |
| Work to be Completed                    | Rehabilitate/repair grit headcells                                                                                |
| Shutdowns Required During Sequence      | Grit Headcells No. 1 and No. 2, Discharge Boxes to Clarifiers No. 1 and No. 2, East Side of Effluent Channel      |
| Equipment and Facilities Out of Service | Grit Headcells No. 1 and No. 2, Discharge Boxes to Clarifiers No. 1 and No. 2                                     |
| Isolation Locations                     | Grit Headcells No. 1 and No. 2 Slide Gates, Grit Headcells No. 1 and No. 2 Bulkheads, Effluent Channel Slide Gate |
| Dewatering Locations                    | Grit Headcells No. 1 and No. 2, East Side of Effluent Channel, Discharge Boxes to Clarifiers No. 1 and No. 2      |
| Construction Duration during Shutdown   | 7 weeks                                                                                                           |
| Total Shutdown                          | 7.5 weeks                                                                                                         |



|                                         |                                                                                                                   |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 8                                                                         |
| Description                             | Headworks Concrete Restoration                                                                                    |
| Work to be Completed                    | Rehabilitate/repair grit headcells                                                                                |
| Shutdowns Required During Sequence      | Grit Headcells No. 3 and No. 4, Discharge Boxes to Clarifiers No. 3 and No. 4, West Side of Effluent Channel      |
| Equipment and Facilities Out of Service | Grit Headcells No. 3 and No. 4, Discharge Boxes to Clarifiers No. 3 and No. 4                                     |
| Isolation Locations                     | Grit Headcells No. 3 and No. 4 Slide Gates, Grit Headcells No. 3 and No. 4 Bulkheads, Effluent Channel Slide Gate |
| Dewatering Locations                    | Grit Headcells No. 3 and No. 4, East Side of Effluent Channel, Discharge Boxes to Clarifiers No. 3 and No. 4      |
| Construction Duration during Shutdown   | 7 weeks                                                                                                           |
| Total Shutdown                          | 7.5 weeks                                                                                                         |



|                                         |                                                                                                                  |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Sequence                                | Headworks Concrete Restoration Sequence 9                                                                        |
| Description                             | Headworks Concrete Restoration                                                                                   |
| Work to be Completed                    | Rehabilitate/repair grit headcells                                                                               |
| Shutdowns Required During Sequence      | Grit Headcells No. 2 and No. 3, Discharge Boxes to Clarifiers No. 2 and No. 3, Middle of Effluent Channel        |
| Equipment and Facilities Out of Service | Grit Headcells No. 2 and No. 3, Discharge Boxes to Clarifiers No. 2 and No. 3                                    |
| Isolation Locations                     | Grit Headcells No. 2 and No. 3 Slide Gates, Grit Headcells No. 2 and No. 3 Bulkheads, Effluent Channel Bulkheads |
| Dewatering Locations                    | Grit Headcells No. 2 and No. 3, Middle of Effluent Channel, Discharge Boxes to Clarifiers No. 2 and No. 3        |
| Construction Duration during Shutdown   | 7 weeks                                                                                                          |
| Total Shutdown                          | 7.5 weeks                                                                                                        |



END OF SECTION

## SECTION 23 33 00 – AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section Includes:
  - 1. Control dampers.
  - 2. Manual volume dampers.

#### 1.2 SUBMITTALS

- A. Subject to requirements of Section 01 33 00 – Submittal Procedures
- B. Product Data: For each type of product.
  - 1. For each type of product specified.
- C. Operation and Maintenance Data:
  - 1. For air duct accessories to include in operation and maintenance manuals

### PART 2 - PRODUCTS

#### 2.1 CONTROL DAMPERS

- A. General Requirements:
  - 1. Unless otherwise indicated, use single round-blade configuration for two-position control.
  - 2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
- B. Performance:
  - 1. AMCA Certification: Test and rate in accordance with AMCA 511.
  - 2. Leakage:
    - a. Class IA: Leakage is not to exceed 3 cfm/sq. ft. against 1 inch wg differential static pressure.
    - b. Class I: Leakage is not to exceed 4 cfm/sq. ft. against 1 inch wg differential static pressure.
    - c. Class II: Leakage is not to exceed 10 cfm/sq. ft. against 1 inch wg differential static pressure.
    - d. Class III: Leakage is not to exceed 40 cfm/sq. ft. against 1 inch wg differential static pressure.
  - 3. Pressure Drop: Up to 6 in. wg differential pressure when tested in accordance with AMCA 500-D, Figure 5.3.
  - 4. Velocity: Up to 4000 fpm.
  - 5. Temperature: Minus 40°F to plus 400°F.
- C. Construction
  - 1. Linkage out of airstream.
  - 2. Suitable for horizontal or vertical airflow applications.
  - 3. Frames:
    - a. Type: Flanged channel
    - b. Frame Material: Stainless steel
    - c. Frame Thickness: Between 10 gauge and 12-gauge thickness
    - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 4. Blades:
    - a. Blade Design: Round butterfly blade.

- b. Blade Material: Stainless Steel.
      - c. Blade Thickness: Between 10 gauge and 12-gauge thickness
    - 5. Blade Edging Seals:
      - a. Replaceable Silicone Rubber.
      - b. Blade Jamb Seal: Flexible stainless steel, compression type.
    - 6. Blade Axles: 1/2-inch to 3/4 inch diameter; stainless steel.
    - 7. Bearings: Stainless steel sleeve.
      - a. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.
  - D. Fully Modulating Damper Actuator - Electric:
    - 1. Electrical – 24VDC.
    - 2. UL 60730-2-14 and UL 2043, plenum rated.
    - 3. Actuator Type: Fully modulating.
      - a. Sufficient motor torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
      - b. Minimum 90-degree drive rotation.
    - 4. Clockwise or counterclockwise drive rotation as required for application.
    - 5. Environmental Operating Range:
      - a. Temperature: Minus 40°F to plus 130°F.
      - b. Humidity: 5 to 95% relative humidity noncondensing.
    - 6. Environmental enclosure: NEMA 8 Explosion proof enclosure.
    - 7. Actuator to be factory mounted and provided with a single-point wiring connection.
    - 8. Actuator shall include Modbus TCP communication capability for integration with SCADA.
  - E. Two Position Damper Actuator – Electric:
    - 1. Shall be supplied by odor-control vendor
    - 2. UL 60730-2-14 and UL 2043, plenum rated
    - 3. Actuator Type: Two Position
      - a. Sufficient motor torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
      - b. Minimum 90-degree drive rotation.
    - 4. Clockwise or counterclockwise drive rotation as required for application.
    - 5. Environmental Operating Range:
      - a. Temperature: Minus 40°F to plus 130°F.
      - b. Humidity: 5 to 95% relative humidity noncondensing.
    - 6. Environmental enclosure: ~~NEMA 8~~ **NEMA 7** Explosion proof enclosure **(REVISED BY ADDENDUM NO. 1)**
    - 7. Actuator to be factory mounted and provided with a single-point wiring connection
  - F. Controllers, Electrical Devices, and Wiring:
    - 1. Electrical Connection: Ethernet
- 2.2 MANUAL VOLUME DAMPERS
- A. General Requirements:
    - 1. Unless otherwise indicated, use parallel-blade configuration for equipment isolation service.
    - 2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
  - B. Performance:
    - 1. AMCA Certification: Test and rate in accordance with AMCA 511.
    - 2. Leakage:

- a. Class IA: Leakage is not to exceed 3 cfm/sq. ft. against 1 inch wg differential static pressure.
    - b. Class I: Leakage is not to exceed 4 cfm/sq. ft. against 1 inch wg differential static pressure.
    - c. Class II: Leakage is not to exceed 10 cfm/sq. ft. against 1 inch wg differential static pressure.
    - d. Class III: Leakage is not to exceed 40 cfm/sq. ft. against 1 inch wg differential static pressure.
  - 3. Pressure Drop: Up to 6 in. wg differential pressure when tested in accordance with AMCA 500-D, Figure 5.3.
  - 4. Velocity: Up to 4000 fpm.
  - 5. Temperature: Minus 40°F to plus 400°F.
- C. Construction:
- 1. Linkage out of airstream.
  - 2. Suitable for horizontal or vertical airflow applications.
  - 3. Frames:
    - a. Type: Flanged channel.
    - b. Frame Material: Stainless steel
    - c. Frame Thickness: Between 10-gauge and 12-gauge thickness
    - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 4. Blades:
    - a. Blade Design: Round butterfly blade.
    - b. Blade Material: Stainless Steel.
    - c. Blade Thickness: Between 10-gauge and 12-gauge thickness
  - 5. Blade Edging Seals:
    - a. Replaceable Silicone Rubber.
  - 6. Blade Jamb Seal: Flexible stainless steel, compression type.
  - 7. Blade Axles: 1/2-inch to 3/4 inch diameter; stainless steel.
  - 8. Bearings: Stainless steel sleeve.
    - a. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.
  - 9. Materials:
    - a. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF AIR DUCT ACCESSORIES

- A. Install duct accessories in accordance with applicable details in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use stainless steel accessories in fibrous-glass ducts.
- C. Install manual and control dampers as shown on drawings.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full-system-design static pressure.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan and damper inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

- G. Install duct test holes where required for testing and balancing purposes. See Section 44 31 83.
- H. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that size and location of access doors are adequate to perform required operation.
  - 3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.

END OF SECTION

## SECTION 31 63 16 – AUGER CAST PILES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes auger cast piles.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. Section 03 20 00 – Concrete reinforcement
  - 2. Section 03 30 00 – Cast-in-Place Concrete.
- C. UNIT PRICES
  - 1. Contract Sum: Base Contract Sum on number and dimensions of piles from tip to pile top.
  - 2. Work of this Section is affected as follows:
    - a. Pile Length: Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, is calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by engineer and measured to nearest 12 inches.
    - b. Number of Piles: Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, is calculated at unit prices stated in the Contract.
    - c. Unit prices include labor, materials, tools, equipment, and incidentals for excavation, grout fill, reinforcement, testing and inspection, and other items for complete pile installation.
    - d. ~~Test piles that become part of permanent foundation system are considered as an integral part of the Work. (REMOVED BY ADDENDUM NO. 1)~~
    - e. No payment is made for rejected piles, including piles out of specified tolerance or defective piles.
- D. Test Piles: Same unit price as indicated for production piles.

#### 1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1077, ASTM D3740, and ASTM E329 for testing indicated
- B. Mix Designs: For each type of grout. Include description of type and proportions of ingredients.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

#### 1.3 SUBMITTALS

- A. Subject to the requirements of Section 01 33 00 – Submittal Procedures
- B. Product Data: For each type of product.
- C. Design Mixtures: For each design mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- D. Shop Drawings: For auger cast piles, sealed by a professional engineer in the State for which the Work is to be performed.
  - 1. Identify each pile and indicate pile dimensions, cross sections, locations, and sizes.
  - 2. Indicate types and configurations of reinforcement and detail fabrication.
  - 3. Detail connections to pile caps.
  - 4. Include methods of centralizing reinforcement, type and size of centralizing devices, and locations on reinforcing bars.
  - 5. Static Pile Tests: Include arrangement of static test pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by a qualified professional engineer in the state of the Work being performed, responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Material Certificates: For the following:
  - 1. Cementitious materials.
  - 2. Concrete admixtures.
  - 3. Steel reinforcing.
- D. Equipment Data: Description of drilling and pumping equipment including the following:
  - 1. Type and make of drilling rig, rated capacity, and boom lengths.
  - 2. Torque of drilling machine and horsepower of hydraulic power unit.
  - 3. Pressure and discharge capacity of grout pump.
  - 4. Automated monitoring equipment to be used.
- E. Static Pile Test Reports: Submit within three days of completing each test.
- F. Certified Piles Survey: Submit within 7 days of completion.
- G. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Record Drawings.
- B. Certified Pile Survey: Submit within seven days of pile installation completion.

#### 1.6 PRECONSTRUCTION TESTING

- A. Test Piles: Construct of diameter, depth, and at locations indicated on Drawings or, if not indicated, of **(REMOVED BY ADDENDUM NO. 1)** same diameter and depth as largest production piles and at locations approved by Engineer, to confirm allowable load of piles and demonstrate Installer's construction methods, equipment, standards of workmanship, and tolerances.
  - 1. If Engineer determines that test pile does not comply with requirements, excavate for and cast another until it is accepted.
  - 2. Tests: Arrange and perform the following pile tests:
    - a. Axial Compressive Static Load Test: ASTM D1143/D1143M, Procedure A, Quick Test
    - b. Lateral Load Test: ASTM D3966, Procedure A; Standard Loading

3. Equip each test pile with two telltale rods, according to ASTM D1143/D1143M, for measuring deformation during load test.
4. Provide pile reaction frame, anchor piles, equipment, and instrumentation with enough reaction capacity to perform tests. Notify Engineer at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.
  - a. Allow a minimum of 7 days to elapse after installing test piles before starting pile testing.
  - b. Test Piles: See Drawings for production piles designated to be used as test piles.
5. Approval Criteria:
  - a. Axial Compression Test – At 150% Design Load as defined on drawings:
    - 1) Net settlement of not more than 0.01in/ton of test load.
    - 2) Total settlement not more than 1 inch provided the load settlement curve shows no sign of failure.
    - 3) No plunging failure or sharp break in the load settlement curve.
    - 4) **Provide 2 test piles for Axial Compression Test (ADDED BY ADDENDUM NO. 1)**
  - b. Lateral Load Test – At 200% Design Load as defined on drawings:
    - 1) Total lateral movement of not more than 1 inch for a fixed head test.
    - 2) **Provide 1 test pile for Lateral Load Test (ADDED BY ADDENDUM NO. 1)**
6. **Test pile locations shall be selected to not interfere with installation of production piles or any other permanent construction. Test piles for Axial compression test are NOT to be reused for Lateral Load Test. (ADDED BY ADDENDUM NO. 1)**
7. Test Pile Records: Prepare records for each test pile compiled and attested to by a qualified professional engineer. Include same data as required for permanent piles.

## 1.7 FIELD CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile excavation.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for auger cast piles. Before excavating, lay out each pile to lines and levels required. Record actual measurements of each pile's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
  1. Record and maintain information pertinent to each pile and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

## PART 2 - PRODUCTS

### 2.1 STEEL REINFORCEMENT

- A. Provide reinforcing steel conforming to requirements of Section 03 20 00 – Concrete Reinforcing.
  1. Reinforcing sizes, number, configurations, spacing, and lengths to be designed by contractor.
- B. Centralizers: Devices to center steel reinforcement in excavation; spaced not less than 20 feet vertically.

### 2.2 CONCRETE

- A. Comply with Section 03 30 00 – Cast-in-Place Concrete, except as modified below:

1. Aggregate: ASTM C33 with 100 percent passing a No. 8 sieve, free of materials with deleterious reactivity to alkali in cement. Provide aggregate from single source.
2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures. Do not use calcium chloride or admixtures containing calcium chloride.
  - a. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - b. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  - c. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
  - d. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
3. Fluidifier: ASTM C937, with expansion of less than 4 percent.

## 2.3 RELATED MATERIALS

- A. Pile-Top Forms: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes. Provide units with enough wall thickness to resist plastic concrete loads without detrimental deformation. Diameter same as pile diameter.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Maintain positive (clockwise) rotation of auger during withdrawal. Promptly remove excavated spoils to prevent accumulation.
- B. Grout Placement: Place grout in continuous operation.
  1. Lift auger 6 to 12 inches at start of grout pumping to facilitate tip plug removal, then return to previously established tip elevation.
  2. Develop an initial grout head of 60 inches before start of auger withdrawal and maintain during extraction.
  3. Monitor pumped grout volumes using automated monitoring equipment.
  4. Volume of placed grout is at least 115% of theoretical volume. If less than required volume is placed for any given 60-inch segment, lower auger a minimum of 60 inches, or to bottom of pile if less than 60 inches available, and restart withdrawal.
  5. If grout pumping is interrupted during placement, lower auger a minimum of 60 inches, or to bottom of pile if less than 60 inches available, and restart withdrawal.

### 3.2 FIELD QUALITY CONTROL

- A. Special Inspections: a qualified special inspector to perform the following special inspections:
  1. Pile excavation, placement, and testing.
  2. Steel reinforcement welding.
- B. Testing Agency: a qualified testing agency to perform tests and inspections.
- C. Grout Tests: Testing of samples of fresh grout obtained according to ASTM C172/C172M shall be performed according to the following requirements:
  1. Flow Rate: ASTM C939 and ASTM C109/C109M using a flow cone with 0.75-inch opening.
  2. Compressive Strength: ASTM C109/C109M with cube specimens restrained from expansion according to ASTM C942.
    - a. Testing Frequency: Obtain six-inch cubes for each 50-cu. yd. or fraction thereof of grout placed, but not less than one set for each day's pour. Obtain an additional set of cubes from each truck during test pile placement.
    - b. Test two cubes at 7 days, two cubes at 28 days, and hold two cubes in reserve.

- c. Strength of each grout mixture is satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi
- d. Report test results in writing to Engineer, grout manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of placement, name of testing and inspecting agency, location of grout batch in Work, design compressive strength at 28 days, grout mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
- e. Additional Tests: Testing and inspecting agency to make additional tests of grout if test results indicate that compressive strengths or other requirements have not been met, as directed by Engineer.
- f. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
- g. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Pile Inspection Reports: Prepare inspection reports for each auger cast pile as follows:

- 1. Pile location.
- 2. Pile diameter.
- 3. Actual top and bottom elevations.
- 4. Final top centerline location and deviations from requirements.
- 5. Variation from plumb.
- 6. Date and time of starting and completing.
- 7. Position and condition of reinforcing steel and splices or mechanical couplings.
- 8. Automatic monitoring equipment record including grout volume actually pumped.
- 9. Grout testing results.
- 10. Remarks, unusual conditions encountered, and deviations from requirements.

E. Certified Piles Survey: Prepared by a qualified land surveyor or professional engineer showing final location of piles in relation to the property survey and existing benchmarks.

- 1. Notify Engineer when deviations from locations exceed allowable tolerances.

F. Auger cast piles will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

### 3.3 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

## SECTION 31 66 13 – AGGREGATE PIER GROUND IMPROVEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Designing, furnishing, and installing aggregate pier ground improvement system in the locations shown on the Contract Drawings and as specified herein.
- B. Related Sections:
  - 1. Division 01 – General Requirements
  - 2. Section 31 23 16 – Excavation
  - 3. Section 31 23 23.13 – Fill and Backfill

#### 1.2 DEFINITIONS

- A. Aggregate Piers: columns of compacted aggregate used to reinforce the ground to increase bearing capacity and reduce settlement of a structure.
- B. General Contractor: main contractor responsible for the project.
- C. Designer: party responsible for the design of aggregate pier ground improvement elements.
- D. Installer: party subcontracted to install aggregate pier ground improvement elements.

#### 1.3 REFERENCES

- A. ASTM International:
  - 1. C33 – Standard Specification for Concrete Aggregates
  - 2. D1143 – Standard Test Methods for Deep Foundation Elements Under Static Axial Compressive Load
  - 3. D3689 – Standard Test Method for Individual Piles Under Static Axial Tension Load
  - 4. D6913 – Standard Test Method for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

#### 1.4 SUBMITTALS

- A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.
  - 1. Detailed design calculations and construction drawings prepared by the Designer of the aggregate pier ground improvement system. Package shall include additional geotechnical investigation data used to determine basis for aggregate pier ground improvement system design. All calculations and drawings shall be sealed by a Professional Engineer currently registered in the State of Work.
  - 2. Detailed explanation of the design parameters for settlement calculations.
  - 3. Detailed description of installation equipment for aggregate pier construction.
  - 4. Construction sequence plan including drilling and compaction procedures.
  - 5. Installation records, complete test data, analysis of the test data and recommended design parameter values based on the modulus test results.
  - 6. Daily aggregate pier progress reports with accurate record of pier installations including pier location, length, average lift thickness, and final elevations of the base and top of piers. The record shall also indicate the type and size of the densification equipment used. The installer shall immediately report any unusual conditions encountered during installation to the General Contractor, Aggregate Pier Designer, and Testing Agency.
  - 7. Experience qualifications of aggregate pier enhancement installer.

8. Modulus test data, analysis of the data and the concluding recommended design parameters prepared by a Professional Engineer currently registered in the State of Work.

#### 1.5 GENERAL CONTRACTOR RESPONSIBILITIES

- A. Furnish all labor, material, equipment, and incidental items necessary to install the aggregate pier ground improvement system and complete the work as shown on the Drawings and as specified herein.
- B. Perform any additional geotechnical investigation work necessary to provide parameters needed to complete design and construction of aggregate pier ground improvement system prior to submission of design package.
- C. Provide all necessary access including access ramps, haul roads, etc., prior to the commencement of the construction of the aggregate pier ground improvement system.
- D. Furnish the names of all subcontractors which he proposes to use for design and construction of this work including necessary evidence and/or experience records. The subcontractor performing the design and construction of the aggregate pier ground improvement system shall have a minimum of five (5) years of experience in design and construction of these systems on similar projects.

#### 1.6 QUALIFICATIONS

- A. The aggregate pier ground improvement Installer and Designer shall have a minimum of five years of continuous experience for performance in similar applications.
- B. The Installer performing the work shall be fully qualified, experienced and equipped to complete this work. The Installer shall submit the following information to the Engineer of Record for review and approval before any work is performed. The following information is required at least three weeks prior to the start of work:
  1. The number of years of experience in performing this type of specialized work.
  2. Resumes of the management, supervisory, and key personnel.
  3. A list of clients that the subcontractor has performed this type of work including names, phone numbers, date installed, and description of the projects.
- C. Prequalification:
  1. All aggregate pier companies shall be prequalified to be considered an acceptable aggregate pier Designer.
  2. A complete prequalification package shall be submitted to the Engineer of Record for consideration 14 days prior to the date set for receipt of bids.
  3. Include:
    - a. Complete construction drawings showing the size and layout of all aggregate pier elements.
    - b. Complete experience record for the aggregate piers as specified in Paragraph 1.6.B. and designed and built in the aggregate pier company's own name. The record shall include the number of aggregate piers, name, address, and telephone number of the Owner, the year of construction, and the name and telephone number of the Engineer for the project.
    - c. Construction schedule which details the duration for aggregate pier construction.
  4. Acceptable Aggregate Pier Companies:
    - a. Keller: Hanover, Maryland.
    - b. Geopier: Davidson, North Carolina.
    - c. **SubStruct, LLC (ADDED BY ADDENDUM NO.1)**

## PART 2 - MATERIALS

### 2.1 AGGREGATE (STONE):

- A. Aggregate used in aggregate piers shall be approved by the aggregate pier ground improvement system Designer. Aggregates used shall be suitable for use in piers constructed below the water table or saturated conditions if applicable.
- B. Backfill aggregate shall consist of hard, angular to sub-angular durable rock fragments, with the majority of particles in the range of 1/8th inch to 1-1/2 inches such as No. 57 stone meeting requirements of ASTM C33.
- C. Potable water or other approved sources of water shall be used to increase aggregate moisture content where required. General Contractor shall furnish water to the pier installer.

## PART 3 - EXECUTION

### 3.1 DESIGN REQUIREMENTS

- A. Aggregate pier elements shall be designed to ensure the subgrade over the area being enhanced by the aggregate pier installation can provide a minimum bearing capacity as shown on the construction drawings.
- B. Aggregate pier enhancement shall be designed in accordance with generally accepted engineering practice and the methods described herein.
- C. Design Considerations:
  - 1. Bearing capacity of all members being supported by the aggregate pier enhanced area.
    - a. Bearing capacities shall exceed bearing pressures listed on drawings.
  - 2. Total and differential settlement:
    - a. Maximum projected settlement of 1 inch.
    - b. Maximum differential settlement of 1/2 inch.
- D. The design of the aggregate pier ground improvement shall include development of an adequate stiffness modulus to accomplish this design parameter. The stiffness modulus shall be verified by the result of the Aggregate Pier Modulus test, as described herein.
  - 1. Stiffness modulus values will be supplied to the Engineer of Record for a design review of the facilities supported on aggregate pier ground improvements.
- E. The aggregate pier ground improvement system shall be designed to preclude plastic bulging deformations at the top-of-pier design stress and to preclude significant tip stresses as determined from the shape of the telltale test curve from telltales installed in modulus test piers. The results of the modulus test shall be used to verify design assumptions.

### 3.2 SITE PREPARATION

- A. General Contractor shall locate and protect underground and above ground utilities and other structures from damage during installation of aggregate pier elements.
- B. General Contractor shall provide site access to installer of aggregate piers after earthwork in the area has been completed.
- C. Site subgrade shall be established within 6 inches of final design subgrade, as approved by the Engineer of Record.

- D. A dry, level, and stable working surface shall be established and maintained to provide wet weather protection of the subgrade and to provide access for efficient operation of the aggregate pier installation. Positive drainage will be maintained to protect the site from wet weather and surface ponding of water.
- E. General Contractor shall coordinate all excavations made subsequent to pier installations so at least five feet of horizontal distance remains between edge of any installed stone pier and the excavation.
- F. If spoils are generated by aggregate pier installation, the General Contractor shall remove spoils from the work area in a timely manner to prevent interruption of aggregate pier installation.

### 3.3 EXCAVATION

- A. All aggregate pier elements shall be pre-augured using mechanical drilling or excavation equipment.
- B. Obstructions
  - 1. Obstructions encountered during excavation or drilling that will prevent installation of the aggregate piers to design depth or cause the aggregate pier to stray from its specified location during installation shall be promptly removed. To the extent the obstructions are shown in the geotechnical report, removal of obstructions shall be performed at no additional cost to the owner.
  - 2. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., that prevent installing the aggregate piers to the required depth or cause the aggregate pier to drift from the required locations.
  - 3. Dense natural rock or weathered rock shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials. The aggregate pier Designer shall be notified within 24 hours to verify that the short piers are acceptable.
- C. No excavations shall be made after installation of aggregate pier elements within a horizontal distance of five feet from the edge of any pier, without the written approval of the aggregate pier Designer.

### 3.4 DENSIFICATION

- A. Aggregate pier elements shall be constructed in accordance with the approved design and shop drawings.
- B. The bottom of the excavation shall be densified prior to the placement of the aggregate. If wet, soft, or sensitive soils are present, open-graded stone, such as No. 57 stone in accordance with ASTM C33 or other stone approved by aggregate pier Designer, shall be placed at the bottom of the excavation and compacted to stabilize the element bottom and may serve as the initial lift when approved by the aggregate pier Designer.
- C. Densification shall be provided using vibrated aggregate pier systems:
  - 1. Stable ground conditions:
    - a. Pre-drilling to the design depth shall be performed with an auger diameter determined by the aggregate pier Designer.
    - b. A high-energy impact or vibratory densification apparatus shall be employed to densify lifts of aggregate.
    - c. The vibrator shall be raised and lowered repeatedly, such that on each re-penetration, the tip of the vibrator advances to within limits determined by the aggregate pier Designer.

- d. Lift heights of aggregate shall be per the aggregate pier Designer's signed and sealed design.
- 2. Unstable ground conditions:
  - a. A bottom feed vibratory densification apparatus, in which the aggregate is fed through the tip of the vibrator, shall be employed to densify lifts of aggregate.
  - b. The vibrator shall be raised and lowered repeatedly, such that on each re-penetration, the tip of the vibrator advances to within limits determined by the aggregate pier Designer.
  - c. Lift heights of aggregate shall be per the aggregate pier Designer's signed and sealed design.
- 3. The aggregate shall be removed and replaced with fresh aggregate if soil cave-ins exceeding 10% of the lift volume occur during the aggregate placement. Steel casings may be used to stabilize the cavity.

### 3.5 PLACEMENT TOLERANCES

- A. The center location of each aggregate pier shall be within six inches of the planned locations indicated. The final measurement on the top of piers shall be the lowest point on the aggregate in the last compacted lift. Piers installed outside of the tolerances specified and deemed not acceptable shall be rebuilt at no additional cost to the Owner.

### 3.6 REJECTED AGGREGATE PIER ELEMENTS

- A. Aggregate pier elements improperly located or installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless other remedial measures are approved by the Designer. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner.

### 3.7 QUALITY CONTROL

- A. The Installer shall have a full-time quality control (QC) representative to verify and report all QC installation procedures. The Installer shall immediately report any unusual conditions encountered during installation to the Designer, the General Contractor, and the Testing Agency. The QC procedures shall include the preparation of Aggregate Pier Progress Reports completed during each day of installation containing the following information: aggregate pier location, aggregate pier length and drilled diameter, planned and actual aggregate pier elevations at the top and bottom of the element, average lift thickness for each pier, soil types encountered at the bottom of the pier and along the length of the element, depth to groundwater (if encountered), documentation of any unusual conditions encountered, and type and size of densification equipment used.
- B. A modulus test shall be performed **on 10% of total piles or a minimum of 2, whichever is greater, (ADDED BY ADDENDUM NO.1)** to verify the parameter values selected for design. The modulus tests shall be of the type and installed in a manner as specified herein.
  - ~~1. A telltale shall be installed at the bottom of the test pier to allow determination of bottom of pier deflections. Acceptable performance is indicated when the bottom of the pier deflection is no more than 20% of the top of pier deflection at the design stress level. (REMOVED BY ADDENDUM NO. 1)~~
  - 2. ASTM D-1143 general test procedures shall be used as a guide to establish load increments, load increment duration, and load decrements.
  - 3. With the exception of the load increment representing approximately 115% of the design maximum top of pier stress, all load increments shall be held for a minimum of 15 minutes, a maximum of 1 hour, and until the rate of deflection reduces to 0.01 inch per hour, or less.

4. The load increment representing approximately 115% of the design maximum stress on the aggregate pier shall be held for a minimum of 15 minutes, a maximum of 4 hours, and until the rate of deflection reduces to 0.01 inches per hour or less.
  5. A seating load equal to 5% of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.
  6. Aggregate pier modulus testing shall be performed in accordance with the requirements outlined in the design submittal.
  7. The location of the aggregate pier modulus test shall be coordinated with the Geotechnical Engineer.
- C. After completion of the bottom pier bulb, or at any time during the process of constructing the pier, the energy source may be turned off, and bottom stabilization verification test may be performed. These tests shall be performed when a new soil formation is encountered, or at the beginning of the construction to provide quantitative information on pier stabilization.
1. Bottom stabilization tests are performed by placing a reference bar over the cavity, marking the tamper shaft, applying energy to the tamper for an additional 15 seconds, and observing the downward deflection of the tamper shaft by observing the deflection of the mark on the tamper shaft.
  2. Acceptable performance is indicated if the vertical movement of the shaft is less than 150% of the vertical movement measured for the modulus test pier.
  3. If the measured vertical movement exceeds 150% of the value achieved during the modulus test, added energy is applied to re-densify the bulb. The procedure for measure is then repeated. If there is still movement greater than 150% of that achieved by the modulus test, a lift of loose stone may be placed on top of the compacted stone, and the verification test may be performed on this next lift after it is densified. If there is excessive movement on this lift, another lift may be placed and tested. Movement must be limited to below 150% of the values achieved for the modulus test before completion of 2/3 of the pier depth.
- D. An independent testing agency, employed by Owner, shall observe the installation of the aggregate piers and provide additional testing services as deemed necessary. The observation of the independent testing agency will be in addition to the observation provided by QC representative defined herein furnished by Installer of aggregate piers. Aggregate pier Installer shall alert independent testing agency prior to proceeding with any installation or testing of aggregate piers.

### 3.8 FOOTINGS

- A. Excavation and surface compaction shall be the responsibility of the General Contractor.
- B. Footing bearing surfaces shall be free of all water and compacted prior to placement of any reinforcement. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used. Other methods must be pre-approved by the Engineer of Record.
- C. Water shall not be allowed to pond in the footing excavation at any time.

END OF SECTION

## SECTION 40 05 07 – HANGERS AND SUPPORTS FOR PROCESS PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section Includes:
  - 1. Pipe supports NOT explicitly detailed on Drawings or in Standard Details.
  - 2. Pipe saddles, guides, anchors, and associated attachments to supporting structures detailed on Drawings or in Standard Details.
  - 3. Layout of piping restraints and thermal expansion and contraction joints.
  - 4. The Work for Contractor to provide pipe support design by a pipe support design engineer.
- B. Related Section:
  - 1. Section 03 10 00 – Concrete Forming
  - 2. Section 03 20 00 – Concrete Reinforcing
  - 3. Section 03 30 00 – Cast-in-Place Concrete
  - 4. Section 05 50 00 - Metal Fabrications
  - 5. Section 09 90 00 – Painting and Protective Coatings
  - 6. Section 09 96 00 – High-Performance Coatings
  - 7. Section 40 05 51 – Common Requirements for Process Valves
  - 8. Section 40 23 39 – Process Piping – General
  - 9. Section 40 23 39.43 – Polyvinyl Chloride Pipe and Fittings Data Sheet

#### 1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers):
  - 1. B31.1 – Power Piping
  - 2. **B31.3 – Process Piping (ADDED BY ADDENDUM NO. 1)**
  - 3. B31.9 – Building Services Piping
- B. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacturer, Selection, Application, and Installation.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design of Standalone Pipe Supports and Restraints Attached to Supporting Structures
  - 1. For attachments to supporting structures and standalone supports not explicitly detailed on Drawings or in Standard Details.
  - 2. Engage the services of an independent registered professional engineer licensed in the State of Work ordinarily engaged in the business of pipe support systems analysis and design, to analyze system piping and service conditions, identify pipe restraint types and locations, identify thermal expansion and contraction joint locations, and to develop a detailed support system design, specific to the piping material, pipe joints, valves, piping appurtenances, and supporting structural framing proposed for use on the Drawings.
  - 3. Design all supports to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any additional aluminum members not already shown in the drawings and required to brace any piping from excessive dislocation shall be as specified in Section 05 50 00 – Metal Fabrications and shall be furnished and installed under this section.
  - 4. Design Criteria:

- a. Consider the content of the pipes in load calculations. All items shall be designed with strength and stiffness to support, restrain, and allow expansion of the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, internal air pressures, thermal expansion and contraction, vibrations, and all probable externally applied forces.
- b. Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89, as applicable.
- c. Horizontal and vertical net wind pressures shall be applied concurrently and in the direction producing the greatest load effect for each component being designed. Design using unfactored (1.0xWL) horizontal and vertical (downward or upward) net wind pressure shall be 65 psf uniformly applied to the vertically- and horizontally- projected areas of the pipe, respectively.
- d. Design unfactored (1.0xEL) horizontal and vertical seismic forces have been evaluated by the Engineer to not control the design of any delegated components, and need not be considered in the Delegated Design.
- e. Internal air pressure per Drawings.
- f. Thermal Change (Range):
  - 1) 420°F-70°F, ambient (**REVISED BY ADDENDUM NO. 1**)
  - 2) 180°F, material surfaces
- g. Deflection Limits:
  - 1) Fiber Reinforced Plastic (FRP): Coordinate with pipe manufacturer.
  - 2) All other pipe: Span/240
- h. Maximum Support Spacing:
  - 1) Fiber Reinforced Plastic (FRP): Shall not exceed the lesser of 10ft on-center, the maximum span determined by Delegated Design analysis, or the maximum set by pipe manufacturer.
  - 2) All other pipe: Shall not exceed the lesser of the maximum span determined by Delegated Design analysis or the maximum set by pipe manufacturer.
- 5. Coordinate support arrangements to eliminate interference with similar systems to be installed under Mechanical and Electrical, to maintain access for both personnel and for the removal of equipment, and to not interfere with existing equipment or structures.
- 6. Where supporting structures are indicated on Drawings to support piping, they shall be utilized for attachment of pipe unless determined to be unnecessary from analysis performed as part of the Delegated Design. Additional support may be required from the Delegated Design analysis and shall be the responsibility of the Contractor.
- 7. Saddles, guides, collars, and other fixtures interfacing with pipe shown on Drawings without explicit dimensions shall be analyzed and detailed as part of Delegated Design.
- 8. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components, if applicable.
- 9. Support pipe and appurtenances connected to equipment to prevent any strain being imposed on the equipment. Comply with manufacturer's requirements regarding piping loads being or not being transmitted to their equipment.
- 10. Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation.
- 11. Standalone supports and restraints are shown only where specific types and locations are required; additional pipe supports may be required.
- 12. Design supports, hangers, anchors, and guides to prevent excessive heat from being transmitted to building structure, equipment, or piping appurtenances.
- 13. Point Loads:
  - a. Support plastic piping containing meters, valves, dampers, appurtenances, and other point loads on both sides.
  - b. Avoid point loads on plastic piping by providing extra wide pipe saddles.

#### 1.4 SUBMITTALS

- A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.
- B. Product Data:
  - 1. Submit manufacturer's catalog data including load capacity for support hardware.
- C. Shop Drawings:
  - 1. Detailed structural drawings showing metal fabrications and connections to supporting structure. Indicate dimensions, sizes, material designations, and other details required for proper fabrication and installation.
  - 2. Layout of pipe support, guide, anchor, and expansion/ contraction joint locations.
  - 3. Shop Drawings shall be signed and sealed by a Professional engineer licensed in the project state responsible for the Delegated Design.
- D. Welder's Certificate:
  - 1. Submit welder's certification of compliance with ASME Section IX, verifying qualification within previous 12 months.
- E. Delegated Design Submittals:
  - 1. Design criteria for each above-ground piping **and duct** system, including design loads complying with the Performance Requirements of this section, ANSI B31.3, and MSS SP-58. **(ADDED BY ADDENDUM NO. 1)**
  - 2. Summary of related components including joints, class, valves, appurtenances, etc.
  - 3. Verification that maximum stresses each pipe system does not exceed allowable capacities as established by pipe manufacturer and/or applicable material standards
  - 4. Resolved and resultant forces and moments at interface of each support/ restraint attachment to supporting structures.
  - 5. Verification that all aspects of the analysis and design comply with the provisions of ANSI B31.3, MSS SP 58, MSS SP 69, MSS SP 89, and the referenced standards, as applicable.
- F. Manufacturer's Instructions:
  - 1. Submit special procedures and assembly of components.
- G. Qualifications Statements:
  - 1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.
  - 2. Submit manufacturer's approval of installer.
- H. Maintenance Material Submittals:
  - 1. See Section 01 77 00 – Closeout Procedures for maintenance material requirements.
  - 2. Spare Parts:
    - a. Furnish one set of manufacturer's recommended spare parts.
  - 3. Tools:
    - a. Furnish special tools and other devices required for Owner to maintain the supplied products.

#### 1.5 COORDINATION

- A. See Section 01 30 00 – Administrative Requirements for coordination requirements.
- B. Coordinate Work of this section with piping and equipment connections specified in other sections and in Drawings.

- C. Coordinate Work of this section with supporting metal framing as shown in Drawings and performed under Section 05 50 00 - Metal Fabrications.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work as specified in AWS D1.2 for welding and support attachments to supporting metal framing.
- B. Perform Work as specified in AWWA standards, State and Local building codes.

#### 1.7 QUALIFICATIONS

- A. Manufacturer:
  - 1. Company specializing in manufacturing Products specified in this section with minimum three years of experience.
- B. Fabricator:
  - 1. Company specializing in fabricating products specified in this section with minimum three years of experience.
- C. Installer:
  - 1. Company specializing in performing Work of this section with minimum three years of documented experience and approved by manufacturer.
- D. Licensed Professional:
  - 1. Engineer responsible for the Delegated Design of Pipe Supports and Restraints shall have at least 5 years of experience in the analysis and design of similar systems, including the use of commercial and custom pipe supports and in the use of commercial pipe stress software programs. Engineer shall hold professional license in the project state.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 60 00 – Product Requirements for transporting, handling, storing, and protecting products.
- B. Inspection:
  - 1. Accept materials onsite in original factory packaging, labeled with manufacturer's identification.
- C. Protect products from weather and construction traffic, dirt, water, chemical, and damage by storing in original packaging.

#### 1.9 AMBIENT CONDITIONS

- A. See Section 01 50 00 – Temporary Facilities and Controls for requirements on ambient condition control facilities for product storage and installation.

#### 1.10 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

## 1.11 WARRANTY

- A. See Section 01 78 36 – Warranties and Bonds for requirements.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. When pipe support products specified on Drawings or in Specifications are not available, fabricate pipe supports of correct material and to general configuration indicated.
- B. Materials:
1. Stainless Steel Plates and Shapes:
    - a. Type 316
    - b. Field welding is prohibited.
  2. Hot-Dip Galvanized Steel Plates, Shapes, and Fasteners:
    - a. Not permitted for Work.
  3. Aluminum Plates and Shapes:
    - a. Field welding is prohibited.
    - b. Where in contact with dissimilar metals and materials, protect per Section 05 50 00 - Metal Fabrications.
  4. Fasteners:
    - a. Type 316 stainless steel.
    - b. See Section 05 50 00 - Metal Fabrications.
  5. Cast-in-Place Concrete Anchors:
    - a. Permitted where indicated on Drawings only.
    - b. See Section 05 50 00 - Metal Fabrications.
  6. Post-Installed Concrete Anchors:
    - a. See Section 05 05 19 - Post-Installed Anchors
  7. Plastic, FRP, and other miscellaneous materials:
    - a. Use where specifically indicated on the Drawings.
  8. Fiberglass Resin:
    - a. Corrosion resistant premium grade vinylester.
  9. Injection Molded Components:
    - a. Polyurethane thermoplastics.
  10. Flame Spread of Fiberglass:
    - a. Vinylester Fiberglass (Series VF): Class 1, ASTM E84.
    - b. Polyurethane: V-O UL 94 V.
  11. Physical Properties of Fiberglass used for Pipe Support components, if applicable:

|                             | Longitudinal              | Transverse                |
|-----------------------------|---------------------------|---------------------------|
| <b>Tensile Strength</b>     | 37,500 psi                | 10,000 psi                |
| <b>Tensile Modules</b>      | 3.0 x 10 <sup>6</sup> psi | 1.0 x 10 <sup>6</sup> psi |
| <b>Flexural Strength</b>    | 37,500 psi                | 14,000 psi                |
| <b>Flexural Modules</b>     | 2.0 x 10 <sup>6</sup> psi | 1.0 x 10 <sup>6</sup> psi |
| <b>Compressive Strength</b> | 37,500 psi                | 20,000 psi                |
| <b>Shear Strength</b>       | 6,000 psi                 | 5,500 psi                 |
| <b>Izod Impact</b>          | 30 ft-psi                 | 5 ft-psi                  |

12. Touch-Up Resin:
  - a. Manufacturers (Choose ONE):
    - 1) Krylon, 7006-Satin Polyurethane Clear Finish
    - 2) Or Approved Equal.

## 2.2 PREFABRICATED SUPPORT COMPONENTS

- A. Manufacturers:
  - 1. Carpenter & Paterson, Inc.
  - 2. Empire Industries, Inc.
  - 3. Globe Pipe Hanger Products Incorporated
  - 4. Haydon Corporation
  - 5. Hilti, Inc.
  - 6. PHD Manufacturing, Inc.
  - 7. Anvil International
  - 8. Substitutions: See Section 01 60 00 – Product Requirements.
- B. Description:
  - 1. Conform to MSS SP58.
  - 2. Provide means of vertical adjustment after erection.
  - 3. Vertical Support: Riser clamp.
  - 4. Floor Supports: Stainless steel adjustable pipe saddle, lock nut, nipple, floor flange
- C. Performance and Design Criteria:
  - 1. Pipe Hangers:
    - a. Allow for expansion and contraction of piping while eliminating undue stress on piping appurtenances and equipment.
    - b. Provide linkage to permit lateral or axial movement where anticipated.
    - c. Where horizontal pipe movement is greater than 1/2 in., or where hanger rod deflection from the vertical is greater than 4° from cold to hot position of pipe, hanger rod and structural attachment shall be offset to maintain rod vertical in hot position.

## 2.3 STRUCTURAL ATTACHMENTS

- A. Manufacturers:
  - 1. ERICO International Corporation
  - 2. Grinnell Mechanical Products
  - 3. Unistrut; Part of Atkore International
  - 4. Anvil International
  - 5. Substitutions: See Section 01 60 00 – Product Requirements.
- B. Mounting Brackets:
  - 1. Stainless steel Type 316
- C. Beam Clamps:
  - 1. Manufacturers:
    - a. B-line, an Eaton Business
    - b. ERICO International Corporation
    - c. Grinnell Mechanical Products
    - d. Anvil International
    - e. Substitutions: Section 01 60 00 – Product Requirements.
  - 2. Description:
    - a. Stainless Steel Type 316; MSS SP-58.
    - b. Clamp Size: Based on load to be supported and load configuration.
    - c. Anchoring: Locknuts and cup-point set screws
    - d. Reversible top or bottom flange
- D. Riser Clamps:
  - 1. Manufacturers:

- a. B-line, an Eaton Business
  - b. ERICO International Corporation
  - c. Grinnell Mechanical Products
  - d. Substitutions:
    - 1) See Section 01 60 00 – Product Requirements.
- 2. Description:
  - a. Stainless Steel Type 316
  - b. Support of Copper Tubing: Provide copper-plated clamps.

- E. Offset Clamps:
  - 1. Manufacturers:
    - a. B-line, an Eaton Business
    - b. ERICO International Corporation
    - c. Grinnell Mechanical Products
    - d. Anvil International
    - e. Substitutions:
      - 1) See Section 01 60 00 – Product Requirements.
  - 2. Description: Double leg, two-piece

## 2.4 PIPE GUIDES

- A. General
  - 1. Galvanized steel components are not permitted.
  - 2. Metallic components supported by aluminum structure shall be isolated from direct contact with Mylar isolators or other protective system, as approved by the Engineer.
- B. Intermediate Guides:
  - 1. Pipes 6 in. and Smaller: Pipe clamp with oversize pipe sleeve
  - 2. Pipes 8 in. and Larger: U-bolts with double nuts
- C. Alignment Guides:
  - 1. Pipes 8 in. and Smaller: Spider type
  - 2. Pipes 10 in. and Larger: Roller type

## 2.5 NONMETALLIC PIPE SUPPORT SYSTEM

- A. Manufacturers:
  - 1. StrutTech
  - 2. Unistrut
- B. Supply all materials from one manufacturer with sole responsibility for the pipe support system.
- C. The supplied system, including pipe clamps, shall be interchangeable with industry standard 1 5/8 in. steel and fiberglass channel framing systems.
- D. Channel Framing:
  - 1. All channel framing shall be supplied with integral notches 1 in. on center.
  - 2. Locate notches on interior flange to prevent slippage of pipe clamps and fittings after installation.
- E. Pipe Clamps:
  - 1. Adjustable Type:
    - a. Nonmetallic and nonconductive
  - 2. Fixed Type:

- a. Pipe clamps for pipe less than 6 in. in diameter shall be nonmetallic and nonconductive.
  - b. Pipe clamps for pipe equal to and greater than 6 in. in diameter shall be fiberglass.
- F. Channel Fittings:
  - 1. Make fittings and post bases from glass-filled polyurethane or polyester.
- G. Fasteners:
  - 1. Make one type of fastener:
    - a. Glass-filled polyurethane
    - b. Vinylester fiberglass

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. See Section 01 60 00 – Product Requirements for installation examination requirements.
- B. Verify field dimensions as indicated on Drawings.

### 3.2 SUPPORT APPLICATIONS

- A. Supporting Structure Installation (Unless otherwise specified in Piping System Sections):
  - 1. Side-Beam or Channel Clamps (MSS Type 20):
    - a. For attaching to bottom flange of beams, channels, or angles.
  - 2. Center-Beam Clamps (MSS Type 21):
    - a. For attaching to center of bottom flange of beams.
  - 3. C-Clamps (MSS Type 23):
    - a. For structural shapes.
  - 4. Side-Beam Clamps (MSS Type 27):
    - a. For bottom of I-Beams.
  - 5. Steel-Beam Clamps with Eye Nuts (MSS Type 28):
    - a. For attaching to bottom of steel I-Beams for heavy loads.
  - 6. Linked-Steel Clamps with Eye Nuts (MSS Type 29):
    - a. For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  - 7. Malleable Beam Clamps with Extension Pieces (MSS Type 30):
    - a. For attaching to structural steel.
  - 8. Welded-Aluminum/ Stainless Steel Brackets:
    - a. For support of pipes from below
    - b. Use ONE for indicated loads:
      - 1) Light (MSS Type 31): 750 lbs.
      - 2) Medium (MSS Type 32): 1,500 lbs.
      - 3) Heavy (MSS Type 33): 3,000 lbs.
  - 9. Side-Beam Brackets (MSS Type 34):
    - a. For sides of aluminum.
  - 10. Plate Lugs (MSS Type 57):
    - a. For attaching to steel beams if flexibility at beam is required.
  - 11. Horizontal Travelers (MSS Type 58):
    - a. For supporting piping systems subject to linear horizontal movement where headroom is limited.
- B. Saddles and Shields Installation (Unless otherwise specified in Piping System Sections):
  - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

C. Pipe Supports:

1. Install as specified in MSS SP 58.
2. Support horizontal piping as indicated on Drawings or as indicated on Shop Drawings.
3. Support riser piping independently of connected horizontal piping.
4. Provide copper-plated hangers and supports for copper piping.
5. Design supports for pipe movement without disengagement of supported pipe.
6. Support piping independently so that equipment is not stressed by piping weight or expansion in piping system.
7. Provide welded steel brackets where piping is to be run adjacent to building walls or columns.
8. Insulated Piping: Provide two bolted clamps designed to accommodate insulated piping.
9. Use offset clamps where pipes are indicated as offset from wall surfaces.

### 3.3 SUPPORT INSTALLATION

A. Thermal Hanger Shield Installation:

1. Install in shield for insulated piping.

B. Fastener System Installation:

1. Install fasteners according to Manufacturer's written instructions.

C. Pipe Positioning System Installation:

1. Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

D. Install supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation:

1. Fabricate from shop welded-stainless steel or aluminum shapes.

F. Install supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe supports to prevent swaying.

H. Load Distribution:

1. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes:

1. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

J. Insulated Piping Compliancy:

1. Attach clamps and spacers to piping.
  - a. Piping Operating above Ambient Air Temperature:
    - 1) Clamp may project through insulation.
  - b. Piping Operating below Ambient Air Temperature:

- 1) Use thermal hanger shield insert with clamp sized to match OD of insert.
  - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - a. Option:
    - 1) Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180°.
  - a. Option:
    - 1) Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Minimum Shield Dimensions for Pipe:
  - a. NPS 1/4 to NPS 3 1/2: 12 in. long and 0.048 in. thick
  - b. NPS 4: 12 in. long and 0.06 in. thick
  - c. NPS 5 and NPS 6: 18 in. long and 0.06 in. thick
  - d. NPS 8 to NPS 14: 24 in. long and 0.075 in. thick
  - e. NPS 16 to NPS 24: 24 in. long and 0.105 in. thick
5. Pipes NPS 8 and Larger:
  - a. Include wood inserts.
6. Insert Material:
  - a. Length at least as long as protective shield.
7. Thermal Hanger Shields:
  - a. Install with insulation same thickness as piping insulation.

### 3.4 EQUIPMENT SUPPORTS

- A. Fabricate stainless-steel or aluminum stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting:
  1. Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.5 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints.
- C. Field Welding:
  1. Not permitted
- D. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.6 INSTALLATION

- A. General:
  1. Obtain permission from Engineer before using powder-actuated anchors.
  2. DO NOT drill or cut structural members.

3. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
4. Support piping connections to equipment by pipe support and NOT by the equipment.
5. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
6. Support no pipe from the pipe above it.
7. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
8. DO NOT install pipe supports and hangers in equipment access areas or bridge crane runs.
9. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
10. Install lateral supports for seismic loads at all changes in direction.
11. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
12. Repair mounting surfaces to original condition after attachments are made.
13. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in Piping System Sections.
14. Comply with MFMA-102 for metal framing system selections and applications that are not specified in Piping System Sections.
15. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
16. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to Section 03 20 00 – Concrete Reinforcing for inserts carrying pipe 4 in. and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

C. Insulation:

1. Provide clearance in hangers and from structure and other equipment for installation of insulation.
2. See Section 40 42 00 – Process Mechanical Insulation.

D. Equipment Bases and Supports:

1. Suspended Equipment:
  - a. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
  - b. Provide lateral bracing, to prevent swaying, for equipment supports.
2. Ground Mounted Equipment:
  - a. Provide housekeeping pads of concrete, minimum 6 in. thick and extending 6 in. beyond supported equipment and valves or as specified in Drawings. See Section 03 30 00 – Cast-in-Place Concrete.
  - b. Grouting: Place grout under supports for equipment and make smooth bearing surface.

END OF SECTION

**SECTION 40 23 39.61  
FIBER REINFORCED PIPE AND FITTINGS**

| <b>Item</b>      | <b>Size</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                            |
|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pipe             | All         | FRP Type 1, Grade 2 RTRP, Class E for ASTM D2310 and D2996. 7 in. minimum static pressure.                                                                                                                                                                                                                                                                    |
| Fittings         | All         | FRP as above. Butt and wrap joint type connections.                                                                                                                                                                                                                                                                                                           |
| Joints           | All         | Butt and wrap joint type connections. All joints per SMACNA Standards.                                                                                                                                                                                                                                                                                        |
| Flanges          | All         | One-piece integral flange or flange on pipe fabrication. <del>150 lb. per Standard ASA B16.5.</del> <b>per Standard ASTM D3982.</b><br><b>(REVISED BY ADDENDUM NO. 1)</b>                                                                                                                                                                                     |
| Bolting          | All         | <b>Flat Face Mating Flange or In Corrosive Areas:</b> ASTM A193 Rev A-94 Type 316 stainless steel Grade B8M hex head bolts and ASTM A194-94 Grade 8M hex head nuts.<br><br><b>With Raised Face Mating Flange:</b> Carbon steel ASTM A307-94 Grade B square head bolts and ASTM A563-93 Grade A heavy hex head nuts.                                           |
| Gaskets          | All         | <b>Flat Face Mating Flange:</b> Full faced 1/8 in. thick.<br><br><b>Raised Face Mating Flange:</b> Flat ring 1/8 in. thick, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.<br><br>Gasket material shall be suitable for each service. Submit recommended gasket material for each service to Engineer. |
| Resin            | All         | Corrosion resistant Class 1 pipe retardant polyester or vinyl ester.                                                                                                                                                                                                                                                                                          |
| Thread Lubricant | All         | Teflon Tape                                                                                                                                                                                                                                                                                                                                                   |

END OF SECTION

## SECTION 40 73 26 – DIFFERENTIAL AND GAUGE PRESSURE TRANSMITTERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section Includes:
  - 1. Differential and gauge pressure transmitters
- B. Related Sections:
  - 1. Section 40 70 00 – Instrumentation for Process Systems

#### 1.2 COORDINATION

- A. See Section 40 70 00 – Instrumentation for Process Systems for requirements.

#### 1.3 SUBMITTALS

- A. See Section 40 70 00 – Instrumentation for Process Systems for requirements.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Section 40 70 00 – Instrumentation for Process Systems for requirements.

#### 1.5 WARRANTY

- A. See Section 01 78 36 – Warranties and Bonds for requirements.

### PART 2 - PRODUCTS

#### 2.1 PRESSURE MEASUREMENT DEVICES

- A. Manufacturers:
  - 1. Endress+Hauser PMC71 (gauge) PMD75 (differential)
  - 2. Siemens Sitrans P320
  - 3. Rosemount 3051
- B. Description:
  - 1. Digital pressure measurement device for with integral transmitter and display, for gauge and differential pressure applications in liquids and gases.
- C. Measuring Range:
  - 1. As specified in schedule.
- D. Features and Performance:
  - 1. Power Supply: 24V DC
  - 2. Accuracy: Plus or minus 0.05%
  - 3. Output Signal: 4 mA DC–20 mA DC
  - 4. Process Temperature Range: (-4)°F–250°F
  - 5. Materials: Type 316 stainless steel
  - 6. Location: As specified in Drawings.
  - 7. Local digital display, NEMA 4X rated
- E. Accessories:
  - 1. Providing mounting hardware accessories as required for mounting application.

2. Furnish cable, field preamplifiers, and signal conditioners as required to maintain accuracy from sensor to terminal device.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. See Section 40 70 00 – Instrumentation for Process Systems for requirements.

#### 3.2 INSTALLATION

- A. Mount meters as specified in manufacturer's instructions and compatible with installed location.
- B. Coordinate location and orientation of transmitters with final piping and equipment installations.
- C. Locate transmitters to be easily read during operation and easily accessible for maintenance.
- D. Provide pulsation dampeners in pressure transmitter sensing lines when located at pump discharge.
- E. Provide with remote pressure compensation tube when required for supplied instrument with length as required.
- F. See Section 40 70 00 – Instrumentation for Process Systems for additional requirements.

#### 3.3 FIELD QUALITY CONTROL

- A. Testing:
  1. Test and calibrate meters to demonstrate that it meets manufacturer's specified accuracy.
- B. See Section 40 70 00 – Instrumentation for Process Systems for additional requirements.

#### 3.4 DEMONSTRATION

- A. See Section 40 70 00 – Instrumentation for Process Systems for requirements.

#### 3.5 ATTACHMENTS

- A. Pressure Transmitter Schedule:

| Instrument Tag  | Application                                                                        | Measurement Range  |
|-----------------|------------------------------------------------------------------------------------|--------------------|
| 10PDI101*       | Fan No. 1 Pressure Differential Indicator                                          | *                  |
| 10PDI102*       | Fan No. 2 Pressure Differential Indicator                                          | *                  |
| 10PDI103*       | Fan No. 3 Pressure Differential Indicator                                          | *                  |
| 10PDIT101*      | Biotrickling Filter Pressure Differential Transmitter                              | *                  |
| 10PDIT001*      | Mist Eliminator Pressure Differential Transmitter                                  | *                  |
| 10PDIT002*      | Carbon Unit Pressure Differential Transmitter No. 1                                | *                  |
| 10PDIT003*      | Carbon Unit Pressure Differential Transmitter No. 2                                | *                  |
| <b>10PIT101</b> | <b>Water Control Panel Inlet Pressure Transmitter<br/>(ADDED BY ADDENDUM NO 1)</b> | <b>0 - 100 psi</b> |

\* Provided as part of Odor Control Manufacturer scope of supply. Measurement range as recommended by manufacturer.

END OF SECTION

## SECTION 44 11 29 – BIO-TRICKLING FILTER ODOR CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section Includes:

1. The work necessary to design, furnish, and install one Biotrickling Filter odor control system as specified herein. The Headworks shall be treated with one Bio-Trickling Filter Tower (10BTF1) and one Carbon Adsorber Tank (10CP1). Each odor control system consists of Biotrickling Filter (BTF) tower, Carbon Adsorber Tank, fan(s), flow control dampers, internal structural members, media with support grating, mist eliminator, internal piping, liquid distributor(s), and Process Controls. Each Process Control system shall include: a nutrient feed system, electrical controls, irrigation valves, recirculation pump, nutrient storage tank, water control panel, and all necessary accessories as described in this specification and the contract drawings.

B. Related Sections:

1. Section 01 40 00 – Quality Requirements
2. Section 05 05 19 - Post-Installed Anchors
3. Section 05 50 00 - Metal Fabrications
4. Section 23 33 00 - Air Duct Accessories
5. Section 40 61 96 - Process Control Descriptions - General
6. Section 40 61 96.1 - Process Control Descriptions - Odor Control
7. Section 44 61 16 - Carbon Adsorber Odor Control System

#### 1.2 REFERENCES:

A. ASTM International:

1. C581 – Determining Chemical Resistance of Thermosetting Resins used in Glass Fiber Reinforced Structures Intended for Liquid Service.
2. C582 – Contact-Molded Reinforced Thermosetting Plastic Laminates for Corrosion Resistant Equipment.
3. D638 – Test for Tensile Properties of Plastics.
4. D695 – Test for Compressive Properties of Rigid Plastics.
5. D746 – Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
6. D790 – Test for Flexural Properties of Plastic.
7. D883 – Standard Nomenclature Relating to Plastics.
8. D1505 – Test Method for Density of Plastics by the Density Gradient Technique.
9. 1693, Test Method for Environmental Stress Cracking of Ethylene Plastics.
10. D2310 – Machine Made Reinforced Thermosetting Resin Pipe.
11. D2563 – Recommended Practice for Classifying Visual Defects in Glass Reinforced Laminated Parts.
12. D2583 – Test for Indentation Hardness of Plastics by Means of a Barcol Impresser.
13. D2996 – Filament Wound, Reinforced Thermosetting Polyester Chemical Resistant Tanks.
14. D3299 – Filament Wound Glass Fiber Reinforced Polyester Chemical Resistant Tanks
15. D4097 – Contact Molded Fiber Reinforced Thermoset Chemical Resistant Tanks.

B. NBS Voluntary Product Standard:

1. PS15-69 Custom Contact Molded Reinforced Polyester Chemical-Resistant Process Equipment.

### 1.3 DESCRIPTION

- A. System Description: It is the intent of this specification that one complete Biotrickling Filter system be provided by a single Manufacturer having complete system responsibility. Each system shall include, but NOT be limited to:
- |     |                                                          |                  |
|-----|----------------------------------------------------------|------------------|
| 1.  | Biotrickling Filter Tower                                | 10BTF1           |
| 2.  | Carbon Adsorber Tank                                     | 10CP1            |
| 3.  | Fans                                                     | 10F1, 10F2, 10F3 |
| 4.  | Control Dampers                                          | 10CD1 - 10CD7    |
| 5.  | Recirculation Pump                                       | 10P1             |
| 6.  | Nutrient Feed & Dilution System                          | 10P2             |
| 7.  | Water Control Cabinet                                    | 10LCP1           |
| 8.  | Electrical Control Cabinet                               | 10CP1            |
| 9.  | Nutrient Storage Tank                                    |                  |
| 10. | Mist Eliminator Attachments of tanks to ends of piping.  |                  |
| 11. | Lateral bracing for vertical pipe segments at BTF tower. |                  |
| 12. | Aluminum Ladder and Platform for BTF Tower.              |                  |
| 13. | Aluminum Ladder and Platform for Carbon Adsorber Tank    |                  |
- B. The components listed above shall be installed to form a complete and operational biological odor control system in accordance with the requirements specified in this section. The drawings show minimum features and equipment required for the system. The carbon media polishing systems will be described in Section 44 61 16 - Carbon Adsorber Odor Control System.
- C. The cost of any other changes and modifications to mechanical, structural, electrical, and emergency electrical facilities necessary to adapt alternate equipment to the layout and design shown shall be borne by the Contractor. Clearances shown on the Drawings shall be maintained. Any such proposed changes or modifications are subject to review and acceptance of the Owner. Any costs associated with the engineering review shall be borne by the Contractor.
- D. Coordination:
1. To ensure that all the equipment is properly coordinated and will function in accordance with the requirements of the Contract Documents, the Contractor shall obtain all equipment specified herein from an odor reduction scrubber Manufacturer who shall have vested unit responsibility for the proper function of the complete system. However, The Contractor shall retain ultimate responsibility under this Contract for equipment coordination, installation, operation and guarantee, and the Contractor shall furnish and install all labor, equipment, materials, appurtenances, specialty items and services NOT provided by the supplier but required for a complete and operable system. The equipment covered by this specification is intended to be standard equipment of proven ability as manufactured by reputable concerns having extensive experience in the production of such equipment. The equipment furnished shall be manufactured and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown and as specified in the Contract Documents.

### 1.4 QUALITY ASSURANCE

- A. Manufacturer:
1. The products furnished under this section shall be of a Manufacturer who has been regularly engaged in the design and manufacture of odor control equipment for a minimum of ten years and biological odor control for eight years. Any costs associated with engineering review of an alternate supplier shall be submitted by a Contractor with all costs of evaluation including site visits be borne by the Contractor.

## 1.5 SUBMITTALS

- A. Submittals shall be made in accordance with Section 01 33 00 - Submittal Procedures.
- B. In addition, the following specific information shall be provided:
  - 1. The Manufacturer shall submit detailed description of the laminate and the type of reinforcing to be used and a letter from the resin Manufacturer stating:
    - a. That the laminate and reinforcing material used complies with the specifications.
    - b. That the resin will meet the performance requirements stated and is suitable for the service conditions specified herein and the fabrication technique proposed.
  - 2. All material properties used in the calculations shall be derived from actual destructive testing of equivalent laminates.
  - 3. Detailed shop drawings showing weights and dimensions of equipment, all nozzles and manways, wall thicknesses, laminate make-up, fabrication techniques, anchor bolt layout, roof access areas, platforms, ladders, fall prevention systems, pipe attachments and accessories, and construction materials for all equipment. Drawings and description of nozzle and liquid distribution system to include spray pattern, pressure drop, liquid flow rate, support system details and materials of construction.
  - 4. Submit fan data sheets with a description of the proposed fan, fan size, type, arrangement, construction materials, weight, motor horsepower, motor type, power supply, frame size, sheave sizes, belts size, number, and length. Submittal shall include pertinent equipment dimensional data, and a performance curve showing the fan operating point and range. A list of accessories to be furnished shall be included.
  - 5. Design structural calculations for each vessel and their anchorage to supporting construction, signed and sealed by a professional engineer registered in Alabama.
    - a. Provide signed and sealed calculations for the biotrickling filter systems, including vessels, roof access areas, ladders, and safety rails to verify compliance with the design criteria indicated in Section G.2 and all applicable OSHA requirements.
  - 6. Current design does not include wiring restraints. If wiring restraints are required based on calculations, modifications to the biotrickling filter design, including pad size to allow appropriate access space, shall be performed at no additional cost to the Owner. A description of media including but not limited to, pressure drop through media, liquid hold-up data, and media physical characteristics.
    - a. Complete data on the head loss for the air flow through the media at both design air flow rates.
    - b. Details of filter media supports.
  - 7. A description of the proposed quality requirements program that will be used during the manufacturing of the scrubber. Include the resume of the quality requirements manager.
  - 8. A schedule for the scrubber's fabrication along with the location of the fabrication site.
  - 9. Written instructions as to the recommended methods for unloading, storing, and installing the fiberglass scrubbers and recommended lifting and handling procedures.
  - 10. Submit listing of previous installations and references to the Engineer. The proposed vessel fabricator shall demonstrate an experience record of at least 5 years with the Manufacturer of filament wound fiberglass vessels for industrial service.
  - 11. Submit written installation procedures.
  - 12. Submit factory test certifications.
  - 13. Submit Manufacturer recommended support ledge requirements for liquid distributor, packing support, and mist eliminator. Submit recommended influent feed pipe design for liquid distributor.
  - 14. Submit certification indicating the quality requirements, testing, and inspection has been completed and standards specified herein have been met prior to shipment to the jobsite.
  - 15. Submit color chart describing the available colors for the vessel exterior pigment color to be selected by the Engineer and/or Owner.
  - 16. Schematic of the system, showing all components and controls.
  - 17. Electrical data for all equipment.

18. Information and data for all instrumentation and controls and for the control panel, including wiring and interconnection diagram.
19. Control panel layout drawing and fabrication details.
20. Complete listing of physical and chemical process parameters required for proper operation of the system.
21. In addition, the following data for motors shall be provided:
  - a. Motors:
    - 1) Name and Manufacturer
    - 2) Type and model
    - 3) Bearing type and lubrication
    - 4) Horsepower rating and service factor
    - 5) Temperature rating
    - 6) Full load rotative speed
    - 7) Net weight
    - 8) Efficiency at rated load
    - 9) Full load current
    - 10) Overall dimensions

#### 1.6 MANUFACTURER'S SERVICES

- A. The system Manufacturer's representative shall be present at the job site for the following time period; travel time excluded:
  1. One day for each system for inspection and certification of the installation, can be performed concurrently if the schedule allows.
  2. One day to train Owner's staff in operation of both systems to include two hours of classroom and two hours at the site(s)
  3. Two days for initial startup and monitoring for each of the systems can be performed concurrently if the schedule allows.
  4. One follow-up trip for two days, 2 weeks after startup to assess the acclimation process, adjust to steady state operation. Can be performed concurrently if the schedule allows.
  5. One trip for two days 3 – 4 weeks after startup to perform performance testing, can be performed concurrently if the schedule allows.
  6. One trip for two days within one month of warranty expiration to perform performance testing. Tests shall meet performance requirements at design conditions. Refer to Subsection 3.3, PERFORMANCE TESTING for further requirements.
  7. A minimum of four trips is required.

#### 1.7 DELIVERY AND INSTALLATION

- A. Components and accessories shall be shipped in safe packaged containers to prevent damage. Installation of components at the job site shall be in strict compliance of Manufacturer's recommendations and under adequate supervision provided by the system supplier.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Six (6) copies of a 3-ring bound O&M manual shall be provided.
- B. One copy of a digital pdf O&M manual shall be provided.

#### 1.9 MANUFACTURER'S WARRANTY

- A. The Contractor shall procure and provide copies of all certified Manufacturer's warranty. The complete system, including accessories and components, shall be warranted for two years by the Manufacturer having unit responsibility.

- B. Provide warranty for a period of 2 years after the Final Acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer shall promptly repair or replace the defective equipment without additional cost to the Owner.
- C. Provide BTF media warranty for a period of 10 years after the Final Acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer shall promptly repair or replace the defective equipment without additional cost to the Owner.
  1. Media failure includes increase in pressure drop through the media such that the specified airflow rates are not achievable with the installed equipment and/or the failure of the media to meet specified odorant removal levels.

## PART 2 - PRODUCTS

### 2.1 BIOTRICKLING FILTER

- A. General:
  1. Each Biotrickling Filter system shall be vertical, countercurrent flow, and shall consist of an FRP vessel, biological media, spray nozzle, mist eliminator, sump, and all internals. The process support equipment, which includes the nutrient reservoir, auxiliary sump, recirculation pump(s), water control cabinet(s), and electrical cabinet shall be included, as necessary, pre-piped, pre-wired, and factory tested on a integrated single Process Support and Control skid.

### 2.2 MANUFACTURERS

- A. Where a Manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features and materials of construction as specified herein. Section 44 61 16 - Bio-Trickling Filter and Carbon Adsorber Odor Control System shall be of same Manufacturer.
  1. Daniel Mechanical
  2. BioAir
  3. ECS
  4. Evoqua

### 2.3 SERVICE CONDITIONS AND PERFORMANCE REQUIREMENTS

- A. BTF Design Specifications and Performance Requirements. BTF shall be sized for minimum empty bed contact time and performance requirements at the higher airflow. Air channeling within BTF at the lower airflow shall not be acceptable.

|                                                                             | <b>10BTF1</b>                               |                                             |
|-----------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------|
| <b>Design Air Changes per Hour</b>                                          | 30                                          | 15                                          |
| <b>Design Air Flow Rate, cfm</b>                                            | 6,300                                       | 3,150                                       |
| <b>Minimum empty bed contact time, seconds</b>                              | 15                                          | 30                                          |
| <b>Average Inlet H<sub>2</sub>S Concentration, ppm(v)<sup>1</sup></b>       | 200                                         | 250                                         |
| <b>Peak Inlet H<sub>2</sub>S Concentration, ppm(v)<sup>1</sup></b>          | 450                                         | 525                                         |
| <b>Odor Removal % H<sub>2</sub>S, % Overall (REVISED BY ADDENDUM NO. 1)</b> | <b>99%, 90% or ≤0.5 ppmv in the outlet,</b> | <b>99%, 90% or ≤0.5 ppmv in the outlet,</b> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>whichever is less stringent</b>                                                  | <b>whichever is less stringent</b>                                                  |
| <b>Odor Removal % Overall (REVISED BY ADDENDUM NO. 1)</b>                                                                                                                                                                                                                                                                                                                                                                                   | <b>90% or <math>\leq 0.5</math> ppmv in the outlet, whichever is less stringent</b> | <b>90% or <math>\leq 0.5</math> ppmv in the outlet, whichever is less stringent</b> |
| Notes:<br>1. Average and Peak Inlet H <sub>2</sub> S Concentrations listed are estimated inlet concentrations after the headworks headspace has been diluted at the specified ventilation rates.<br>2. Average and Peak H <sub>2</sub> S Concentrations measured in the headworks headspace are 1,406 ppm and 3,150 ppm, respectively. The concentrations were measured with stagnant air and do not include any dilution from ventilation. |                                                                                     |                                                                                     |

- B. All components of the odor control system shall be compatible with the conditions and constituents to which they will be subjected to during normal operation. Compounds with which the materials of construction must be compatible with include, but are not limited to:
1. Hydrogen sulfide
  2. Carbonyl sulfide
  3. Methyl mercaptan
  4. Dimethyl sulfide
  5. Carbon disulfide
  6. Dimethyl disulfide
- C. Service Conditions for each Odor Control System.
1. Service Conditions:
    - a. Ambient Air Temperature Range: 40–110°F (5–50°C)
    - b. Entering Air Temperature Range: 40–100°F (5–40°C)

## 2.4 MATERIALS AND CONSTRUCTION

- A. Fiberglass Vessel:

|                                                 |               |
|-------------------------------------------------|---------------|
|                                                 | <b>10BTF1</b> |
| <b>Air Flow Rate, cfm</b>                       | 6,300         |
| <b>Number of Towers</b>                         | 1             |
| <b>Minimum Number of Media Levels per Tower</b> | 1             |

- B. Materials & Construction:
1. The Biotrickling Filter shall be cylindrical tower in shape with upflow air passage and countercurrent liquid flow. Vessel size and configuration shall be as shown on the drawings. Unit shall be complete with flanges, nozzles, manways, lifting lugs, anchors, and other appurtenances.
    - a. Vessel diameter shall not exceed 10 feet.
  2. The vessel, including its anchorage to supporting construction and all supported attachments, shall be designed to meet all applicable requirements of the governing building code adopted by the jurisdiction. For governing building code, wind speed and exposure, and seismic parameters, see the Structural Notes in the Drawings. Structural analysis shall be performed in accordance with the edition of ASCE 7-"Minimum Design Loads and Associated Criteria for Buildings and Other Structures" adopted by the governing building code.
  3. The vessel shall be filament wound in accordance with ASTM D3299. The vessel shall be designed for positive pressure service conditions as specified for Type II Grade 1 tanks in

ASTM D3299. Any fabrication by hand lay-up shall NOT be acceptable. Any vessel made of PVC, polypropylene, or any other material shall NOT be acceptable. A 10:1 safety factor shall be used for internal pressure loadings and a 5:1 safety factor shall be used for external and vacuum loadings. Contact molded components and accessories, including scrubber baffles, shall be fabricated in accordance with ASTM D4097 and PS 15-69. The resin will be exposed continuously to chemical scrubbing liquid and gas as listed in the service conditions above. The resin shall be capable of continuous exposure to H<sub>2</sub>SO<sub>4</sub> concentrations up to 5% at temperatures up to 210°F. Without exception the resin shall be vinyl ester ~~Hotron 922 by Allnex~~, CoRezyn CORVE 8401 by Interplastic, Derakane 510B-400P by Ashland Chemical, or pre-approved equal. **Flame spread rating shall be Class 1.** Dual media systems that utilize polyester resin as the structural layer and vinyl ester as the corrosion shall NOT be allowed. **(REVISED BY ADDENDUM NO. 1)**

4. The laminate shall consist of a single resin rich layer, with Nexus 111-00010, C-glass veil, or approved equal reinforcement followed by two 1-1/2-ounce layers of random chopped strand glass, fully wetted out with resin. This interior surface shall yield a minimum 100-mil thick corrosion barrier. Filament wind over this to the required thickness. Exterior surface coat shall be paraffinated, complete with ultraviolet screener such as UV-9. No thixotropic or other additives shall be used. The pigment tone shall be selected by the Owner during the submittal.
5. The minimum properties of filament wound laminate shall be as specified in ASTM D3299.
6. The minimum properties of contact molded laminate shall be as follows:
  - a. Minimum glass content 35%
  - b. Tensile strength 17,000 psi
  - c. Tensile modulus 1,400,000 psi
  - d. Flexural strength 27,000 psi
  - e. Flexural modulus 1,000,000 psi
7. Anchorage: Each tank shall be furnished with concrete anchors and hold down lugs, complete with 316 stainless steel plates, bolts, nuts, and washers for proper anchoring of the tank as required by the design calculations.
  - a. Manufacturer shall provide anchor requirements and locations to contractor.
8. Lifting lugs shall be provided for use in transporting and placing the vessel.
9. Visual defects shall be better than Level II on the inside of the vessel and better than Level III on the outside in accordance with ASTM D2563.
10. Tower components shall be preassembled at the point of fabrication. Preassembly will NOT require all joints to be factory assembled, but all joints shall be prepared for filed fabrication and square within plus or minus 3/16 inch. Each matched piece shall then be numbered correspondingly. All FRP work shall be protected from atmospheric or otherwise induced conditions of adverse temperatures, moisture, wind, or blowing dust and sand and other contaminants that would adversely affect the laminate or joint construction. The protective means shall be provided during the construction and curing period.
11. Other than those associated nozzles, couplings, manways, and top and bottom heads, the towers shall be filament wound in one piece with no more than one joint.
12. All metal hardware shall be 316 stainless steel.
13. Sizes of manways shall be as shown on the Drawings, or as required for normal routine maintenance and shall be in accordance with ASTM D3299. As a minimum, manways shall be provided for access to the sump, bottom of EACH media level, nozzle inspection and top of packing, media replacement, and mist eliminator for each tower. Bolted manways shall be provided with 1/8-inch thick full face EPDM gaskets with 316 stainless steel bolts. Provide a transparent blind flange to view operation of the nozzles and allow inspection of the media.
14. Flanged nozzles, double flanged gusseted nozzles, bottom drain nozzle, and threaded full couplings shall be provided as required. Flanged nozzles with 1/8-inch thick EPDM

- full-face gaskets of 60 durometer shall be provided by the supplier. Press-molded flanges are NOT acceptable. Threaded full couplings shall be PVC.
15. The bottom or reservoir section, as required for system operation, shall include air inlet connection, make-up water connection, recirculation pump suction connection, drain, overflow, and sump low level indicator fabricated of SCH 80 clear PVC pipe.
  16. Each bioscrubber sump shall be equipped with a titanium or hastelloy grounding rod. The grounding rod will provide an earth ground for the bioscrubber solution. The Contractor shall install a grounding rod adjacent to the bioscrubber for connection to the lugs.
- C. Media Support:
1. Media support plates shall be VINYL ESTER FRP GRID type rated at 150 psi. Free area shall be a minimum of 95% of the cross-sectional area of the tower. Packing support plates and mid span supports shall be suitable to support weight of the packing specified plus entrained recirculation solution. Opening size shall NOT allow passage of packing media in any random orientation. Construction shall be fiberglass constructed of vinyl ester resins. Furnish supplier instructions for placement and removal of the packing support in and out of the tower.
- D. Biological Media:
1. The media material shall be synthetic reticulated polyurethane foam, resistant to the corrosive attack of acids. The media configuration shall promote thorough mixing and good contact between the gas and irrigation solution. Organic material, clay, mineral media, or media containing carbon or impregnated with nutrients or metals shall NOT be allowed.
  2. Media material and configuration shall be suitable for both high airflow and low airflow conditions. Air channeling at low airflow condition shall not be acceptable.
- E. Liquid Distributor:
1. A liquid distribution header shall be provided to uniformly distribute the scrubbing liquid onto the packing material. Internal spray piping shall have flanged connection for easy removal. Without exception the liquid spray distributor system shall be consist of full cone, non-clog spray nozzle attached to the header array. The spray nozzle shall have a minimum free passage diameter of 0.25 inch and shall be specifically designed to be clog resistant. Pressure loss across the nozzle at design capacity shall be no more than 10 psi. The spray nozzles shall be Teflon, polypropylene, PVC or 316 stainless steel. The irrigation piping and nozzle within the vessel shall be readily accessible from the outside of the vessel without any entry into the vessel.
- F. Exhaust Stack:
1. Each tower scrubber shall be furnished with a flanged connection vertical stack fabricated from fiberglass reinforced plastic with flanged connection to the scrubber outlet. Each stack shall be provided with one inch diameter fitting for outlet air sampling.
- G. Lateral Pipe Support:
1. Manufacturer to provide support tabs on side of BTF vessel to attach vertical segment of pipe to vessel for lateral bracing.
  2. Support tabs shall be corrosion resistant.
  3. Vertical support for self weight and/ or uplift of vertical pipe segment shall be the responsibility of pipe supplier.
- H. Identification Tag:
1. Vessel shall be provided with a permanently attached, 16-gauge stainless steel equipment identification plate or label laminated into the final fiberglass coat. The label shall state the following in 1/4-inch die-stamped lettering for the plate or 1-inch lettering for the laminated label.

2. Equipment identification (tag) number shown on Drawings and vessel name "BIOTRICKLING FILTER".
3. Resin type, inner surface reinforcement, and resin Manufacturer's name
4. Date of manufacture
5. Manufacturer's name and address
6. Manufacturer serial number
7. Purchase order number
8. Allowable temperature range
9. Design pressure (vacuum)
10. Vessel dimensions and capacity in cubic feet
11. Operating Weight

I. Neoprene Pad:

1. A 1/4" thick, 60 durometer neoprene rubber sheet shall be placed underneath the scrubber vessel.

J. Ladder and Platform: Size and configuration as indicated on the Drawings and as follows:

1. Ladder: Fabricated from aluminum.
2. Elevated Platform and Structural Members: Fabricated from aluminum for access to the tank top. See Drawings for configuration. Scrubber Manufacturer shall design and supply platform support system. Platform shall be supported from scrubber tower.
3. Ladder Design Live Loads, Deflection, Extension, and Fall Protection System shall all comply with the requirements for Metal Ladders as indicated in Section 05 50 00 - Metal Fabrications and OSHA.
4. Platforms shall be designed to meet OSHA requirements for Walking-Working services. Live load used for design of each platform component shall be a minimum of the greater load effect resulting from a 40 psf distributed load or a 300 pound concentrated load (unfactored).
5. Provide aluminum handrail around platform.
6. Design and fabricate Type 316 stainless steel or FRP support members for anchoring platform to vessel wall.
7. Fasteners:
  - a. Type 316 stainless steel.
8. Secure ladder to the vessel using Type 316 stainless steel or Hastalloy C bolts with polyethylene encapsulated heads.
9. Anchor Bolts:
  - a. Type 316 stainless steel.
10. Ladder shall be equipped with safety rail and fall protection.

## 2.5 EXHAUST FAN

A. Exhaust Fan:

1. Fan shall have fiberglass reinforced plastic centrifugal backward inclined impeller. The wheel shall be dynamically balanced. Resin shall be suitable for exposure to the specific service conditions. The shaft shall be carbon steel and shall have a stainless steel sleeve. The shaft seal shall be Teflon or Viton.
2. All fans shall be provided with lugs, brackets, or supplied devices to allow the fan to be firmly bolted to concrete equipment pad.
3. Fan shall be rated for Class 1 Div 2 conditions.

B. Bearings shall be heavy duty, self aligning grease lubricated ball type with minimum of 100,000-hour B-10 life. OSHA approved belt guard and shaft guard shall be provided. Motor shall be high-efficiency, TEFC, 1800 RPM with a 1.15 service factor and suitable for 3/60/230-460V. Fan shall be belt driven. Fan shall have a constant V-belt drive. Provide access for greasing bearings, tachometer readings of fan and motor speed without removing the cover. Covers shall be properly ventilated to prevent motor overheating.

1. When bearings are not accessible, extended supply and relief fittings shall be supplied. Both supply and relief fittings shall terminate in the same location.
- C. Fan Housing shall be constructed of fiberglass and reinforced with rigid bracing to increase structural integrity. Fan housing shall be ultraviolet and corrosion resistant. Bearing support brackets shall be positioned to directly oppose belt tension forces. Fan housing shall be a curved scroll design with a 1-inch drain connection at the lowest portion of the fan scroll. The fan inlet shall be slip type and the fan outlet shall have a flanged nozzle.
- D. The fan shall be designed for the following specifications:

| Fans                                                                                                                                                                                                            | 10F1, 10F2, 10F3 |             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------|
| Design Air Flow Rate, cfm                                                                                                                                                                                       | 6,300            | 3,150       |
| S.P. up to BTF Filter Inlet, in. WC<br>(REVISED BY ADDENDUM NO. 1)                                                                                                                                              | 4.7<br>18.5      | 48.5<br>4.7 |
| Approximate Total Pressure Drop, in. WC <sup>1</sup>                                                                                                                                                            | 17.0             | 30.0        |
| Motor HP                                                                                                                                                                                                        | 30               | 30          |
| Notes:<br>1. Total pressure drop through odor control system to vary by manufacturer. It is the responsibility of the odor control system manufacturer to coordinate final pressure drop with fan manufacturer. |                  |             |

- E. All fastening and hardware exposed to a corrosive environment shall be Type 316 stainless steel.
- F. Fan base shall be Type 316 stainless steel.
- G. Fan shall be furnished with stainless steel nameplates including information of manufacturer, model number, rated capacity, static pressure, RPM, and any other pertinent data.
- H. Flanged Connections:
  1. Connects to expansion joints, dampers, fan, bio-trickling filter, carbon adsorber, or other equipment shall be flanged fiberglass reinforced plastic, unless otherwise noted in the drawings or specifications. Gaskets shall be EPDM.
  2. Furnish all bolts, nuts, washers, and other fasteners required. Metallic fasteners shall be Type 316 stainless steel. All flange bolts shall be torqued to values as recommended by manufacturer.
- I. Flexible Connector:
  1. Provide flanged expansion joint for inlet and outlet of fan to FRP vessel transition piece. The flange drilling shall be coordinated with fan and transition.
  2. Type: W-design configuration with fully molded integral flanges suitable for service with FRP duct.
  3. The properties of the flexible connectors shall be as follows: Material shall be EPDM. Material shall be resistant to ultraviolet light degradation and shall be suitable for contact with odorous air as specified herein. The backing rings shall be 1/4-inch thick, 2" wide, type 304 stainless steel. The length from flange-to-flange shall be 6" unless shown otherwise. The extension shall be 1 inch, compression shall be 2 inches, lateral offset shall be 2.5 inches, and the thickness shall be 1/4-inch minimum.
  4. Manufacturer shall be:
    - a. Senior Flexonics Pathway
    - b. Or Approved Equal.
- J. Transition Pieces:

1. Provide duct transition pieces between the exhaust fan outlet connection and the bio-trickling filter inlet connection. Transition piece shall be constructed of FRP of the same resin as, and equal or superior in strength to, the adjacent equipment. Dimensions of end connections shall be adjusted to match equipment connection sizes.
2. Manufacturer shall design transition pieces so that they shall be free from buckling, pulsing, warpage, and sagging at design pressures listed above. Thickness of transition pieces shall be designed using a safety factor of 10:1 for pressure and 5:1 for vacuum service.

K. The fan shall:

1. Be shipped loose from the scrubber system and be anchored to a concrete pad without vibration isolators.
2. Have an AMCA seal.
3. Manufactured by:
  - a. New York Blower
  - b. Hartzell
  - c. Or Approved Equal.

L. Motor shall be 480 volt, 3 phase, 60 hz suitable for full voltage starting and continuous operation at 40 degrees C ambient temperature at the specified loads. The motor shall be suitable for Class 1 Div 2 conditions and suitable for use with a VFD.

M. Motor shall be furnished with stainless steel nameplates including information of manufacturer, serial number, model number, horsepower, speed, voltage, amperes, and any other pertinent data.

N. The motor shall be manufactured by:

1. WEG
2. Siemens
3. ABB
4. Or Approved Equal.

O. Fan shall be located upstream of Bio-Trickling Filter tower and Carbon Adsorber.

## 2.6 DAMPERS

- A. Provide manually operated isolation dampers as indicated on the Drawings. Provide motorized dampers as indicated on the Drawings. See Section 23 33 00 - Air Duct Accessories for more information.

## 2.7 PROCESS CONTROL EQUIPMENT

- A. See Section 40 61 96 Process Control Descriptions - General and 40 61 96.1 Process Control Descriptions - Odor Control for more information.

- B. Without exception all process control equipment shall be provided as a completely integrated system with all components pre-piped and pre-wired by the Manufacturer and shall include:

C. Fans:

1. Three fans shall be provided in the odor control package. At low flows of 15 ACH, the fans shall be one duty, two standby. At high flows of 30 ACH, the fans shall be two duty, one standby. System shall be designed such that Operator has the ability to choose low flow or high flow and which fan(s) shall be online.

D. Flow Control Dampers:

1. Six motorized flow control dampers shall be provided in the odor control package. Dampers shall be integrated such that the dampers directly upstream and downstream of a fan shall open when the fan is energized and close when the fan is de-energized.

E. Insertion Mass Flow Meter

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
  - a. FCI
  - b. Kurz
  - c. Or approved equal.
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Type:
  - a. Insertion heat elements.
  - b. 316 stainless steel body.
  - c. Provide units with an integral transmitter.
  - d. Flow meters shall be of sufficient length to accommodate shut-off valve as shown in the drawings.
4. Function/Performance:
  - a. Function: To provide a contact output when air flow is sensed in a pipeline.
  - b. Operating Principle: Two 316 Stainless Steel RTDs, one is heated and the other senses the process temperature. The temperature difference between the two RTDs is proportional to the process flow.
5. Functional:
  - a. Output: Looped power 4-20mA.
6. Physical:
  - a. Two 316 stainless steel measuring probes.
  - b. Body: 316 stainless steel with a flanged connection.
  - c. 1-inch minimum NPT mounting or otherwise match the process line connection.
  - d. Instrumentation not mounted in instrument racks or stands shall be provided with sunshields when mounted outdoors.
7. Manufacturer Start-up and Training Services
  - a. Provide manufacturer's start-up and training services as specified in the start-up and training services paragraph.
8. **Provide flow conditioner if required for proper operation. (ADDED BY ADDENDUM NO. 1)**

F. Recirculation Pump:

1. ~~As required for system operation, the~~ The recirculation pump shall be supplied pre-piped and pre-wired into the process control skid. The recirculation pump shall be seal-less, magnetic, centrifugal type. The pump shall be totally enclosed, manufactured of polypropylene, and shall include Kynar rear housing. The pump motor shall be TEFC, 3500 rpm, 230/460 VAC/3-Ph/60 Hz and shall include a 1.15 service factor. **(REVISED BY ADDENDUM NO. 1)**
2. Provide one shelf spare recirculation pump.

G. Nutrient Feed System:

1. The nutrient pump shall be housed within an insulated and heated Water Control Cabinet for each tower which is mounted at a location convenient to the operation of the system. The nutrient system stores and delivers biological nutrients to the spray nozzle where the solution is circulated through the packing media. The nutrient reservoir shall provide a minimum of 50 gallons of nutrient for 10BTF1. The nutrient feed system shall include a nutrient pump, reservoir, and all piping and equipment necessary to deliver nutrients from the reservoir to the irrigation water.

H. Nutrient Storage Tank:

1. A nutrient reservoir shall be constructed of FRP or UV-resistant HDPE and furnished for the containment of biological nutrients with a minimum capacity of 50 gallons for 10BTF1.
2. Without exception the tank shall be made of vinyl ester fiberglass reinforced plastic or high density polyethylene and be suitable for storage in direct sunlight.
3. The nutrient storage tank shall be sized to provide a minimum of one month nutrient supply.
4. The reservoir shall be provided with bulkhead pipe connections for tank drain, outlet, inlet, pressurized water connection, low level indicator, and vent. Flanged connections shall be of the same materials as the tank wall. Threaded connections shall be of standard NPT. The tank details showing the locations of all openings, nozzles, and appurtenances shall be included in shop drawings and submitted for approval before fabrication of the chemical storage tank.
5. The reservoir shall have an electronic low level indicator and a connection to a pressurized water source that is controlled by a ball valve, as required by manufacturer.
6. Each storage tank shall be insulated and heated to preclude freezing.

I. Irrigation Piping:

1. The piping on the Process support and Control Skid shall be Sch. 80 PVC and shall include all piping from the Water Control Cabinet to the pump(s), an overflow and water level control device with a clear site tube that allows inspection of the blowdown rate and the level of the vessel sump.

J. pH probe:

1. Provide each water control cabinet with a prewired pH probe in the BTF sump.
2. The transmitter shall be remotely mounted on the main control panel.
3. The probe shall send signals and receive power from the main control panel as shown on the drawings.
4. pH measurement shall use the potentiometric measurement method utilizing a glass electrode. The pH sensitive glass membrane surface shall react to the acid content of the solution with a specific voltage, which is measured relative to a reference electrode.
5. Manufacturer: One of the following or equal.
  - a. Sensor: GF 2724 signet pH electrode.
  - b. Transmitter: Signet 8750 with suitable pre-amplifier if required.
  - c. Transmitter performance requirement:
    - 1) Accuracy: within 0.01 pH
    - 2) Repeatability: within 0.01 pH
  - d. Sensor material: glass pH sensor housed in a molded reinforced polypropylene body threaded for insertion, with an in built temperature sensor.
  - e. Transmitter:
    - 1) Should be suitable for panel or field mounting options.
    - 2) Power Supply: 24 VDC with pre-amplifier if required.
    - 3) Output: Isolated 4 to 20 mA DC proportional to pH, Alarm contacts (SPDT) for low pH indication in the main control panel.
    - 4) Display: backlist LCD digital display.
    - 5) Enclosure: NEMA Type 4X.
    - 6) Mounting: panel mounting option.

K. Instrumentation and Controls:

1. The odor control system consists of three fans, one bio-trickling filter (BTF), one carbon adsorber. The ancillary system to the BTF includes a water panel, recirculation pump, nutrient feed tank, nutrient pump, and one water source for the water panel. Foul air from the headworks flows through the fan(s) to the BTF and then continues through the carbon adsorber before discharging into the atmosphere. The water panel combines flows from the recirculation pump, nutrient pump, and water source to feed the combination to the top of the BTF.

- a. At low flows with one fan in operation, the motorized dampers on the suction and discharge of that fan will be open. The motorized dampers on the suction and discharge of the other two fans will remain closed.
  - b. At high flows with two fans in operation, the motorized dampers on the suction and discharge of the fans will be open. The motorized dampers on the suction and discharge of the other fan will remain closed.
  - c. The motorized damper after the discharge of the carbon adsorber will only be used to isolate the carbon adsorber in events when the carbon adsorber needs to be taken offline.
  - d. Under normal operating conditions, the system will be controlled based on operator mode selection in SCADA.
  - e. All motorized dampers provided by odor control system will be controlled by vendor-supplied PLC.
2. Automatic Mode:
- a. There will be two modes that the Owner will select from the SCADA HMI. The first automatic mode is one fan operation. The second automatic mode is two fan operation.
  - b. One Fan Operation Mode:
    - 1) In the One Fan Operation automatic mode, one fan will operate at the flow specified in specification 41 11 29. The odor control system will operate at this setting until another operation mode is selected. The mass flowmeter will operate as the process variable for PID control of the VFD. The VFD will control the fan to a set speed as determined by TAB contractor.
    - 2) Motorized dampers 10CDX and 10CDX on the suction and discharge of the fan will open before the fan ramps up to set speed.
    - 3) Motorized dampers 20FCDX-20FCDX will open to operation set point 1 as determined by TAB contractor.
    - 4) Each motorized damper may have a different control setpoint.
  - c. Two Fan Operation Mode:
    - 1) In the Two Fan Operation automatic mode, two fans will operate at the flow specified in specification 41 11 29. The mass flowmeter will operate the process variable for PID control of the VFDs. The odor control system will operate at this setting until another operation mode is selected.
    - 2) Motorized dampers 10CDX and 10CDX on the suction and discharge of both fans will open.
    - 3) Motorized dampers 20FCDX-20FCDX will open to operation set point 2 as determined by TAB contractor.
    - 4) Each motorized damper may have a different control setpoint
3. Electrical panels shall comply with the requirements of Section 40 67 23 - Control Panels. PLCs shall comply with the requirements of Section 40 63 43 - Programmable Logic Controllers. The electrical control panel shall provide electrical control for the exhaust fan, pumps, and water and nutrient addition systems. The panels that are housed outdoors, shall be provided with sunshields and required air conditioning units.
4. A 480 VAC, 3-phase feed shall be supplied to the panel for use to power the system. The control panel shall include motor starters for fans and pumps. Variable Frequency drives shall comply with the requirements of Section 26 20 23 - Variable Frequency Motor Controllers. Provide fuse protection for all motor circuits. Provide two spare fuses of each size and type.
5. The control panel enclosure shall be of fiberglass construction and rated NEMA 4X 316 SS. The panel shall be mounted at a location outside of hazardous boundaries to system operation and shall be factory tested to full operation with all other components prior to shipment.
- a. Controls:
    - 1) The Vendor Control Panel (VCP) shall have a Programmable Logic Controller. PLC shall be Allen Bradley ControlLogix or CompactLogix.

- a) Plant PLC shall receive at a minimum I/O, via fiber connection from the VCP, as shown on the SCADA Architecture, 90-T101.
    - b) Each PLC shall support IEC Standard 61131-3 for all the following programming languages:
      - i. Ladder (LD)
      - ii. Function Block Diagram (FBD)
      - iii. Structured Text (ST)
  - 2) Provide a panel mount 10" Allen-Bradley PanelView Plus 7 Standard OIT for VCP in accordance with Operator Interface Terminal (OIT). Mount to panel face.
  - 3) Provide network components in accordance with Section 40 66 13 - Networking Equipment and Section 40 66 33 - Fiber Optic Communication Systems.
- 6. The panel shall have the following components or capabilities:
  - a. Fan switch (H-O-A)
  - b. Recirculation pump (H-O-A)
  - c. Nutrient pump switch (H-O-A)
  - d. External Interfaces
    - 1) Dry Contact Outputs
      - a) Run Status (SCADA)
      - b) Run Status (Fan Control)
      - c) Run Status (Recirculation Pump Control)
      - d) Run Status (Nutrient Pump Control)
      - e) Common Alarm
- 7. Each water control cabinet shall be constructed from a NEMA 4X 316 SS cabinet with all internal piping SCH 80 PVC. The panel shall be mounted at a location convenient to system operation. A separate water control cabinet shall be provided for the tower. The cabinet shall contain the following components:
  - a. Recirculation system pressure gauge.
  - b. Make-up water pressure gauge (one per location)
  - c. Heating cable
  - d. pH probe
- 8. Water rotameter shall be provided for control of water application rates.
- 9. Both the electrical control panel and water control cabinet shall be installed outside of the classified hazardous area.

L. Recycle Piping:

- 1. All recycle piping, irrigation water and drain piping, and blowdown piping shall be SCH 80 PVC. All external piping shall be insulated and heat traced by the Contractor as required in specification sections 40 41 13 Heat Tracing and 40 42 00 Process Mechanical Insulation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The complete biological odor control system shall be installed in strict accordance with the Manufacturer's recommendations. The system shall be compatible with the basic provisions shown.

### 3.2 FIELD ENGINEERING/STARTUP

- A. The biological odor control system Manufacturer shall provide field engineering startup assistance to startup, test, and arrive at proper operating conditions. Minimum service time required shall be as listed in Subsection 1.6 4-5, MANUFACTURER'S SERVICES. If additional time is required for reasons attributable to the odor control equipment supplier, the costs shall

be borne by the supplier. Should the extra time be required because of reasons attributable to the Contractor, these charges will be borne by the Contractor at prevailing rates. **(REVISED BY ADDENDUM NO. 1)**

### 3.3 PERFORMANCE TESTING

#### A. General:

1. The Contractor shall be responsible for all costs associated with odor control system testing.

#### B. Functional Testing:

1. Using non-odorous ambient air, the entire odor control system shall be operated for NOT less than 24 continuous hours in order to demonstrate the mechanical and electrical integrity of the system. Any mechanical or electrical breakdowns, unusual vibrations, or control sequencing problems shall be considered sufficient cause to reject the test. Inability to successfully complete the functional testing in five tries shall be considered cause for the construction manager to reject the odor control system. Contractor shall balance all air flows prior to system performance testing.

#### C. Performance Testing:

1. **Two performance tests are required: (ADDED BY ADDENDUM NO. 1)**
  - a. **One test after sufficient acclimation time.**
  - b. **One test to be performed one month prior to the end of the warranty period.**
2. Performance tests shall be conducted after the Testing and Balancing Report for the entire ductwork system is submitted and approved by Engineer per Section 44 31 83 Adjusting and Balancing Odor Control Systems.
3. The performance tests shall be conducted after sufficient acclimation time and at such time as all anticipated odorous air streams are present in the scrubber inlet. The time of the tests and detailed test procedure shall be submitted for approval prior to the testing period.
4. During testing, scrubber overflow, recirculation and scrubber air flow rates shall be held constant. Changes in scrubber system operating conditions shall NOT be permitted. All fine-tuning of operating conditions shall be performed prior to testing.
5. Design operating conditions shall be maintained for a minimum of 4 hours. During this time, all pertinent operating parameters shall be monitored and recorded, sufficient sampling and analysis shall be conducted to demonstrate that flow rates are at design conditions.
6. Hydrogen sulfide concentration shall be measured in each scrubber inlet and outlet. Inlet and outlet levels shall be measured once every 30 minutes using a portable H<sub>2</sub>S analyzer such as Interscan, Jerome or equal.
7. Results:
  - a. A description of the performance tests shall be submitted. The hydrogen sulfide compound removal efficiency shall be as specified in the design and performance requirements. Should scrubber system performance NOT meet any of the above requirements, that system shall have failed the performance tests. The Contractor shall make any additions or modifications to that scrubber system as may be necessary, at no additional cost to the Owner, and the performance tests for that system shall be repeated in its entirety.

### 3.4 OPERATION AND MAINTENANCE TRAINING

- A. The Contractor shall provide the services of a factory-trained Manufacturer's representative to provide training of the Owner's personnel in the proper operation and maintenance of the equipment. Prior to final acceptance, the Contractor shall furnish the Construction Manager with two copies of the Manufacturer's certifications. Training shall be performed in accordance with Section 01 75 00 - Startup Testing and Training.

- B. A trained Manufacturer's representative to visit site, verify operations of biological odor control system, and retrain Owner personnel in proper operation and maintenance of equipment. Site visits shall be conducted every 6 months throughout the warranty period. (ADDED BY ADDENDUM NO. 1)**

3.5 MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall include in his bid all costs associated with providing the services of the Manufacturer's field representative for checking, aligning, testing, placing in operation, and Owner training.

END OF SECTION

## SECTION 44 61 16 – CARBON ADSORBER ODOR CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Furnish all labor, materials, equipment, and incidentals required to install one odor control system for the control of atmospheric H<sub>2</sub>S and other noxious odors as shown on drawings and specified herein. The carbon system (10CP1) shall act as a polishing stage in series with the BTF (Biological Trickling Filter) system (10BTF1). The carbon polishing system shall be an activated carbon adsorber system consisting of an adsorber vessel, activated carbon, interconnecting ductwork and other appurtenances for a complete operating system. A demister shall be installed between the BTF units and the carbon polishing units.
- B. The entire system shall consist of the following major components:
  - 1. Demister
  - 2. Adsorber Inlet Transition
  - 3. Adsorber Inlet Flexible Connector
  - 4. Vessel Inlet Isolation Damper
  - 5. Carbon Adsorber Vessel
  - 6. Activated Carbon Media

#### 1.2 SYSTEM DESCRIPTION

- A. The malodorous air shall enter the dual bed carbon adsorber and shall flow through densely packed beds of activated carbon. The activated carbon shall remove hydrogen sulfide and other odor causing constituents. The air shall continue through the vessel and be exhausted through the outlets.
- B. Related Sections:
  - 1. Section 44 11 29 - Bio-Trickling Filter Odor Control System

#### 1.3 QUALITY ASSURANCE

- A. All systems shall be supplied by a single manufacturer fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.
- B. To ensure unity of responsibility, fan, damper, ducting, vessel, control panel, carbon and other miscellaneous system appurtenances shall be furnished by a single manufacturer.
- C. Each system shall be dual bed bulk carbon adsorption system.

#### 1.4 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer in accordance Section 01 33 00 – Submittal Procedures, and as a minimum, the following items:
  - 1. Certified shop and erection drawings showing the important details of construction, dimensions, and anchor bolt layout.
  - 2. Descriptive literature, bulletins, and catalogs of the equipment.
  - 3. The total weight of the equipment as well as the weight of the single largest items.
  - 4. Calculations showing theoretical anticipated life of carbon media, based on anticipated average hydrogen sulfide (H<sub>2</sub>S) concentrations.
  - 5. Test results according to Subsection 2.4.B
  - 6. Carbon media MSDS and specification sheet.

7. Design structural calculations for each vessel and their anchorage to supporting construction, a signed and sealed by a professional engineer registered in Alabama.
  - a. Provide signed and sealed calculations for the Carbon Adsorber systems, including vessels, roof access areas, ladders, and safety rails to verify compliance with the design criteria indicated in Section 2.3 and all applicable OSHA requirements.
  - b. Current design does not include wiring restraints. If wiring restraints are required based on calculations, modifications to the Carbon Adsorber vessel design, including pad size to allow appropriate access space, shall be performed at no additional cost to the Owner.

## 1.5 OPERATING INSTRUCTIONS

- A. The Contractor shall provide five copies of operation and maintenance manuals for all equipment furnished.
- B. One copy of a digital pdf O&M manual shall be provided.

## 1.6 EQUIPMENT WARRANTY

- A. ~~The manufacturer shall warrant that the equipment sold here under shall be free from defects in material and workmanship for a period of 1 year from acceptance or 18 months from shipment, whichever occurs first. The warranty does NOT include the carbon media itself. (REMOVED BY~~  
**ADDENDUM NO. 1)**
- B. Provide warranty for a period of 24 months after the final acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer shall promptly repair or replace the defective equipment without additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. See Section 44 11 29 – Bio-Trickling Filter Odor Control system, Subsection 2.2. Bio-Trickling Filter and Carbon Absorber Odor Control system shall be of same manufacturer.

### 2.2 DESIGN AND PERFORMANCE CRITERIA

- A. Design Criteria: The odor control system shall be designed for the following operating conditions and shall meet the following performance criteria when put in service with fresh carbon media. The carbon adsorber vessel shall be sized for minimum empty bed contact time at the higher airflow. Air channeling within the vessel at the lower airflow shall not be acceptable.

|                                                                               | <b>10CP1</b>                                                                 |                                                                              |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Design Air Changes Per Hour                                                   | 30                                                                           | 15                                                                           |
| Design Air Flow Rate, cfm                                                     | 6,300                                                                        | 3,150                                                                        |
| Minimum Empty Bed Contact Time, seconds                                       | 3                                                                            | 3                                                                            |
| Odor Removal % H <sub>2</sub> S, % Overall <b>(REVISED BY ADDENDUM NO. 1)</b> | 99%, 90% or<br>≤0.5 ppmv in<br>the outlet,<br>whichever is<br>less stringent | 99%, 90% or<br>≤0.5 ppmv in<br>the outlet,<br>whichever is<br>less stringent |

|                                                               |                                                                                      |                                                                                      |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Odor Removal % Overall (REVISED BY<br/>ADDENDUM NO. 1)</b> | <b>90% or ≤0.5<br/>ppmv in the<br/>outlet, which-<br/>ever is less<br/>stringent</b> | <b>90% or ≤0.5<br/>ppmv in the<br/>outlet, which-<br/>ever is less<br/>stringent</b> |
| Number of units                                               | 1                                                                                    |                                                                                      |

### 2.3 CARBON ADSORBER VESSEL

- A. Design Criteria: The carbon adsorber vessel should be designed for the following criteria:

|                                   | <b>10CP1</b>     |
|-----------------------------------|------------------|
| Maximum Vessel Diameter, ft       | 12.0             |
| Vessel Straight Side Height, ft   | As Required      |
| Wall Thickness, ft                | Per Design Calc. |
| Internal Positive Pressure, in.wg | +20              |
| Maximum Operating Temperature, °F | 120              |
| Number of Beds                    | 2                |
| Carbon Bed Depth, ft              | 3                |

- B. Structural Load Criteria:

- The vessel, including its anchorage to supporting construction and all supported attachments, shall be designed to meet all applicable requirements of the governing building code adopted by the jurisdiction. For governing building code, wind speed and exposure, and seismic parameters, see the Structural Notes in the Drawings. Structural analysis shall be performed in accordance with the edition of ASCE 7-"Minimum Design Loads and Associated Criteria for Buildings and Other Structures" adopted by the governing building code.

- C. Material of Construction:

- The vessel shall be fabricated from premium grade vinyl ester resin FRP construction.
- Resin used in fabrication shall be a premium vinyl ester resin such as ~~Hotron 922 by Allnex~~, CoRezyn CORVE 8401 by Interplastic, Derakane 510B-400P by Ashland Chemical, or pre-approved equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010, C-glass veil, or approved equal. **Flame spread rating shall be Class 1. (REVISED BE ADDENDUM NO. 1)**
- Reinforcement: Glass fiber reinforcement used shall be commercial grade corrosion resistant borosilicate glass.
- Fabrication:
  - General: Fabrication shall be in accordance with NBS PS 15-69, ASTM D3299 and ASTM D4097. All non-molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat.
  - Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with one NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion layer shall consist of two layers of 1 1/2 oz. per sq. ft. chopped strand mat. The total corrosion liner thickness shall be a minimum of 100 mils.
  - Structural Laminate:
    - Option A: Structural laminates shall consist of alternating layers of 1-1/2 oz per sq. ft mat or chopped glass and 24 oz per sq. yard woven roving applied to reach a designed thickness.

- 2) Option B: Structural laminates shall consist of helical wind roving in accordance with the filament winding process.
  - 3) The exterior shall be surface coated with white gel coat containing ultraviolet light inhibitors.
5. Fittings:
- a. The vessel shall be fitted with the following fittings:

| 10CP1 Description | Size (in.) | Type    | Qty |
|-------------------|------------|---------|-----|
| Gas Inlet         | 24         | Flanged | 1   |
| Gas Outlets       | 24         | Flanged | 2   |
| Drain             | 2          | Flanged | 1   |
| Pressure Tap      | 1          | NPT     | 4   |
| Carbon Sample     | 1          | NPT     | 6   |

## 2.4 CARBON ADSORBER VESSEL ACCESSORIES

- A. Differential Pressure Gauge:
  1. Two Series 2000 differential pressure gauge as manufactured by Dwyer Instruments shall be provided to continuously monitor the pressure drop across the carbon beds. The differential pressure gauge shall be isolated with isolation valves and shall be mounted on the vessel.
- B. Carbon Sample Probes:
  1. Each vessel shall have three 1-inch diameter sample probes per bed which shall extend into the bed a minimum of twelve inches. The sample probes shall be blocked off with a ball valve constructed of PVC.
- C. Grounding Rod:
  1. A stainless steel rod shall be provided to adequately ground each carbon bed. Rods shall be grounded via a 10 gauge wire.
- D. Carbon Support Grating and Screen:
  1. Each adsorber vessel shall be furnished to accommodate a two beds of activated carbon having an average depth of three feet per bed. The carbon beds shall be supported on a polypropylene screen through an FRP support grating system. The screen and the support system shall be removable through access manways. The support system shall consist of removable grating. Pall rings or other dumped packing media as a means of carbon support shall NOT be acceptable. The support system shall be designed to withstand a load of at least 150 lbs/ft<sup>2</sup> with a minimum deflection of 1/4 inch under all conditions.
- E. Access Manway:
  1. The vessel shall have two 24-inch diameter access manways – one for the upper bed and one for the lower bed.
- F. Exhaust Stack:
  1. The adsorber shall be furnished with two flanged connection vertical stacks fabricated from fiberglass reinforced plastic with flanged connection to the tank outlet. Each stack shall be provided with one inch diameter fitting for outlet air sampling.
  2. Stacks and piping shall be configured and installed to prevent rain water from entering into the system.
- G. Anchor Bolts:

1. Scrubber shall be provided with properly sized epoxy HILTI anchor system. Contractor to coordinate anchorage and foundation design calculations with vessel manufacturer.
- H. Equipment Tags:
1. The vessel shall be provided with an I.D. Tag with the following minimum information: Carbon Type, Vessel Dimension, Date of Manufacture, Design Conditions, Equipment Tag Number.
- I. Ladder and Platform: Size and configuration as indicated on the Drawings and as follows:
1. Ladder: Fabricated from aluminum.
  2. Elevated Platform and Structural Members: Fabricated from aluminum for access to the tank top. See Drawings for configuration. Scrubber Manufacturer shall design and supply platform support system. Platform shall be supported from scrubber tower.
  3. Ladder Design Live Loads, Deflection, Extension, and Fall Protection System shall all comply with the requirements for Metal Ladders as indicated in Section 05 50 00 - Metal Fabrications and OSHA.
  4. Platforms shall be designed to meet OSHA requirements for Walking-Working services. Live load used for design of each platform component shall be a minimum of the greater load effect resulting from a 40 psf distributed load or a 300 pound concentrated load (unfactored).
  5. Provide aluminum handrail around platform.
  6. Design and fabricate Type 316 stainless steel or FRP support members for anchoring platform to vessel wall.
  7. Fasteners: Type 316 stainless steel.
  8. Secure ladder to the vessel using Type 316 stainless steel or Hastalloy C bolts with polyethylene encapsulated heads.
  9. Anchor Bolts: Type 316 stainless steel.
  10. Ladder shall be equipped with safety rail and fall protection.

## 2.5 ACTIVATED CARBON MEDIA

- A. Type: The activated carbon shall be virgin, pelletized, derived from high grade bituminous coal, vapor phase type, suitable for the control of sewage odors. The carbon shall have the following specifications:
- B. Specifications

| Coal Type                                         | Bituminous   |
|---------------------------------------------------|--------------|
| MPD,mm                                            | 4.0 – 4.25   |
| Apparent Density,g/cc                             | 0.40 - 0.425 |
| Hardness No.                                      | 93 min       |
| CTC Activity                                      | 60 min       |
| CTC Retentivity, wt %                             | 22 -25       |
| H <sub>2</sub> S Capacity, gH <sub>2</sub> S/cc** | 0.2 minimum  |

## 2.6 MIST ELIMINATOR

- A. Mist Eliminator unit shall consist of a 316SS pad for grease filtration in front of a polypropylene mesh pad with 316SS grids for mist elimination, housed inside an FRP enclosure. The pads shall be removable for cleaning and the housing shall have a drop-out flange to allow removal and replacement of the filter pads. The mist eliminator pads shall be style 7CA/8P by ACS/AMACS Industries. The FRP housing shall be flanged and drilled per PS 15-69, and be ready for installation into the system supply ductwork. A Dwyer Series 2000 Magnehilic gage shall be installed on the housing to indicate pressure drop through the unit.

## 2.7 INTERCONNECTING DUCTWORK AND DAMPER

- A. The odor control system manufacturer shall provide the necessary ductwork, transitions, and dampers between the BTF, the demister, and the carbon adsorber vessel(s). Construction shall be FRP using the same resin as the adsorber vessels. Each carbon vessel shall be provided with an inlet isolation damper of manufacturer as listed on Drawings, or equal. Design and supply of all supports shall be by the Contractor.

## 2.8 HARDWARE AND GASKETS

- A. All hardware shall be 316 stainless steel. Gaskets shall be a minimum of 1/8-inch thick, full face, EPDM, **OR** neoprene suitable for the intended service.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Odor control system shall be furnished and installed in accordance with manufacturer's recommendations. The Contractor shall provide all utility connections, inlet ductwork from odor source, concrete pads, fencing and other items shown on the drawings NOT specified. The Contractor shall be responsible for providing a complete and operable system.

### 3.2 SERVICE OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall provide services of a qualified manufacturer's technical representative as specified under Section 44 11 29 – Bio-Trickling Filter Odor Control System, Subsection 1.5 who shall inspect and certify proper installation of equipment, supervise loading of carbon media, assist in equipment start-up, and provide training of plant operators. The carbon start-up and service shall be performed concurrent with the Bio-Trickling Filter service.

## END OF SECTION

## SECTION 46 23 23.16 – STACKED TRAY VORTEX GRIT REMOVAL EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. The Work for furnishing all labor, equipment, materials, tools, and incidentals required for replacement of the existing (4) grit headcell inlet chutes.
  2. The Work that the vortex grit removal equipment manufacturer shall furnish and have overall system responsibility for coordination of all major components of the system.
  3. **Vortex grit removal equipment manufacturer shall provide headcell inlet chutes, anchor bolts, and hardware. Contractor is responsible for removing, storing, and re-installing equipment. Contractor is responsible for removing existing corroded inlet chute and installing new inlet chute. (ADDED BY ADDENDUM NO. 1)**
- B. Equipment Requirements:
1. Like items of equipment provided in later sections shall be the end products of one Manufacturer to achieve standardization of appearance, operation, maintenance, ~~spare parts~~, **(REMOVED BY ADDENDUM NO. 1)** and Manufacturer's services.

#### 1.2 SUBMITTALS

- A. Subject to the requirements of Section 01 33 00 – Submittal Procedures.
- B. **Drawings: (ADDED BY ADDENDUM NO. 1)**
1. **Provide shop and erection drawings. Show all important details of construction dimensions and anchor bolt locations.**
- C. ~~Action Submittals: (REMOVED BY ADDENDUM NO. 1)~~
- ~~1. Product Data:~~
    - ~~a. The total weight of the equipment including the weight of the single largest item or component.~~
    - ~~b. Complete description of surface preparation and shop prime painting.~~
  - ~~2. Shop and Erection Drawings:~~
    - ~~a. Show all important details of construction dimensions and anchor bolt locations.~~
    - ~~b. Show general arrangement and dimensional drawings of the grit removal system.~~
- D. **Informational Submittals: (REMOVED BY ADDENDUM NO. 1)**
- ~~1. Manufacturer's Instructions~~
    - ~~a. Written recommended procedures for job site storage, handling, and installation of the equipment.~~
  - ~~2. Manufacturer's Field Report~~
    - ~~a. A list of manufacturer's recommended spare parts with the manufacturer's current price for each item.~~
    - ~~b. Bill of materials of all equipment.~~
  - ~~3. Certificates:~~
    - ~~a. Certificate of Compliance:~~
      - 1) The Manufacturer shall warrant that the Grit Removal System to be supplied shall be manufactured in strict compliance with the Contract Specifications.
- E. See Section 01 77 00 – Closeout Procedures for additional requirements.
1. **Existing Operations and Maintenance Manual to be reused. (ADDED BY ADDENDUM NO. 1)**

### 1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00 – Product Requirements.
- B. Delivery of Materials:
  - 1. Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.
- C. Storage:
  - 1. Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.
- D. Protection of Equipment:
  - 1. Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall always be kept thoroughly dry. ~~Pumps, motors, drives, electrical equipment, and other equipment with anti friction or sleeve bearings shall be stored in weathertight and heated storage facilities prior to installation.~~ **(REMOVED BY ADDENDUM NO. 1)** For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings.
- E. The equipment, material, ~~spare parts~~ **(REMOVED BY ADDENDUM NO. 1)** shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.
- F. Provide lifting eyes or lugs to allow easy installation of the units to be installed in tanks and in the rooms. Items required to be installed in the rooms shall fit through a standard double door.
- G. ~~Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.~~ **(REMOVED BY ADDENDUM NO. 1)**
- H. The Contractor shall inspect equipment prior to unloading and notify the Manufacturer of any damage to equipment to effect proper remedial action. Failure to notify the Manufacturer of damage to equipment prior to unloading shall void all warranties pertaining to subject equipment.
- I. The Contractor shall unload, store and safeguard equipment, **and** materials, ~~and spare parts~~ in accordance with Manufacturer's recommendations. **(REVISED BY ADDENDUM NO. 1)**

### 1.4 QUALITY ASSURANCE

- A. The system shall be furnished by a Manufacturer who is ISO 9001:2015 ~~9001:2008 and 14001~~ Certified. **(REVISED BY ADDENDUM NO. 1)**
- B. Manufacturer shall be successful in the experience of manufacture, operation, and servicing of Grit Removal Systems of type, size, quality, performance, and reliability equal to that specified for a period of not less than 10 years. The Manufacturer shall submit evidence of experience having supplied a minimum of ten installations in North America of similar size to the proposed system.
- C. In the absence of verifiable experience, the Manufacturer shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the Manufacturer was found lacking in experience from the specified 10-year period. The performance bond shall commence with acceptance of the equipment and time described in this section and beyond the standard warranty period.

- D. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the Engineer. Revised drawings shall show the proposed location of the alternate unit, and area required for withdrawal space of replacement or serviceable components. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.

## 1.5 WARRANTY

- A. Provide warranty for a period of 24 months from the final acceptance by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.
- B. See Section 01 78 36 – Warranties and Bonds for additional requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Where a Manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified in this section.
- B. Approved Manufacturers:
1. Hydro International

### 2.2 MATERIALS AND FINISHES

- A. Materials:
1. Inlet chute shall be 316 stainless steel.
  2. Stainless Steel Equipment Fabrication:
    - a. Plate and Sheet:
      - 1) ASTM A167
      - 2) ASTM A240
    - b. Bar:
      - 1) ASTM A276
      - 2) ASTM A479
    - c. Tube:
      - 1) ASTM A312
- B. Exterior Surfaces Finishes:
1. All surfaces shall be free of sharp edges, weld spatter and residue. All welds shall be ground smooth.
  2. All stainless steel surfaces shall be acid washed.
  3. ~~All non-submerged exterior surfaces shall be Glass Bead Blasted to a uniform finish.~~  
**(REMOVED BY ADDENDUM NO. 1)**

### 2.3 FABRICATION

- A. Shop Assembly:
1. The system shall be factory assembled and tested.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordination shall include space and structural requirements, clearances, ~~utility and connections, signals, outputs, and features~~ required by the ~~manufacturer including safety interlocks~~. **(REVISED BY ADDENDUM NO. 1)**

### 3.2 FIELD QUALITY CONTROL

- A. Functional Testing:
  - 1. Prior to plant startup, all equipment described in this section shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test. Provide certification of test results. Tests and certification shall be as specified in Section 01 75 00 – Startup Testing and Training.

### 3.3 STARTUP, TRAINING, AND MANUFACTURER'S SERVICES

- A. A factory trained representative for the equipment specified in this section shall be present at the jobsite and/or classroom designated by the Owner for a maximum of four 8-hour man-days, across two separate visits, for installation inspection, plant startup, **and** functional testing, ~~and operator instructions~~; travel time excluded. A minimum of 30 days of notice is required to schedule manufacturer's services. Any services with less than 30 days of notice shall result in the Contractor being billed for service time and actual travel costs. **(REVISED BY ADDENDUM NO. 1)**
- B. Training of Owner's personnel shall be at times and locations specified by the Owner.

### 3.4 MANUFACTURER'S CERTIFICATE(S)

- A. Provide as specified in Section 01 75 00 – Startup Testing and Training.

END OF SECTION

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| GENERAL NOTES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| <div>1. GENERAL NOTES SHALL APPLY TO THE ENTIRE PROJECT UNLESS NOTED OTHERWISE ON SPECIFIC STRUCTURAL DRAWINGS, STANDARD DETAILS, OR IN THE SPECIFICATIONS.</div> <div>2. ADOPTED BUILDING CODE: 2021 INTERNATIONAL BUILDING CODE (IBC) W/ STATE AND LOCAL AMENDMENTS.</div> <div>3. PROJECT RISK CATEGORY----- III</div> <div>4. DESIGN LIVE LOADS<ul style="list-style-type: none"><li>• ROOF WITHOUT REDUCTION----- 20 PSF</li><li>• FLOORS:-----</li><li>• CORRIDORS----- 100 PSF</li><li>• STAIRS/PLATFORMS----- 100 PSF</li><li>• HEADWORKS----- 100 PSF</li><li>• ODOR CONTROL SLAB----- 250 PSF</li><li>• AREAS WITH UNRESTRICTED VEHICULAR ACCESS----- AASHTO HS-20</li></ul></div> <div>5. WIND LOAD PARAMETERS ----- ASCE 7-16<ul style="list-style-type: none"><li>• BASIC WIND SPEED----- 179 MPH (RISK CATEGORY IV)</li><li>• EXPOSURE CATEGORY----- C</li><li>• GCPI +/- 0.18 (ENCLOSED BUILDINGS)</li></ul></div> <div>6. SEISMIC DESIGN PARAMETERS ----- ASCE 7-16<ul style="list-style-type: none"><li>• IMPORTANCE FACTOR, I<sub>e</sub>----- 1.25</li><li>• SITE CLASS----- E<ul style="list-style-type: none"><li>• SEISMIC SPECTRAL ACCELERATIONS</li><li>• S<sub>s</sub> ----- 0.093 G</li><li>• S<sub>1</sub> ----- 0.060 G</li><li>• SEISMIC DESIGN CATEGORY----- C</li><li>• DESIGN SPECTRAL ACCELERATIONS</li><li>• S<sub>Ds</sub> ----- 0.149 G</li><li>• S<sub>D1</sub> ----- 0.167 G</li><li>• ADDITIONAL CRITERIA----- SEE FACILITY PLANS</li></ul></li></ul></div> <div>7. RAIN LOAD PARAMETERS ----- 2021 IBC<ul style="list-style-type: none"><li>• 15 MIN RAIN INTENSITY ----- 9.90 IN/HR</li></ul></div> <div>8. SNOW LOADS PARAMETERS ----- ASCE 7-16<ul style="list-style-type: none"><li>• GROUND SNOW LOAD, P<sub>g</sub> ----- 0 PSF</li><li>• -----</li></ul></div> <div>9. FLOOD DESIGN PARAMETERS ----- ASCE 24-14<ul style="list-style-type: none"><li>• FLOOD DESIGN CLASS ----- 3</li><li>• ELEVATION OF LOWEST FLOOR ----- N/A</li><li>• -----</li></ul></div> <div>10. FROST DEPTH ----- 12 IN</div> <div>11. THE STRUCTURE SHOULD NOT BE CONSIDERED TO BE STABLE DURING CONSTRUCTION UNTIL ALL ELEMENTS ARE IN PLACE AND CONNECTED. THE CONTRACTOR IS RESPONSIBLE FOR DESIGNING ALL TEMPORARY CONSTRUCTION BRACING, AS REQUIRED.</div> <div>12. CONSTRUCTION METHODS, PROCEDURES, AND SEQUENCES ARE THE CONTRACTOR'S RESPONSIBILITY. THE CONTRACTOR SHALL TAKE THE ALL NECESSARY MEANS TO MAINTAIN AND PROTECT THE STRUCTURAL INTEGRITY OF ALL CONSTRUCTION, NEW AND EXISTING, AT ALL STAGES.</div> <div>13. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO ANY PERTINENT WORK. ALL EXISTING CONDITIONS AND DIMENSIONS SHALL BE NOTED ON THE SHOP DRAWINGS.</div> <div>14. COORDINATE WITH THE ARCHITECTURAL, CIVIL, MECHANICAL, STRUCTURAL, AND ELECTRICAL DRAWINGS, AND VERIFY THE LOCATIONS AND SIZES OF THE CHASES, OPENING, INSERTS, SLEEVES, FINISHES, CONDUITS, DEPRESSIONS AND OTHER PROJECT REQUIREMENTS.</div> <div>15. THE CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE DRAWINGS AND EXISTING CONDITIONS TO DETERMINE WHERE OPENINGS ARE REQUIRED IN WALLS AND SLABS.</div> <div>16. STANDARD DETAILS ARE INTENDED TO BE TYPICAL AND SHALL APPLY TO ALL SIMILAR SITUATIONS THROUGHOUT THE PROJECT UNLESS NOTED OTHERWISE ON SPECIFIC STRUCTURAL DRAWINGS.</div> <div>17. ALL REFERENCED CODES AND STANDARDS SHALL BE THE EDITION INDICATED IN CHAPTER 35 OF THE BUILDING CODE ADOPTED BY THE AHJ (SEE NOTE 2) UNO.</div> | <div>1. SITE PREPARATION SHALL INCLUDE REMOVAL OF ALL SURFICIAL VEGETATION, ROOT SYSTEMS, UTILITIES, AND EXISTING UNDERGROUND STRUCTURES FROM PLANNED FOUNDATION AREAS.</div> <div>2. STRIPPING DEPTH SHALL BE DETERMINED BY FIELD OBSERVATION BY A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER, WITH PARTICULAR ATTENTION TO OLD DRAINAGE AREAS, PLOW DEPTHS, UNEVEN TOPOGRAPHY, AND EXCESSIVELY WET SOILS.</div> <div>3. EXPOSED SUBGRADE SHALL BE PROOF ROLLED TO DETECT SOFT SPOTS OR PUMPING OF SUBGRADE AREAS. ANY DEFECTIVE AREAS SHALL BE CORRECTED AND MADE STABLE BEFORE CONSTRUCTION PROCEEDS.</div> <div>4. PROOF ROLLING SHALL BE PERFORMED USING A HEAVY PNEUMATIC TIRED ROLLER, LOADED DUMP TRUCK, OR SIMILAR EQUIPMENT WEIGHING AT LEAST 25 TONS, UNDER THE OBSERVATION OF A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER.</div> <div>5. ALL EXPOSED FOUNDATION BEARING SURFACES, INCLUDING THE MODIFIED SUBGRADE SOILS, SHALL BE PROTECTED BY A 4-INCH-THICK SEAL SLAB OF LEAN CONCRETE IF THE BEARING SURFACE WILL REMAIN EXPOSED FOR MORE THAN 72 HOURS PRIOR TO PLACING OF CONCRETE.</div> <div>6. EXCAVATION AT THIS SITE MAY ENCOUNTER GROUND WATER. DEWATERING OF EXCAVATION AND PROPER DRAINAGE OF THE EXCAVATION TO AVOID PONDING ARE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.</div> <div>7. SEE CIVIL NOTES AND LEGEND FOR OTHER EARTHWORK REQUIREMENTS.</div> | <div>1. STRUCTURAL CONCRETE SHALL HAVE A SPECIFIED COMPRESSIVE STRENGTH OF 5,000 PSI AT FACILITY 20 (HEADWORKS), AND 4,500 PSI AT ALL OTHER LOCATIONS, UNO. SEE SPECIFICATION SECTION 03 30 00 FOR MIX DESIGNS.</div> <div>2. HOLD SLUMP TO 3 TO 4 INCHES IN ALL FLOOR SLABS.</div> <div>3. ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED 3/4".</div> <div>4. NON-PRESTRESSED CONCRETE REINFORCEMENT SHALL CONFORM TO ASTM A 615 GRADE 60.</div> <div>5. REINFORCEMENT LAP SPLICES SHALL CONFORM TO D03/3000-100C.</div> <div>6. CONCRETE COVER OVER REINFORCEMENT SHALL CONFORM TO THE MINIMUM REQUIRED BY D03/3000-101, UNO.</div> <div>7. REINFORCEMENT DETAILING AND PLACEMENT SHALL CONFORM TO ACI SP-66.</div> <div>8. NO REINFORCING BAR SHALL BE WELDED OR FIELD BENT IN ANY MANNER, UNLESS SPECIFICALLY SHOWN OR NOTED ON THE DRAWINGS.</div> <div>9. DOWEL EMBEDMENT SHALL BE THE FULL DEVELOPMENT LENGTH OF THE BAR. IF NOT OTHERWISE SPECIFIED, DOWEL SIZE AND SPACING SHALL BE THE SAME AS MAIN REINFORCING.</div> <div>10. MECHANICAL EQUIPMENT PADS ON FLOOR SLABS SHALL BE 6" THICK AND REINFORCED WITH #4 @ 12" EW, UNO.</div> <div>11. WATERSTOP PIPE SLEEVES REQUIRED ON ALL WATERTIGHT WALLS AND FLOORS.</div> <div>12. TREMIES REQUIRED ON ALL PLACEMENTS DEEPER THAN 5 FEET.</div> <div>13. ALL WATERSTOPS TO BE RIBBED PVC, UNLESS NOTED OTHERWISE AS STRIP-TYPE . REFER TO DETAIL D03/3000-206 AND D03/3000-102B FOR WATERSTOP DETAILS.</div> <div>14. WHEN WATERSTOP IS PLACED HORIZONTALLY IN SLABS, THE CONTRACTOR SHALL TEMPORARILY TIE UP OR CLAMP UP THE WATERSTOP UNTIL THE CONCRETE IS PLACED TO SLIGHTLY ABOVE THE DEPTH OF THE WATERSTOP.</div> <div>15. VERTICAL WATERSTOP SHALL BE FULLY EMBEDDED IN SLAB POUR AND WELDED TO ALL ADJACENT WATERSTOP.</div> <div>16. PROVIDE A MINIMUM OF SEVEN (7) DAYS CURE TIME BETWEEN ADJACENT POURS</div> <div>17. CONTRACTOR SHALL SUBMIT TO ENGINEER FOR APPROVAL A SCHEDULE AND SEQUENCE OF CONCRETE PLACEMENT. SEQUENCE SHALL INCLUDE CURE TIME BETWEEN ADJACENT PLACEMENTS.</div> <div>18. WALKWAYS AND SIDEWALKS SHALL BE PLACED WITH A SLIGHT SLOPE TO FREELY DRAIN WITH NO LOW SPOTS. ALL SLOPES SHALL COMPLY WITH ADA REQUIREMENTS.</div> <div>19. ALL CONSTRUCTION JOINTS SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE INCORPORATED INTO THE STRUCTURE. ADDITIONAL CONSTRUCTION JOINTS TO FACILITATE CONSTRUCTION SHALL BE LOCATED AND DETAILED ON THE SHOP DRAWINGS FOR REVIEW. HORIZONTAL CONSTRUCTION JOINTS SHALL NOT BE PERMITTED IN WALLS AND BEAMS, UNLESS SHOWN ON THE STRUCTURAL DRAWINGS.</div> <div>20. POST INSTALLED ANCHORS SHALL NOT BE SUBSTITUTED FOR CAST IN ANCHORS UNLESS APPROVED BY ENGINEER.</div> <div>21. USE MANUFACTURER'S CERTIFIED DRAWINGS AND SPECIFICATIONS FOR EQUIPMENT ANCHORAGE AND DETAILS. VERIFY EQUIPMENT SIZE AND WEIGHTS WITH ENGINEER PRIOR TO CONSTRUCTION OF ANY AND ALL EQUIPMENT PADS.</div> | <div>AFC ABOVE FINISH CEILING</div> <div>AFF ABOVE FINISH FLOOR</div> <div>AFG ABOVE FINISH GRADE</div> <div>AHJ AUTHORITY HAVING JURISDICTION</div> <div>AL ALUMINUM</div> <div>APPROX APPROXIMATELY</div> <div>ARCH ARCHITECTURAL/ARCHITECTURE</div> <div>BFF BELOW FINISH FLOOR</div> <div>BM BEAM</div> <div>CJ CONSTRUCTION JOINT</div> <div>CJP COMPLETE JOINT PENETRATION</div> <div>CLG CEILING</div> <div>COL COLUMN</div> <div>DEMO DEMOLISH/DEMOLITION</div> <div>EF EACH FACE</div> <div>EJ EXPANSION JOINT</div> <div>EL ELEVATION</div> <div>ES EACH SIDE</div> <div>EW EACH WAY</div> <div>EX EXISTING</div> <div>EXP EXPANSION</div> <div>EXST EXISTING</div> <div>EXT EXTERIOR</div> <div>FD FLOOR DRAIN</div> <div>FND FOUNDATION FOOTING</div> <div>FS FAR SIDE</div> <div>HT HEIGHT</div> <div>IJ ISOLATION JOINT</div> <div>INT INTERIOR</div> <div>KIP 1,000 POUNDS</div> <div>KLF KIPS PER LINEAR FOOT</div> <div>KSF KIPS PER SQUARE FOOT</div> <div>LLH LONG LEG HORIZONTAL</div> <div>LLV LONG LEG VERTICAL</div> <div>LSL LONG SLOT</div> <div>MCJ MASONRY CONTROL JOINT</div> <div>MECH MECHANICAL</div> <div>NS NEAR SIDE</div> <div>NTS NOT TO SCALE</div> <div>OFCI OWNER FURNISHED CONTRACTOR INSTALLED</div> <div>OFOI OWNER FURNISHED OWNER INSTALLED</div> <div>OPP OPPOSITE HAND</div> <div>OVS OVERSIZED</div> <div>PCF POUNDS PER CUBIC FOOT</div> <div>PFJ PRE-FORMED JOINT</div> <div>PJP PARTIAL JOINT PENETRATION</div> <div>PLF POUNDS PER LINEAR FOOT</div> <div>PSF POUNDS PER SQUARE FOOT</div> <div>PSI POUNDS PER SQUARE INCH</div> <div>REF REFERENCE</div> <div>REINF REINFORCEMENT</div> <div>REV REVISION</div> <div>SIM SIMILAR</div> <div>SPEC SPECIFICATIONS</div> <div>SS STAINLESS STEEL</div> <div>SSL SHORT SLOT</div> <div>STL STEEL</div> <div>T&amp;B TOP AND BOTTOM</div> <div>T/ TOP OF</div> <div>T/BOTTOM TOP OF BEAM</div> <div>T/COLUMN TOP OF COLUMN</div> <div>T/CONC TOP OF CONCRETE</div> <div>T/FTG TOP OF FOOTING</div> <div>T/FND TOP OF FOUNDATION</div> <div>T/GRAT TOP OF GRATING</div> <div>T/JOIST TOP OF JOIST</div> <div>T/PAD TOP OF PAD</div> <div>T/PARAPET TOP OF PARAPET</div> <div>T/SLAB TOP OF SLAB</div> <div>T/STL TOP OF STEEL</div> <div>T/WALKWAY TOP OF WALKWAY</div> <div>T/WALL TOP OF WALL</div> <div>T/WEIR TOP OF WEIR</div> <div>TYP TYPICAL</div> <div>UNO UNLESS NOTED OTHERWISE</div> <div>VCJ VERTICAL CONSTRUCTION JOINT</div> <div>VIF VERIFY IN FIELD</div> | <div>EXISTING ELEMENTS</div> <div>NEW ELEMENTS</div> <div>EXISTING ELEMENTS TO BE REMOVED/DEMOLISHED</div> <div>FUTURE CONSTRUCTION NEW ELEMENT</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| GENERAL DRAWING SYMBOLS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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<div><div></div><div>POINT OF CONNECTION - NEW TO EXISTING</div></div> <div><div></div><div>DEMO TO POINT</div></div> <div><div></div><div>1</div><div>KEYED NOTE REFERENCE</div></div> <div><div>ROOM NAME</div><div>101</div><div>150 SF</div><div>SYMBOL INDICATES A ROOM / AREA DESIGNATION, WITH ROOM NUMBER AND SQUARE FOOTAGE</div></div> <div><div></div><div>A</div><div>SYMBOL INDICATES A STRUCTURAL GRIDLINE OR DATUM</div></div> <div><div></div><div>01-T/CONC</div><div>EL 271.00</div><div>SYMBOL INDICATES A LEVEL DATUM IN A SECTION OR ELEVATION</div></div> <div><div></div><div>D00</div><div>0000-000</div><div>CALLOUT DENOTES A STANDARD DETAIL REFERENCE.<br/>EXAMPLE: D03/0000-000<br/>SPECIFICATION DIVISION: 03<br/>SPECIFICATION SECTION: 0000<br/>DETAIL REFERENCE: 000</div></div> <div><div>REFER TO 1 / 01-S101</div><div>CALLOUT DENOTES A VIEW REFERENCE ABOUT A MATCHLINE</div></div>                                             |
| STRUCTURAL TAGS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <div><div>COMPOSITE BEAM TAG</div><div><div>W14X22 c = 3/4" (10)</div><div>BEAM SHAPE</div><div>BEAM SIZE</div><div>CAMBER</div><div>NUMBER OF STUDS</div><div>PIER TAG</div><div>PIER TYPE</div><div>TOP OF PIER ELEVATION (FROM SURVEY POINT)</div></div></div> <div><div>SPOT ELEVATION TAG</div><div><div>PP</div><div>EL. 271.00</div><div>SPOT ELEVATION ABBREVIATION/DESIGNATION</div><div>ELEVATION OF TAGGED ELEMENT (FROM SURVEY POINT)</div></div></div> <div><div>STRUCTURAL FRAMING TAG</div><div><div>AL C12X11.8</div><div>FRAMING MATERIAL</div><div>FRAMING SHAPE</div><div>WEIGHT PER LENGTH (LB/FT)</div><div>FRAMING NOMINAL HEIGHT</div></div></div> <div><div>STRUCTURAL COLUMN TAG</div><div><div>HSS14X14X3/4</div><div>COLUMN TYPE/SHAPE</div><div>COLUMN WIDTH</div><div>WALL THICKNESS</div><div>COLUMN HEIGHT</div></div></div> <div><div>STRUCTURAL REBAR TAG</div><div><div>#X @ DIM" EF</div><div>REBAR SIZE</div><div>SPACING DIMENSION/DISTANCE</div><div>DESCRIPTION OF DIRECTION, FACE, OR ORIENTATION</div></div></div> |
| STRUCTURAL ANNOTATIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| <div></div> <div>CENTERLINE</div> <div></div> <div>FLANGE</div> <div></div> <div>GRIDLINE</div> <div></div> <div>PLATE</div> <div></div> <div>PERCENT</div> <div></div> <div>DEGREES</div> <div></div> <div>PLUS/MINUS</div> <div></div> <div>WATERSTOP</div> <div></div> <div>DIRECTION OF DECK SPAN / GRATING</div> <div></div> <div>SLAB TRANSITION - RAMP</div> <div></div> <div>SLAB TRANSITION - STEP</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| GENERAL SHEET NOTE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| ALL GENERAL NOTES ON THIS SHEET ARE TO BE APPLIED TO ALL DRAWINGS IN THIS SET UNLESS OTHERWISE NOTED PER DISCIPLINE. SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET MAY OR MAY NOT BE USED IN THE CONTAINED REFERENCE DRAWINGS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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| METAL GRATINGS, PLATES, AND FLOOR PLATE NOTES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| <div>1. SEE DRAWINGS FOR MATERIAL DESIGNATION OF ALL GRATING, CHECKER PLATE, PLANK, AND HATCHES.</div> <div>2. ALL CHECKERED PLATE AND PLANKS INCLUDING ALL SUPPORT MEMBERS, REINFORCING RIBS STIFFENERS, EDGE MEMBERS, EDGE SUPPORTS, CORNER AND/OR INTERSECTION SUPPORTS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF THE WORK AND PROVIDED BY THE MANUFACTURER. SUCH DESIGN FOR PLANK AND/OR CHECKERED PLATE COVERING, INCLUDING ALL SUPPORTS AND INTEGRAL MEMBERS SHALL BE FOR THE ACTUAL DEAD LOAD AND A UNIFORM LIVE LOAD AS INDICATED IN PROJECT SPECIFICATIONS OR THE UNIFORM LIVE LOAD OF THE ADJACENT FLOOR, WHICHEVER LOADS PRODUCES THE GREATER EFFECT, WITH TOTAL LOAD DEFLECTION LIMITED AS INDICATED IN PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL SUBMIT THE DESIGN OF THE PLANK AND/OR CHECKERED PLATE, INCLUDING ALL SUPPORTS AND INTEGRAL MEMBERS COMPLETE WITH DETAILS AND CALCULATIONS TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL PRIOR TO FABRICATION OF THE PLANK AND/OR CHECKERED PLATE.</div> <div>3. ALL ENDS AND OPENINGS SHALL BE Banded.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <div>4. SEE D05/5300-901 FOR TYPICAL SUPPORT AND ATTACHMENT OF ALUMINUM GRATING.</div> <div>5. THE WEIGHT OF A GRATING, PLANK, OR CHECKERED PLATE SECTION SHALL NOT EXCEED 150 LBS.</div> <div>6. ALUMINUM SURFACES IN CONTACT WITH CONCRETE GROUT OR DISSIMILAR METALS WILL BE PROTECTED WITH A COAT OF BITUMINOUS PAINT, MYLAR ISOLATES OR OTHER APPROVED MATERIAL.</div> <div>7. SEE SPECIFICATION SECTION 05 53 00 FOR ADDITIONAL REQUIREMENTS AND LOADING CRITERIA.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               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| DATE        | 09/09/26    |                 |  |
| REV         |             |                 |  |

MOBILE AREA WATER AND SEWER SYSTEM

MOBILE: AL

CC WILLIAMS HEADWORKS REHABILITATION AND ODOR CONTROL

STRUCTURAL  
LEGEND & NOTES

JOB NO.: 2402007

DATE: AUG. 2026

DESIGNED BY: JNM

DRAWN BY: SJB

CHECKED BY: MJS

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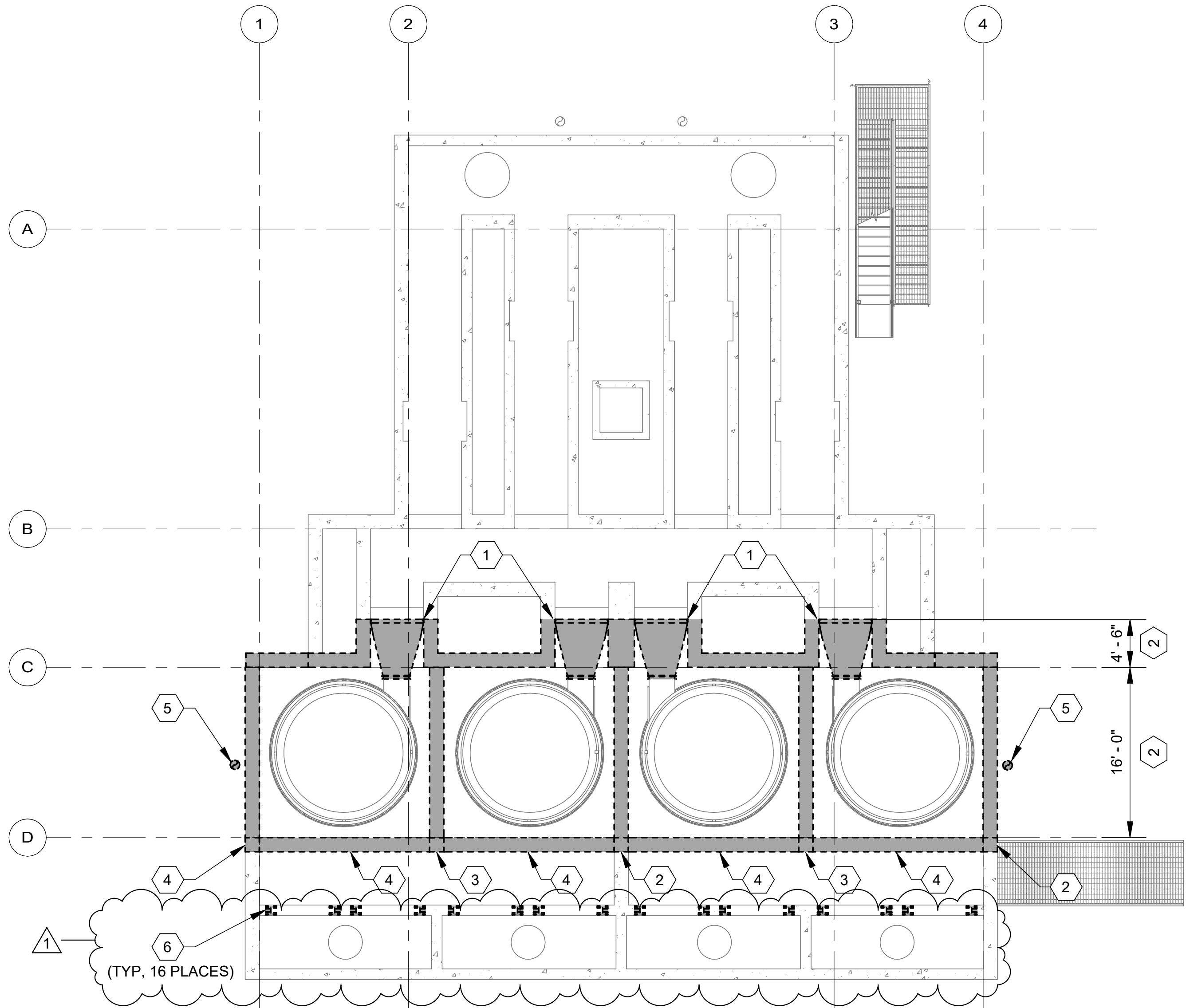
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DRAWING NUMBER  
**01-G007**

SHEET NUMBER  
**08**

Revit File: Autodeskt Docs\\W\\10-2402007 - MAWSS CC Williams Odor Control System\\2402007\_20\_HEADWORKS.rvt  
Plot Date: 9/9/2026 11:05:05 AM



1  
20-X102

### INTERMEDIATE DEMOLITION PLAN

SCALE: 1/8" = 1'-0"

#### DEMOLITION KEYNOTES

1. DEMOLISH CORRODED GRIT HEADCELL INLET CHUTE.
2. PARTIALLY DEMOLISH CONC WALL FROM TOP OF CONCRETE EL TO EL=29.75'. (4'-0" MINIMUM DEMOLITION HEIGHT)
3. PARTIALLY DEMOLISH CONC WALL FROM TOP OF CONCRETE EL TO EL=28.75'. (5'-0" MINIMUM DEMOLITION HEIGHT)
4. PARTIALLY DEMOLISH CONC WEIR FROM TOP OF WEIR EL TO EL=28.75'. (1'-11 1/4" MINIMUM DEMOLITION HEIGHT)
5. DEMOLISH VAPEX SYSTEM AND ASSOCIATED PIPING, APPURTENANCES, AND ELECTRICAL EQUIPMENT.
6. DEMOLISH EXISTING STOP LOG GUIDES.

1

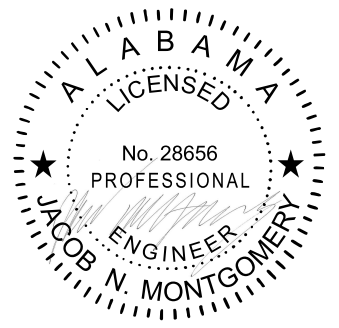
#### NOTES:

1. SEE SPECIFICATION 02 41 00 - DEMOLITION FOR ADDITIONAL REQUIREMENTS NOT LISTED ON DRAWINGS.
2. ELEVATIONS AND DIMENSIONS PROVIDED ARE BASED ON RECORD DRAWINGS AND ARE PROVIDED FOR THE CONTRACTORS REFERENCE. CONTRACTOR SHALL CONFIRM ALL ELEVATIONS PRIOR TO BEGINNING WORK, AND OWNER AND ENGINEER SHALL NOT BE HELD RESPONSIBLE FOR VARIANCES BETWEEN DRAWING AND ACTUAL ELEVATIONS.
3. DEMOLITION SHEETS, DRAWINGS, AND NOTES ARE PROVIDED FOR THE CONVENIENCE OF THE CONTRACTOR. OWNER AND ENGINEER SHALL NOT BE HELD RESPONSIBLE FOR VARIANCES BETWEEN DRAWING AND ACTUAL CONDITIONS. CONTRACTOR IS RESPONSIBLE FOR THE PRE-MEASURING OF EQUIPMENT AND EXISTING OPENINGS PRIOR TO REMOVAL.
4. CONTRACTOR TO REMOVE AND STORE GRIT HEADCELL UNIT. HEADCELL TO BE REINSTALLED WITH NEW INLET CHUTE AFTER CONCRETE WALLS ARE REBUILT. SEE SPECIFICATIONS FOR ADDITIONAL STORAGE REQUIREMENTS.



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**MAWS**  
MOBILE AREA WATER  
AND SEWER SYSTEM  
MOBILE, AL  
CC WILLIAMS HEADWORKS  
REHABILITATION AND ODOR  
CONTROL

HEADWORKS  
INTERMEDIATE  
DEMOLITION PLAN

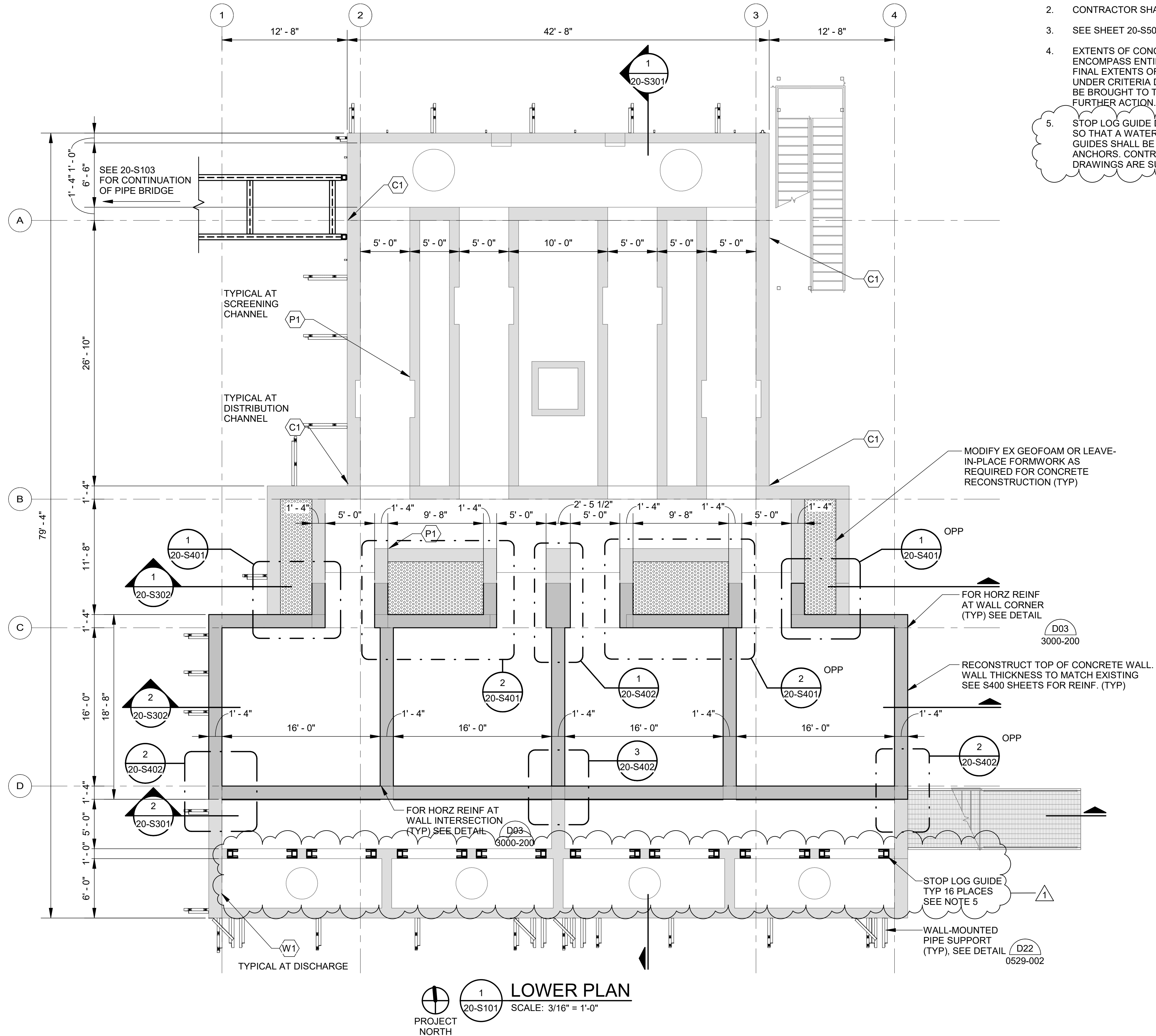
JOB NO.: 2402007  
DATE: AUG. 2026  
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NUMBER

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- NOTES:
- FOR GENERAL NOTES, SEE GENERAL DRAWINGS.
  - CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS SHOWN.
  - SEE SHEET 20-S501 FOR REPAIR PROCEDURES OF ALL CONDITIONS NOTED, U.N.O. ON PLAN.
  - EXTENTS OF CONCRETE CONDITIONS INDICATED ARE APPROXIMATE, AND MAY NOT ENCOMPASS ENTIRETY OF ELEMENTS TO BE REPAIRED. CONTRACTOR TO FIELD-VERIFY FINAL EXTENTS OF WORK REQUIRED. ADDITIONAL INSTANCES OF CONDITIONS FALLING UNDER CRITERIA DESCRIBED ON SHEET 20-S501 OBSERVED DURING REPAIR WORK SHALL BE BROUGHT TO THE ATTENTION OF THE EOR AND MAWSS FOR EVALUATION PRIOR TO ANY FURTHER ACTION.
  - STOP LOG GUIDE DIMENSIONS SHALL BE COORDINATED WITH EXISTING STOP LOGS ON-SITE SO THAT A WATERTIGHT SEAL IS ACCOMPLISHED WHEN STOP LOGS ARE INSTALLED. GUIDES SHALL BE 316 SST AND EPOXY ANCHORED INTO THE CONCRETE WITH SST EPOXY ANCHORS. CONTRACTOR TO COORDINATE EMBED DEPTHS WITH EOR WHEN FABRICATION DRAWINGS ARE SUBMITTED FOR REVIEW.

| KEYNOTES                                                              |                                     |
|-----------------------------------------------------------------------|-------------------------------------|
| MARK                                                                  | DESCRIPTION                         |
| C1                                                                    | VERTICAL LEVEL 4 CRACK              |
| W1                                                                    | FULL-HEIGHT LEVEL 4 WEAR ALONG WALL |
| P1                                                                    | DEGRADED COATING                    |
| SEE SHEETS 20-S501 FOR REPAIRS TO ADDRESS THE ABOVE-NOTED CONDITIONS. |                                     |



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MOBILE AREA WATER  
AND SEWER SYSTEM  
MOBILE, AL  
CC WILLIAMS HEADWORKS  
REHABILITATION AND ODOR  
CONTROL

HEADWORKS LOWER  
PLAN

JOB NO.: 2402007  
DATE: AUG. 2026  
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**20-S101**  
SHEET  
NUMBER

# INDEX OF STANDARD DETAILS

## DIV 03 - CONCRETE

| DETAIL SECTION | DETAIL DESCRIPTION                                                                  |
|----------------|-------------------------------------------------------------------------------------|
| 3000-100C      | STANDARD HOOK AND REINFORCING LAP SPLICE                                            |
| 3000-101       | STANDARD COVER FOR REINFORCING STEEL                                                |
| 3000-102B      | STRIP-TYPE WATERSTOP DETAIL                                                         |
| 3000-200       | TYPICAL REINFORCED WALL, GRADE BEAM, AND FOUNDATION INTERSECTION/CORNER REINFORCING |
| 3000-202       | WALL VERTICAL CONSTRUCTION JOINT                                                    |
| 3000-206       | RETROFIT WATERSTOP                                                                  |
| 3000-600       | ADDITIONAL REINFORCEMENT AT WALL OPENINGS                                           |
| 3000-1000      | EQUIPMENT BASE DETAIL                                                               |
| 3000-1001      | ANCHOR BOLT DETAIL                                                                  |

## DIV 05 - METALS

| DETAIL SECTION | DETAIL DESCRIPTION                |
|----------------|-----------------------------------|
| 5213-100       | TEE FITTING DETAIL                |
| 5213-101       | TOEBOARD DETAILS                  |
| 5213-102       | SPLICE LOCK                       |
| 5213-103       | TYPICAL WALL RAIL DETAIL          |
| 5213-105       | SIDE MOUNT BRACKET                |
| 5213-106       | STAIR STRINGER BASE FLANGE DETAIL |
| 5213-107       | BASE FLANGE DETAIL                |
| 5213-108       | EXPANSION JOINT SPLICE            |
| 5213-109       | EXPANSION SPLICE DETAIL           |
| 5213-600       | OSHA TYPE GUARDRAIL               |
| 5300-901       | TYPICAL GRATING FRAME DETAIL      |

## DIV 22 - PLUMBING

| DETAIL SECTION | DETAIL DESCRIPTION                    |
|----------------|---------------------------------------|
| 0529-001       | ADJUSTABLE FLOOR MOUNTED PIPE SUPPORT |
| 0529-002       | FABRICATED WALL MOUNTED PIPE SUPPORT  |
| 0529-004       | WALL MOUNTED PIPE SUPPORT             |
| 0529-012       | WALL MOUNTED VERTICAL PIPE SUPPORT    |

## DIV 26 - ELECTRICAL

| DETAIL SECTION | DETAIL DESCRIPTION                                       |
|----------------|----------------------------------------------------------|
| 0526-006       | CONDUIT GROUNDING DETAIL                                 |
| 0526-009       | GROUNDING CONDUIT SLEEVE DETAIL                          |
| 0526-012       | GROUND SYSTEM CONNECTION DETAIL                          |
| 0526-013       | TYPICAL GROUND ROD WITH TEST WELL INSTALLATION           |
| 0529-001       | CONDUIT AND JUNCTION BOX SUPPORT DETAIL                  |
| 0529-002       | TYPICAL PAD MOUNTING ELECTRICAL EQUIPMENT DETAIL         |
| 0529-009       | RACK BASEPLATE DETAIL                                    |
| 0529-011       | TYPICAL ELECTRICAL EQUIPMENT MOUNTING DETAIL - SIDE VIEW |
| 0529-012       | TYPICAL ELECTRICAL EQUIPMENT MOUNTING DETAIL- FRONT VIEW |
| 0529-013       | TYPICAL SUN SHIELD FOR CONTROL PANEL AND INSTRUMENTS     |
| 0529-014       | TYPICAL UNISTRUT STAND DETAIL                            |
| 0529-016       | TYPICAL CONDUIT INSTALLATION AT WALKWAY DETAIL           |
| 0533-017       | CONDUIT WALL PENETRATION SEAL DETAIL                     |
| 0533-018       | TYPICAL DEFLECTION COUPLING DETAIL                       |
| 0543-012       | CONCRETE ENCASED ELECTRICAL DUCT DETAIL                  |
| 0543-013       | UNDERGROUND DETECTABLE WARNING TAPE DETAIL               |
| 0543-014       | ELECTRICAL PULLBOX DETAIL                                |
| 0543-015       | TYPICAL DUCTBANK SPACING AND COUPLNG DETAIL              |
| 0553-002       | TYPICAL ENGRAVED NAMEPLATE DETAIL                        |
| 0593-001       | TYPICAL MOTOR LEAD DETAIL                                |
| 0593-002       | SHIELDED VFD CABLE TERMINATION DETAIL                    |

## DIV 31 - EARTHWORK

| DETAIL SECTION | DETAIL DESCRIPTION                                                                 |
|----------------|------------------------------------------------------------------------------------|
| 2323-001_AL    | BEDDING BACKFILL FOR TRENCHES - AL                                                 |
| 2323-002       | BEDDING BACKFILL REQUIREMENTS AROUND MANHOLES & OTHER DRAINAGE/SANITARY STRUCTURES |

## DIV 32 - EXTERIOR IMPROVEMENTS

| DETAIL SECTION | DETAIL DESCRIPTION               |
|----------------|----------------------------------|
| 0000-009       | TYPICAL BOLLARD                  |
| 1216-001_AL    | ASPHALT PAVEMENT - AL            |
| 3113-009       | CHAIN LINK SECURITY FENCE DETAIL |

## DIV 33 - UTILITIES

| DETAIL SECTION | DETAIL DESCRIPTION                                |
|----------------|---------------------------------------------------|
| 0000-001       | EXTERIOR BACKFLOW PREVENTER (2" DIAMETER OR LESS) |
| 3913-002       | TYPE A CAST IN PLACE MANHOLE                      |
| 3913-004       | TYPICAL MANHOLE RINGS & COVERS                    |
| 3913-005       | MANHOLE CORING DETAILS                            |

## DIV 40 - PROCESS INTEGRATION

| DETAIL SECTION | DETAIL DESCRIPTION                                           |
|----------------|--------------------------------------------------------------|
| 0513-006       | PRESSURE SWITCH AND INDICATOR WITH ANNULAR SEAL INSTALLATION |
| 0513-007       | TYPICAL PRESSURE INDICATOR INSTALLATION                      |
| 2339-004       | TYPICAL CLEANOUT DETAIL                                      |
| 2400-001       | PIPE WALL PENETRATION SEAL                                   |
| 2400-009       | PIPE ENCASEMENT                                              |
| 7000-001       | TYPICAL INSTRUMENT SURGE PROTECTION DETAIL                   |
| 7276-002       | LEVEL SWITCH INSTALLATION - TANK DETAIL                      |
| 7326-002       | PIPE MOUNTED PRESSURE TRANSMITTER DETAIL                     |

|                                                                                     |          |                             |                      |
|-------------------------------------------------------------------------------------|----------|-----------------------------|----------------------|
|  | 09/09/26 | REVISED FOR ADDENDUM NO. 01 | JNM                  |
| REV                                                                                 | DATE     | DESCRIPTION                 | BY                   |
| STANDARD DETAILS INDEX 1                                                            |          |                             | DIVISION             |
|                                                                                     |          |                             | SECTION - DETAIL NO. |
| DETAIL NOT TO SCALE                                                                 |          |                             | DATE: AUGUST         |

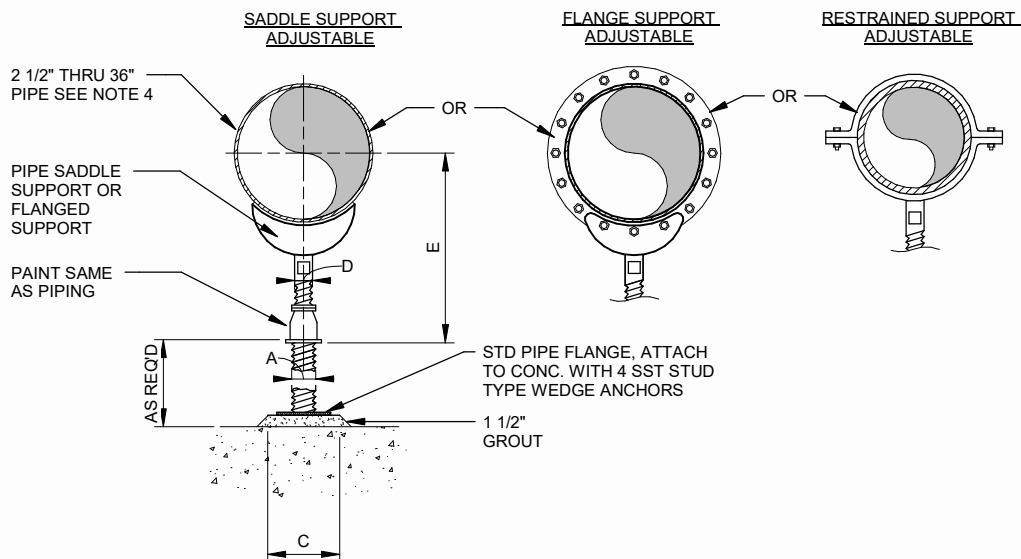


**MOBILE AREA WATER AND  
SEWER SYSTEM**

MOBILE, AL

CC WILLIAMS HEADWORKS REHABILITATION AND ODOR  
CONTROL

JOB NO.: 2402007



| DIMENSION TABLE |        |           |     |        |         |         |
|-----------------|--------|-----------|-----|--------|---------|---------|
| PIPE SIZE       | A      | B         | C   | D      | E       |         |
|                 |        |           |     |        | MIN     | MAX     |
| 2-1/2"          | 2-1/2" | 3-1/2"    | 6"  | 1-1/2" | 8"      | 13"     |
| 3"              | 2-1/2" | 3-3/4"    | 8"  | 1-1/2" | 8-1/4"  | 13-1/4" |
| 3-1/2"          | 2-1/2" | 4"        | 8"  | 1-1/2" | 8-1/2"  | 13-1/2" |
| 4"              | 3"     | 4-1/4"    | 8"  | 2-1/2" | 9-1/4"  | 14"     |
| 5"              | 3"     | 4-7/8"    | 8"  | 2-1/2" | 10"     | 14-3/4" |
| 6"              | 3"     | 5-1/2"    | 10" | 2-1/2" | 10-1/2" | 15-1/4" |
| 8"              | 3"     | 6-7/8"    | 10" | 2-1/2" | 11-3/4" | 15-1/2" |
| 10"             | 3"     | 8-1/2"    | 14" | 2-1/2" | 13-1/2" | 18-1/4" |
| 12"             | 3"     | 9-15/16"  | 18" | 2-1/2" | 15"     | 19-3/4" |
| 14"             | 4"     | 10-15/16" | 18" | 3"     | 16-1/4" | 20-3/4" |
| 16"             | 4"     | 12-3/8"   | 20" | 3"     | 17-3/4" | 22-1/4" |
| 18"             | 6"     | 13-7/8"   | 22" | 3-1/2" | 19-1/2" | 24"     |
| 20"             | 6"     | 15-3/8"   | 22" | 3-1/2" | 21"     | 25-1/2" |
| 24"             | 6"     | 17-15/16" | 24" | 4"     | 23-3/4" | 28-1/4" |
| 30"             | 6"     | 21-5/16"  | 30" | 4"     | 27"     | 31-1/2" |
| 32"             | 6"     | 22-1/2"   | 30" | 4"     | 28-1/4" | 32-3/4" |
| 36"             | 6"     | 24-1/2"   | 30" | 4"     | 30-1/4" | 34-3/4" |

**NOTES:**

1. PROVIDE HALF ROUND RIGID INSULATION AND INSULATION PROTECTION SHIELD WHERE PIPING IS INSULATED.
2. PROVIDE NEOPRENE WAFFLE INSULATION PAD, SIMILAR TO MASON TYPE "W" OR KORFUND 40, UNDER SUPPORT FOOT WHEN PIPING IS ISOLATED OR SUPPORT IS ADJACENT TO MECHANICAL EQUIPMENT.
3. FOR BASE, HEIGHT AND FLANGE DIMENSIONS, SEE TABLE.
4. USE 2 1/2" SUPPORTS FOR PIPES LESS THAN 2 1/2" DIAMETER.
5. SUPPORT HARDWARE SHALL BE TYPE 316 STAINLESS STEEL OR ALUMINUM
6. ADJUSTABLE FLOOR MOUNTED PIPE SUPPORTS ARE A DELEGATED DESIGN ITEM. SEE SPECIFICATION SECTION 40 05 07 - HANGERS AND SUPPORTS FOR PROCESS PIPING FOR ADDITIONAL REQUIREMENTS.



**MOBILE AREA WATER AND SEWER SYSTEM**

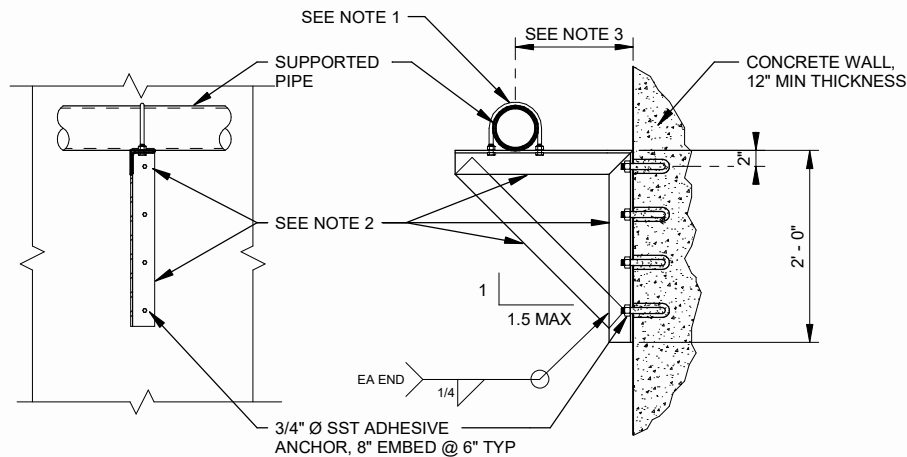
MOBILE, AL

CC WILLIAMS HEADWORKS REHABILITATION AND ODOR CONTROL

JOB NO.: 2402007

| REV                                          | DATE     | DESCRIPTION                 | JNM BY                                  |
|----------------------------------------------|----------|-----------------------------|-----------------------------------------|
|                                              | 09/09/26 | REVISED FOR ADDENDUM NO. 01 |                                         |
| <b>ADJUSTABLE FLOOR MOUNTED PIPE SUPPORT</b> |          |                             | DIVISION<br><b>D22</b>                  |
|                                              |          |                             | SECTION - DETAIL NO.<br><b>0529-001</b> |
|                                              |          |                             | DATE: AUGUST                            |

DETAIL NOT TO SCALE



**ELEVATION**

**SECTION**

**NOTES:**

1. RESTRAINT OF PIPE AND ASSOCIATED ATTACHMENTS TO SUPPORTING STRUCTURE ARE DELEGATED DESIGN ITEMS. SEE SPECIFICATION SECTION 04 05 07- HANGERS AND SUPPORTS FOR PROCESS PIPING FOR ADDITIONAL REQUIREMENTS.
2. FOR WASTEWATER APPLICATIONS, USE A MINIMUM ANGLE SIZE OF SST L4X4X3/8. WHERE DELEGATED DESIGN OF PIPE RESTRAINT ATTACHMENTS TO SUPPORTING STRUCTURES INDICATE A SUPPORT LENGTH GREATER THAN 4", FURNISH AN EQUAL LEG ANGLE OF MATCHING WIDTH AND 1/2" THICK LEG THICKNESS. WHERE LONGITUDINAL ANCHOR POINT IS PROVIDED, PROVIDE ANGLE KICKER TO NEXT PIPE SUPPORT FROM ATTACHMENT POINT.
3. DISTANCE FROM PIPE CENTERLINE TO FACE OF WALL SHALL BE AS SHOWN ON PLANS, NOT TO EXCEED 4'-0".
4. SPACING OF PIPE SUPPORTS SHALL BE AS SHOWN ON PLANS, NOT TO EXCEED VALUES SHOWN IN TABLE BELOW:

| MAX SPACING OF SUPPORTS |                  |
|-------------------------|------------------|
| PIPE SIZE (IN)          | MAX SPACING (FT) |
| 4                       | 14               |
| 6                       | 14               |
| 8                       | 14               |
| 10                      | 14               |
| 12                      | 12               |
| 14                      | 8                |
| 16                      | 6                |
| 18                      | 6                |
| 20                      | 4                |
| 24                      | 4                |



**MOBILE AREA WATER AND SEWER SYSTEM**

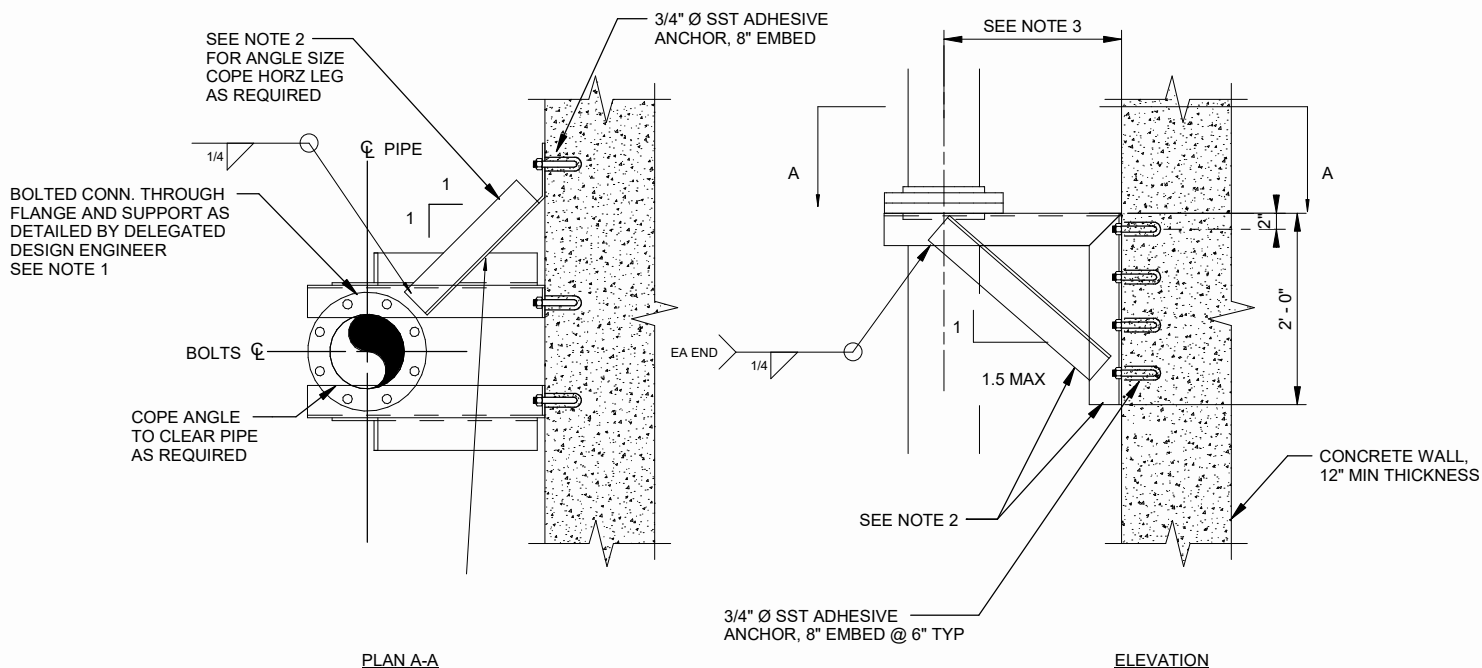
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CC WILLIAMS HEADWORKS REHABILITATION AND ODOR CONTROL

JOB NO.: 2402007

| REV                                         | DATE     | DESCRIPTION                 | JNM BY          |
|---------------------------------------------|----------|-----------------------------|-----------------|
|                                             | 09/09/26 | REVISED FOR ADDENDUM NO. 01 |                 |
| <b>FABRICATED WALL MOUNTED PIPE SUPPORT</b> |          |                             | <b>D22</b>      |
|                                             |          |                             | <b>0529-002</b> |
| DETAIL NOT TO SCALE                         |          |                             | DATE: AUGUST    |

1



**NOTES:**

1. RESTRAINT OF PIPE AND ASSOCIATED ATTACHMENTS TO SUPPORTING STRUCTURE ARE DELEGATED DESIGN ITEMS. SEE SPECIFICATION SECTION 04 05 07- HANGERS AND SUPPORTS FOR PROCESS PIPING FOR ADDITIONAL REQUIREMENTS.
2. FOR WASTEWATER APPLICATIONS, USE A MINIMUM ANGLE SIZE OF SST L4X4X3/8.
3. DISTANCE FROM PIPE CENTERLINE TO FACE OF WALL SHALL BE AS SHOWN ON PLANS, NOT TO EXCEED 4'-0".
4. MAXIMUM ALLOWABLE VERTICAL LOAD = 1500 LB.



**MOBILE AREA WATER AND  
SEWER SYSTEM**

MOBILE, AL

CC WILLIAMS HEADWORKS REHABILITATION AND ODOR  
CONTROL

JOB NO.: 2402007

| REV | DATE | DESCRIPTION | JNM<br>BY |
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**WALL MOUNTED VERTICAL PIPE  
SUPPORT**

DIVISION  
**D22**

SECTION - DETAIL NO.  
**0529-012**

DETAIL NOT TO SCALE

DATE: AUGUST