Jones & Henry
ENGINEERS, LTD.

City of Greenville, Ohio
WWTP Solids Handling Facility and Administration Building

ADDENDUM 1

12.16.2024

Planholders of the City of Greenville, WWTP Solids Handling Facility and Administration Building are hereby notified of the following amendments to the Contract Documents. This Addendum is hereby made a part of the Contract Documents.

REFERENCE NOTE

Geotechnical Consultants Inc.: Subsurface Exploration and Geotechnical Engineering Report

GENERAL CLARIFICATIONS

A1-G1:
Question:
Are special inspections / construction materials testing are available to bid for the Greenville Wastewater Treatment Facility - Biosolids Facility Improvements project in Greenville, Ohio.
Response:
Per Supplementary Conditions (C-800), SC-14.02, Contractor shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Contractor, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

A1-G2:
Question:
Are any snow guards required on any of the new metal roofs?
Response:
Per the specification 13650 snow guards are to be placed over all personnel doors.

A1-G3:
Question:
Request a copy of the geotechnical report mentioned on page 2 of the Supplementary Conditions
Response:
The geotechnical report will be included with the attachments to this addendum.

A1-G4:
Question:
The pipe schedule under 02555 mentions buried ductile air piping. Do the buried gaskets need to be viton due to high temperatures?

Response:
All buried ductile iron air piping should be mechanical joint and use viton gaskets. Refer to specification 15210.

A1-G5:
Question:
Is the Final Completion 860 days as noted on the bid form or 834 days as noted on the agreement
Response:
Final Completion shall be 834 days as noted in the agreement. Refer to updated C-410 - Bid Form for Construction Contracts.

A1-G6:
Question:
There is no allowance noted for AES costs. We assume that the owner will be paying for any AES cost. Please confirm.
Response:
Yes, Owner will be paying for any AES cost.

A1-G7:
Question:
Spec 02050 does not seem applicable to this project. Please confirm
Response:
Yes, 02050 specification will be removed.

A1-G8:
Question:
Item 15.08.A of the General Conditions calls for a 2-year warranty period. Numerous specs mention a 1-year warranty. Is 15.08.A correct?
Response:
Standard warranty as noted in Specification Section C700,15.08 A has been updated to 1 year.

A1-G9:
Question:
Page 10 of the bid form provides a list for the bidder to write in proposed suppliers. Most process equipment specs name one manufacturer and mention “or equal”. What is the planned procedure if a bidder indicates a supplier of process equipment that is not named in the spec? Would this evaluation of the “or equal” status be done prior to award of a contract?
Response:
"Or equals” will be reviewed in accordance with the requirements stated in EJCDC C-700 7.04.

A1-G10:
Question:
Item 4.06.C.3 in spec 01043 mentions the possible need to landfill the first batch of dewatered sludge. Will the owner cover these costs?
Response:
Yes, Owner will cover these costs.

A1-G11:
Question:
The room finish schedule calls for epoxy base for rooms that have epoxy flooring. Item 4.01.D in spec 09250 calls out vinyl base. Please clarify
Response:
Provide epoxy base where epoxy flooring is provided.

SPECIFICATIONS

Replace the following specifications with the attached:

C-111 – Advertisement for Bid

C-410 – Base Bid Manufacturers Schedule

C-410 – Bid Form for Construction Contacts

01010 – Definition of Contract Items

03300 – Cast in Place Concrete

081113 – Hollow Metal Doors and Frames

11104 – Air Diffusion Equipment

11222 – Biosolids Storage Day Tank

11239 – Rotary Lobe Blowers

11441 – Sludge Macerator

11735 – Pumping Equipment

11835 – Volute Dewatering Press

12310 – Cabinets and Furnishings

12601 – Lunchroom Equipment

12602 – Office Equipment and Furniture

14551 – Shaftless Screw Conveyors

15150 – Sanitary Waste and Vent Piping

15210 – Piping

15250 – Valves

Amend and revise the following specification sections as noted below:

Page C-700, General Conditions, 15.08 Correction Period:

In the first line of the paragraph, delete the word “two” and substitute with “one”.

DRAWINGS

Replace the following drawing with the attached:

M-0.7 page 128

RECEIPT OF THIS ADDENDUM MUST BE ACKNOWLEDGED ON PAGE C-410-1 OF THE BID.

GEOTECHNICAL
CONSULTANTS INC.

MAIN OFFICE
720 Greencrest Drive
Westerville, OH 43081
614.895.1400 **phone**
614.895.1171 **fax**

YOUNGSTOWN OFFICE
8433 South Avenue
Building 1, Suite 1
Boardman, OH 44514
330.965.1400 **phone**
330.965.1410 **fax**

DAYTON OFFICE
2380 Bellbrook Avenue
Xenia, OH 45385
937.736.2053 **phone**

www.gci2000.com

GEOTECHNICAL CONSULTANTS INC.

GCI PROJECT No. 23-G-28027

Subsurface Exploration and Geotechnical Engineering Report

Greenville WWTP Improvements
209 N Ohio Street
Greenville, Ohio

Prepared for:
Jones & Henry Engineers

October 13, 2023
November 14, 2023

GEOTECHNICAL CONSULTANTS INC.

MAIN OFFICE
720 Greencrest Drive
Westerville, OH 43081
614.895.1400 **phone**
614.895.1171 **fax**

YOUNGSTOWN OFFICE
8433 South Avenue
Building 1, Suite 1
Boardman, OH 44514
330.965.1400 **phone**
330.965.1410 **fax**

DAYTON OFFICE
2380 Bellbrook Avenue
Xenia, OH 45385
937.736.2053 **phone**

www.gci2000.com

October 13, 2023
Updated November 14, 2023 to include corrosion testing

Mr. Jake Meinerding, P.E. email: JMeinerding@jheng.com
Jones & Henry Engineers, Ltd.
4357 Ferguson Drive, Suite 220
Cincinnati, Ohio 45245

Reference: Subsurface Exploration and Geotechnical Engineering Report
Greenville WWTP Improvements
209 N Ohio Street - Greenville, Ohio
GCI Project No. 23-G-28027

Dear Mr. Meinerding:

As you authorized, Geotechnical Consultants, Inc. (GCI) performed a subsurface exploration and prepared this geotechnical engineering report for the above referenced project. In summary, the borings encountered a surface cover of topsoil and existing fill underlain by a layer of organic soil/old topsoil, natural lean clay, sand, and gravel. We encountered groundwater seepage in the borings at elevations ranging from 994.5 feet to 998.0 feet, typically between 997.0 feet and 998.0 feet. We did not encounter bedrock within the maximum drilled depth of 30 feet.

Geotechnical issues that will impact site development are site stripping, site and subgrade preparation, fill placement, addressing the existing fill and organic soil, and managing settlements. Provided these considerations are properly addressed during design and construction, it is GCI's opinion that the site should be suitable for the proposed development using conventional shallow foundations (extended as needed), slab-on-grade, and flexible pavements. The attached report provides more detailed recommendations for foundations and site preparation work.

After you have reviewed the report, feel free to contact us with any questions you may have. We appreciate the opportunity to provide our services for this project and hope to continue providing our services through construction.

Respectfully submitted,
Geotechnical Consultants, Inc.

Michael Travis, P.E.
Project Manager

Todd R. Meek, P.E., LEED AP
In-House Reviewer

Distribution: Mr. Jake Meinerding @ Jones & Henry Engineers – pdf via email
GCI File

TABLE OF CONTENTS

INTRODUCTION

As requested and authorized by Mr. Jake Meinerding on behalf of Jones & Henry Engineers, Geotechnical Consultants, Inc. (GCI) performed a subsurface exploration and prepared this geotechnical engineering report for the proposed improvements at the existing Greenville Waste Water Treatment Plant located at 209 N Ohio Street in Greenville, Ohio. Prior to drilling, GCI was provided with a rough site plan showing the proposed locations of the new structures and digesters, along with the requested boring locations.

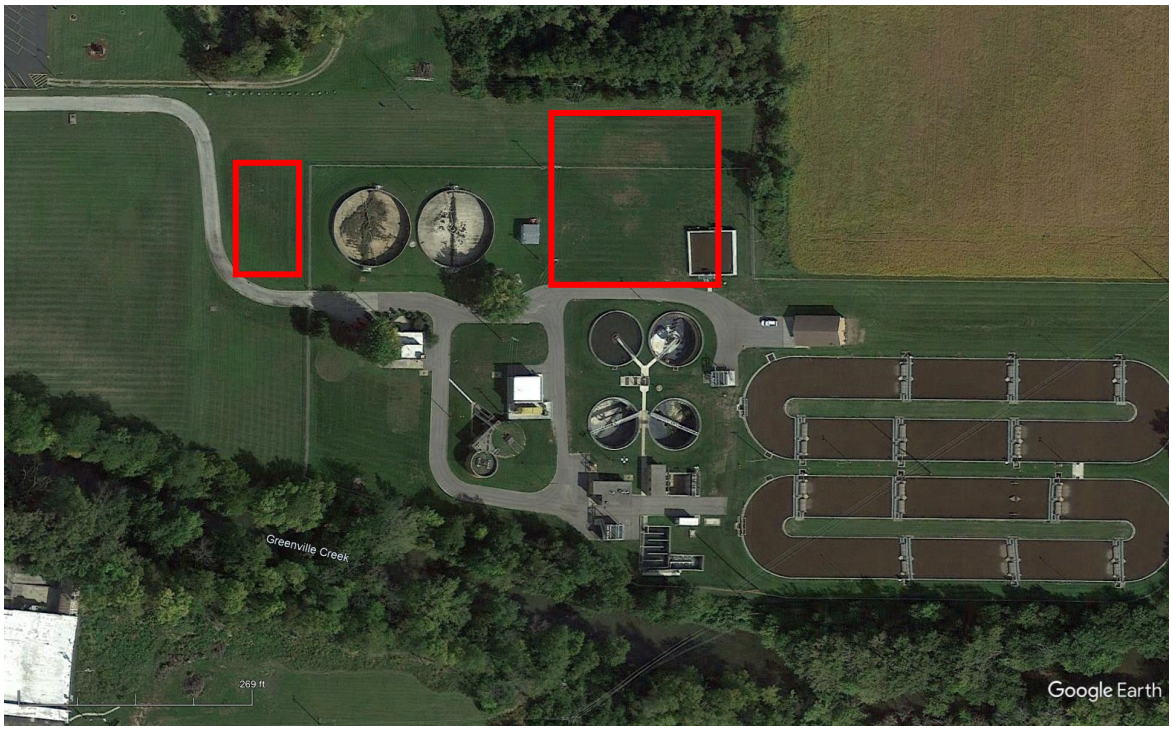
GCI's subsurface study consisted of nine (9) standard penetration test borings. The boring locations were located with the use of the provided site plan, GIS coordinates, and a hand-held GPS device, the boring locations should be considered approximate. GCI estimated ground surface elevations of the borings with the provided topographic site map, these elevations were not verified in the field and are only meant to be approximations.

The intent of this study was to evaluate subsurface conditions and comment on the impact of the encountered conditions relative to earthwork, foundations, and slabs for the proposed structures. This report is issued prior to receipt of final grading plans. GCI should review these plans when available and provide additional recommendations and borings, if necessary.

GCI prepared this report for the exclusive use of Jones & Henry Engineers and their client for specific application to the above referenced project in Greenville, Ohio in accordance with generally accepted soil and foundation engineering practices. No warranty, express or implied, is made.

SITE LOCATION AND PROJECT DESCRIPTION

The project site is located at 209 N Ohio Street in Greenville, Ohio at the existing Greenville waste water treatment plant. Topographically, the site is relatively flat with rolling terrain in areas that haven't been developed. A *Site Location Map and Boring Location Plan* is included in the Appendix and the aerial photograph below shows conditions at the site similar to those encountered during our drilling operations. The approximate areas being developed are shown in red on the aerial photograph below.



Aerial Photograph of the site (Google Earth, Imagery Date: 9/24/2014)

The proposed improvements will consist of a new administration building on the west side of the site, and three aerobic digesters, a biosolids storage building, and a solids handling building on the northeast side of the site. A final grading plan was not available at the time of writing this report. We understand that the buildings and tankage structures will bear approximately 4 feet below grade.

SUBSURFACE CONDITIONS

On September 26, GCI mobilized two truck-mounted rotary drill rigs (with automatic sampling hammers) and performed nine standard penetration borings (B-1 to B-9) within the proposed building/aerobic digester footprints to depths of 25 to 30 feet below grade. Borings B-1 to B-3, and B-7, were drilled within the proposed aerobic digesters, B-4 to B-6 were drilled within the proposed solids handling and biosolid storage buildings, and B-8 and B-9 were drilled within the new administration building.

The boring logs, a boring location plan, and a summary table of encountered subsurface conditions are attached in the appendix. The subsurface findings are summarized below. Refer to the individual boring logs for more detailed subsurface information at specific boring locations.

Surface Cover

The borings encountered a 0.3 feet thick topsoil surface cover. Below the topsoil, the borings encountered existing fill materials consisting of a mix of black, stained, brown, and dark brown, lean to silty clay with varying amounts of sand and gravel. Fill consisting of clayey sand with gravel were also encountered in several of the borings. The existing fill was medium stiff to very stiff in cohesive consistency and loose to medium dense in cohesionless density and extended to depths of 2 to 8 feet in our borings.

Organic Soil, Trapped Topsoil, Stained Lean Clay

Below the fill in borings B-3, B-4, B-5, B-6, and B-8, a layer of black to stained lean clay or organic soil (classified as CL/OL in the Unified/ASTM Soils Classification System) was encountered. The samples retrieved in this layer varied in organic content and were soft

to medium stiff in cohesive consistency. The organic soil/stained lean clay extended to depths of 4 to 8 feet in these borings.

Natural Soils

Below the fill and organic/stained soil, borings B-1, B-2, B-3, and B-6 encountered natural dark brown, brown, and gray lean clay to sandy lean clay of low to moderate plasticity (classified as CL in the Unified/ASTM Soils Classification System). The lean clay extended to depths of 7 to 10 feet below existing grade in these borings. Standard penetration testing indicated the lean clay was medium stiff to very stiff in cohesive consistency.

Below the fill, organic/stained soil, and lean clay, the borings encountered granular soils at depths of 2 to 10 feet below existing grades. The encountered granular soils were typically brown or gray in color and consisted of the following gradations:

- Poorly Graded Sand with Silt (SP-SM)
- Poorly Graded Gravel with Silt and Sand (GP-GM)
- Silty Sand (SM)
- Poorly Graded Sand with Silt and Gravel (SP-SM)
- Silty Gravel with Sand (GM)
- Well Graded Sand with Silt and Gravel (SW-SM)

The granular soils extended to the boring termination depths of 25 to 30 feet below existing grade. Standard penetration testing indicated the sand was loose to dense in cohesionless density.

Bedrock

We did not encounter bedrock within the maximum drilled depth of our borings (30 feet).

Groundwater

Groundwater seepage was encountered in the borings at depths of 6 to 10 feet below grade and was recorded at a slightly higher elevation in most of the borings upon completion of the drilling. The water seepage was encountered within granular soils.

The fill soils were generally noted to be dry to moist, while the natural cohesive soils were noted to be moist to very moist. The granular soils were typically wet below water seepage. Note that groundwater levels and moisture conditions can vary with changes in season and in response to precipitation events.

LABORATORY TESTING

GCI implemented a laboratory index/classification testing program on select samples from the borings considered representative of the site soils. The testing program consisted of moisture content, Atterberg Limits, and gradation testing on the split spoon samples. The results are included in the appendix.

Moisture content and organic content testing were performed on two samples retrieved from the organic soil/stained clay layer (B-4 @ 4.0', B-6 @ 4.0'). The moisture contents in these samples ranged from 26.7 to 44.8 percent with organic contents of 2.1 to 7.4 percent, indicating slight to moderate organic contents.

GCI also performed laboratory soil testing on combined soil samples obtained from three different soil layers (Existing Fill, Natural Clay, Natural Sand/Gravel) within borings B-1

through B-6, to assess potential soil corrosivity in accordance with publication ANSI/AWWA C105/A21.5-99 specifications. Table 3 on the following page (ANSI/AWWA C105/A21.5-99 Table A.1 from the publication) shows the rating system based on laboratory test findings. Results of the testing are summarized in the below table.

TABLE 1 – Lab Test Results

Sample	pH	Resistivity (ohm-cm)	Redox Potential(mV)	Sulfides	Moisture
Existing Fill	7.8	3,500	414	Positive	Fair
Natural Clay	8.1	2,900	232	Positive	Fair
Natural Sand/Gravel	8.0	3,100	226	Positive	Poor

TABLE 2 – ANSI/AWWA Point Summary

Sample	pH	Resistivity	Redox Potential	Sulfides	Moisture	Sum
Existing Fill	0	0	0	3.5	1	4.5
Natural Clay	0	1	0	3.5	1	5.5
Natural Sand/Gravel	0	0	0	3.5	2	5.5

Using the ANSI/AWWA Table A.1 soil test evaluation system (Table 3 on following page), the tested soil samples had total points of between 4.5 and 5.5. Per the ANSI/AWWA rating system, soils with a sum of 10 points or higher are indicative of a corrosive environment to ductile iron pipe and protection would be needed. The testing showed total points below the 10-point threshold in all three samples.

TABLE 3 - ANSI/AWWA C105/A21.5-99 Table A.1

Table A.1 Soil-test evaluation

Soil Characteristics Based on Samples Taken Down to Pipe Depth	Points*
Resistivity—ohm-cm (based on water-saturated soil box)	
<1,500	10
≥1,500–1,800	8
>1,800–2,100	5
>2,100–2,500	2
>2,500–3,000	1
>3,000	0
pH:	
0–2	5
2–4	3
4–6.5	0
6.5–7.5	0†
7.5–8.5	0
>8.5	3
Redox potential:	
> +100 mV	0
+50 to +100 mV	3.5
0 to +50 mV	4
Negative	5
Sulfides:	
Positive	3.5
Trace	2
Negative	0
Moisture:	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

*Ten points indicates that soil is corrosive to ductile-iron pipe; protection is needed.

†If sulfides are present and low or negative redox-potential results are obtained, add three points for this range.

ANALYSES AND CONCLUSIONS

GEOTECHNICAL EVALUATION

It is GCI's opinion that, provided the site is prepared in accordance with the recommendations of this report, the site geotechnical conditions will be suitable for the

proposed structures, using conventional shallow/mat foundations. The primary geotechnical considerations are the impacts that topsoil cover, existing fill, soft/organic soils, soil moisture conditions, and shallow groundwater will have on site preparation and foundations. Geotechnical considerations for the project are discussed in the following paragraphs.

Site Stripping

Surface vegetation, topsoil, and other organic materials are not suitable for foundation or slab support and should be stripped from below the proposed building/structure footprints, plus a minimum of 5 feet laterally. Topsoil is not suitable for use as structural fill and should be stockpiled for later use in site landscaping or otherwise be hauled off-site.

Existing Fill and Stained/Organic Soil

We encountered existing fill extending to depths ranging from approximately 2 feet to 8 feet below existing grade underlain by areas of stained/organic soil and topsoil. In our opinion, the existing fill, soft/organic lean clay, and trapped topsoil are not suitable for foundation support due to settlement concerns. We provide the following options for how to address the existing fill and soft/organic soils during construction.

Option 1: Fill and Stained/Organic Soil Removal and Replacement

The first option is to remove the existing fill, and soft stained/organic underlying natural soils, from within the structures footprint plus 10 feet laterally beyond. The excavation would then be backfilled with structural fill (as we describe in the *Structural Fill Placement* and *Site Preparation and Earthwork* sections of report).

Prior to new fill placement, the undercut subgrade should be carefully proof-rolled to assess the stability of the natural soils. Soft subgrades should be brought to a stable condition prior to new fill placement. With this option, the bottom of the excavation could consist of wet, and loose sand and gravel that may not be stable below compaction equipment. To stabilize granular soils at the bottom of the excavation, a 12-inch layer of 57 limestone can be placed and compacted prior to backfilling with structural fill. In our opinion, existing non-organic fill and the natural, non-organic site soils can be re-used as structural fill. Fill with excessive amounts of organic material, and other deleterious material, is not suitable for reuse in controlled fill; these materials can be disposed of at an off-site location, wasted to green spaces, or reused in landscaping mounds. We note that the encountered existing fill materials were generally dry, and would need moisture conditioned to achieve proper compaction if reused as structural fill. Imported fill should be reviewed by GCI prior to its use as structural fill.

Once this procedure is completed, foundations would be constructed in the new, controlled fill at design grades and settlement associated with the existing fill will be mitigated.

Option 2: Extend Foundations

The second option for building construction is to leave the existing fill in-place for slab support, and to extend the foundations downward (through the fill and stained/organic soils and any local soft zones in the natural soils) to bear directly on the stable, natural soils. Undercuts can be backfilled to grade with a controlled density fill (CDF) such as K-krete or lean concrete to allow footings to be constructed at design grade.

With this procedure, foundation settlements associated with the existing fill will be mitigated, although there is some risk of slab settlement due to the existing fill and organic soils that would remain in place. In our opinion, this risk is low for a lightly loaded slab, provided the subgrade is brought to a firm and stable condition, as judged by a proof-roll, and provided a significant amount of fill is not placed (which can cause the organic soils to consolidate and slabs to settle). The owner must assume the risk of possible settlement and slab cracking when constructing over the existing fill and organic soils. We recommend Option 1 and 3 if/where heavy slab loads are planned.

Option 3: Modify the In-Situ Fills with Aggregate Piers

This option consists of leaving the existing fills in place and modifying/stiffening the fill with the installation of vibratory stone columns or rammed aggregate piers to allow construction of a shallow foundation and slab-on-grade system. This option could also provide higher bearing capacities and reduced settlements, if needed.

This technique involves drilling auger holes or advancing a vibrating probe through the unsuitable soils and either ramming or vibrating aggregate into the holes in controlled lifts up to the bearing elevation. A casing may be required to keep the excavations open depending on the system used. Holes would be drilled in a grid pattern beneath foundations (and slabs if desired to eliminate settlement risks associated with existing fills below slabs). Ramming or vibrating both densifies the aggregate and forces the aggregate laterally into the sidewalls of the holes, resulting in improved bearing and settlement characteristics of the soils to support footings and floor slabs. Stone columns and rammed aggregate

piers are designed by specialty design firms and are installed by the design firm as part of a design-build process or by a specialty contractor. The specialty design firms will have to determine the correct system based on the encountered soil conditions and encountered groundwater levels.

A common approach is to install the stone columns or rammed aggregate piers below the foundation loads and to place the slab-on-grade over the existing fill. With this procedure, there is some risk of slab settlement due to the existing fill that would remain in place. In our opinion, this risk is low for lightly loaded slabs, provided the subgrade is brought to a firm and stable condition, as judged by a proof-roll, and provided a significant amount of fill is not placed (which can cause the organic soils to consolidate and slabs to settle). The owner must assume the risk of possible settlement and slab cracking when constructing over the existing fill materials. The slab would be designed to "float" independent of the foundations. Alternatively, install the stone columns below slabs to eliminate slab settlement risks associated with the existing fill and allow conventional slab-on-grade design.

Subgrade Stabilization

Once the topsoil is removed the exposed subgrades will consist of existing fill and natural soils where fill is removed. Elevated moisture conditions will cause subgrade instability, especially below repeated construction traffic. At the time our borings were performed, the upper fill soils were generally very dry and below optimum moisture condition. However, if construction begins in the late fall, winter, or spring, these conditions may change and stabilization may be needed to create stable subgrades and create fills near

optimum moisture to meet compaction requirements. We make the following comments on stabilization, if it is needed.

Conventional mechanical aeration methods to dry wet soils are typically not feasible through fall, winter, and through early spring seasons. Drying of clay soils by means of air-drying (even under favorable conditions) is a time-consuming, weather dependent endeavor. Subgrade instabilities will be exacerbated below repetitive rubber-tired traffic during construction unless the subgrades are stabilized or construction traffic is controlled to designated travel paths. Chemical stabilization of the building pad areas would improve subgrade performance through building construction during unfavorable weather conditions.

Chemical stabilization of the building pad soil subgrades can be utilized to improve slab subgrade modulus values in slab design and to improve subgrade stability during adverse weather or lengthy construction schedules. To realize the benefits of chemical stabilization (as discussed later in the report), we recommend an application rate of cement, lime, or LKD at 4-7% by dry unit weight of the soils being stabilized. Cement is more costly, but usually requires less percentage by weight and does not rely on a favorable chemical reaction with the soil. The application/mixing depth normally varies between 12 and 16 inches. It is our experience that a mixing depth of 12 inches is normally sufficient in building areas.

Regardless of the encountered soil moisture conditions, the earthwork contractor should proof-roll the exposed soil subgrades using a fully-loaded, tandem-axle dump truck (or equivalent) to determine the extent of the soft, yielding subgrade areas. Soft spots

identified during the proof-roll should be undercut to firm, stable conditions or otherwise chemically stabilized prior to placing additional fill or slab construction.

Structural Fill Placement

Structural fill can be placed to design grade once the subgrades are brought to firm and stable conditions. Non-organic site soils are suitable for reuse in new, controlled fills provided proper moisture control is maintained. Depending on the time of year the earthwork is performed, the fill may require drying or moisture conditioning to achieve compaction. Fill materials within building pads should be placed in a controlled manner as described in the *Site Preparation and Earthwork* section of this report.

FOUNDATIONS

In our opinion, the proposed structures can be constructed on conventional spread and mat foundations and continuous wall footings. Provided the site is prepared as described herein, all foundations should bear on stable, natural soils, on new controlled fill placed directly over stable natural soils, or soils modified by aggregate piers, depending on which option is chosen (see the *Geotechnical Evaluation* section above). In the table below, we provide a range of estimated settlements for foundations bearing directly on firm and stable natural soils, or new structural fill placed directly over stable natural soils, based on the design loading.

	Bearing Capacity (psf)	Individual Aerator Mat (50'x50')	(3) Aerator Mats Loaded simultaneously	Building Strip and Spread Footings
Estimated Settlements at Capacity (inch)	1,500	1.2	2	<1
	2,000	1.6	2.6	<1
	3,000	2.4	3.9	<1

To reduce settlements, Option 3 discussed in the *Geotechnical Evaluation* section would be needed, which involves installing aggregate piers. GCI feels a bearing capacity of between 4,000 to 6,000 psf with settlements limited to an inch is feasible with the use of aggregate piers (to be confirmed by the design build contractor).

Regardless of calculated sizes, we recommend minimum sizes of 16 inches wide for wall footings and 30 inches square for column pads to prevent a "punch" effect. All exterior footings should extend to local frost bearing depth (36 inches) or to stable bearing (as stated above), whichever is deeper. Interior footings in heated areas may be placed as shallow as feasible, if bearing on acceptable soils. Interior footings should be lowered to frost bearing depth to prevent frost from penetrating bearing soils if winter construction is planned.

Typical to local practice, if soft or unstable, natural soils are encountered at footing subgrade, undercut to stable soils. We recommend that a geotechnical engineer or their representative be present during foundation excavations. Soft, unstable bearing soils should be reviewed by the geotechnical engineer prior to undercuts. Undercut areas can be backfilled to design bottom-of-footing elevation using controlled density fill (CDF) to allow footing construction at design grade. Alternatively, the foundations can be constructed on firm, stable natural soils at the bottom-of-footing undercut.

FLOOR SLABS

Slab-on-grade construction is feasible for the proposed structures, provided the subgrades are prepared as discussed in the above *Geotechnical Evaluation* section of this report. GCI recommends placing a minimum of 4 inches of granular fill under the floor slabs to serve as a capillary cut-of and to provide a uniform, firm subbase. The

granular thickness should be increased to 6 inches for heavily loaded slabs. Place a vapor retarder below the slab in areas where moisture could cause problems with floor finishes.

RETAINING WALLS

Retaining walls allowed to move freely at the top of the wall should be designed using active lateral earth pressure. Walls restrained at both top and bottom should be designed to resist an at-rest lateral soil pressure. The design loading depends on the type of backfill material used and boundary support conditions. The following table provides recommended equivalent fluid pressures for two types of soils and loading conditions above the water table.

Soil Type	Moist Unit Weight (pcf)	Active Coefficient Ka	At-Rest Coefficient Ko	Equivalent Active Fluid Pressure (pcf)	Equivalent At-Rest Fluid Pressure (pcf)
Lean Clay (non-organic)	125 – 130	0.42	0.54	55	70
Sand and Gravel (compacted)	135 – 140	0.26	0.41	35	55

We do not recommend using cohesive soils as wall backfill due to their poor drainage characteristics and potential for lateral wall loads resulting from surface frost. We recommend that granular material (less than 15% passing the No. 200 sieve) be used for all wall backfill. The stone should be placed at a 35° angle defined by a line from the vertical to allow use of the lower values above. We recommend that footing drains and underslab drains leading to a permanent sump pump or otherwise drained to daylight be installed to minimize the build-up of hydrostatic forces behind the below-grade walls. GCI also suggests damp-proofing of below-grade walls.

A coefficient of friction of 0.35 can be used to evaluate the friction (sliding) resistance along the base of the footing. The use of passive-case lateral earth pressures to resist wall sliding is not recommended, because, in our opinion, soils within the passive zone are subject to freezing and subsequent strength loss during the thaw cycle. If passive resistance is used in design, we suggest using a value of 200 pcf, which helps account for potential loss; this value also incorporates a safety factor of 1.5, but presumes an earth-formed footing.

SEISMIC FACTOR

Based on the boring findings, review of geological information, and in accordance with the Ohio Building Code – Site Class Definitions, the site is estimated as a Site Class D – stiff soil profile.

Liquefaction

The borings revealed that the site generally consists of 2 to 10 feet of cohesive soils underlain by loose to dense sand and gravel with the water table at a depth of about 6 to 10 feet below grade. The clay-based soils are not susceptible to liquefaction during a seismic event. In our opinion, the loose sands are potentially susceptible to liquefaction during a seismic event.

Based on information obtained from the Ohio Earthquake Epicenters map by ODNR, the closest recorded earthquake occurred in 2023 approximately 10.5 miles away from the project site. The earthquake had a 2.2 magnitude. This is classified as a minor earthquake.

In addition to the ODNR map, we obtained information from the 2018 National Seismic Hazard Model from the USGS. The model displays the chance of damaging earthquake shaking in 100 years, equivalent to a Modified Mercalli Intensity VI. Based on the model, the chance for damaging earthquake shaking at the project site in 100 years is roughly 4% - 19%.

Based on this information, we are of the opinion that the risk of damage to the structures from seismically induced liquefaction is low to moderate. It would be very difficult to accurately estimate the potential settlement due to liquefaction.

EXCAVATIONS

We did not encounter bedrock within the depths of our borings, and we do not anticipate rock will be encountered within typical shallow excavations for the project. We expect that the natural site soils can be excavated with conventional track hoe equipment. Excavations that extend into granular layers will be unstable. Use of trench boxes, or flatter than normal laybacks, will be needed. **Excavations should comply with current OSHA regulations**.

GROUNDWATER

The borings encountered groundwater seepage at depths of 6 and 10 feet below grade, typically between elevations 997 to 998. We do not anticipate that groundwater seepage will significantly impact shallow foundation, shallow utility, or earthwork operations that are at least 2 feet above this elevation (estimated elevations of 999 to 1000). If water is encountered in shallow site excavations, the excavations should be dewatered to allow construction, including backfilling, in dry conditions.

Excavations extending to depths below elevation 999 to 1000 will likely encounter more significant/constant groundwater flows that will require an extensive dewatering system, especially if the excavations extend into the sands and gravels (if a remove and replace is performed, or if aggregate piers are installed, special precautions should be considered with respect to groundwater as discussed earlier in this report). In this case, substantial dewatering measures such as deep wells, deep sumps, and/or well points would be required; a dewatering specialist should be engaged to design such a dewatering system along with installation of groundwater monitoring wells to assess extended groundwater level conditions. We recommend the dewatering effort be sufficient to depress the water level a minimum of 3 feet below the lowest anticipated excavation to avoid disturbing the bearing soils.

Considerations for the dewatering system include:

1. Early installation of the wells to pre-drain the site prior to excavation activities.
2. Possible water supply to jet the wells points into the ground
3. The impact of dewatering on the surrounding development
4. Determining disposal of pumped water, environmental testing and city approval
5. Proper locations of the wells to avoid interference with footings, trenches, pits, etc.
6. A backup generator with a transfer switch and auto callout to maintain dewatering in the event of a power outage
7. Maintain upper level well points throughout construction to avoid internal erosion of fines from the sand and gravel and subsequent loss of ground due to erosion. Loss of ground could affect support of foundations and slabs constructed

SITE PREPARATION AND EARTHWORK

GCI provides below general guidelines for site preparation and earthwork operations.

1. Dewater and lower the groundwater level, if needed. Continue groundwater control throughout construction.

2. Remove topsoil and vegetation from below the area of the structures plus a distance of 5 feet laterally beyond these limits. Topsoil can be disposed of in green spaces, used to backfill borrow pits, or otherwise hauled offsite.

3. Remove existing fill and stained/organic underlying soils (if remove and replace option is used). If granular soils form the bottom of the excavation, a layer of 57 limestone can be placed and compacted prior to placing structural fill.

4. Carefully and thoroughly proof-roll the exposed soil subgrades with a fully-loaded, tandem-axle dump truck (or equivalent) to identify potential soft subgrade areas (if fill and stained/organic soils are left in place). Undercut soft areas or otherwise stabilize soft spots identified during the proof-roll prior to placing controlled fills or slab construction. GCI should review unstable subgrades prior to remediation to assess appropriate stabilization/undercutting procedures.

5. With stable subgrades, place controlled fills to design grade, as required. Non-organic natural site soils are suitable for reuse in controlled fills provide moisture is controlled. **Off-site borrow materials should be reviewed by GCI prior to use.**

6. Place controlled fills in maximum 8-inch thick loose lifts and compact each lift to a minimum of 98% of the maximum Standard Proctor dry density (ASTM D-698). The moisture in the fill soils should be controlled to within ±3% of the optimum Standard Proctor moisture content. **Depending on the time of year of earthwork, moisture adjustment of the site soils may be required to achieve proper compaction.** The clay-based site soils will compact best with “sheepsfoot” type equipment, while granular site soils will compact best with a vibratory smooth-drum roller.

7. Excavate for foundations after the building pads are complete. Refer to the *Geotechnical Evaluation* and *Foundation* sections of this report for specific earthwork and foundations construction and design parameters.

8. If work is performed during the winter (e.g., when freezing temperatures occur), special protective measures will be required during filling and footing construction procedures. Contact GCI for additional recommendations on cold-weather earthwork operations, if applicable.

CONSTRUCTION MATERIALS ENGINEERING AND TESTING

GCI provides construction materials engineering and testing services. For project continuity throughout construction, it is recommended that GCI be retained to observe, test, and document:

- earthwork procedures (stripping, fill placement, compaction, utility trench backfill, etc.),
- foundation and slab preparation (proof-rolling, excavations, undercuts, etc.),
- concrete placement and compressive strength testing (footings, slabs, pavements, etc.), and
- structural steel (welds, bolts, etc.).

The purpose of this work is to assess that the intent of the recommendations provided in this report is being followed and to make timely changes to the recommendations (as needed) in the event site conditions vary from those encountered in the borings. Please contact GCI's field department to initiate these services.

FINAL

We recommend that GCI be provided the opportunity to review final site layout and grading plans. Recommendations contained in this report may be changed based on review of final site plans. If any changes in the nature, design, or locations of the construction are planned, conclusions and recommendations should not be considered valid unless verified in writing by GCI. The recommendations contained in this report are the opinion of GCI based on the subsurface conditions found in the borings and available development information.

It should be noted that the nature and extent of variations between borings might not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report. This report has been prepared for

design purposes only and should not be considered sufficient to prepare an accurate bid document.

If you have any questions or need for any additional information, please contact our office. GCI appreciates the opportunity to work with you on this project and hopes to continue our services through construction.

GEOTECHNICAL CONSULTANTS INC.

APPENDIX – Greenville WWTP Improvements

General Notes for Soil Sampling and Classifications
Site Location Map and Boring Location Plan
Summary of Encountered Subsurface Conditions
Test Boring Logs (B-1 and B-9)
Laboratory Testing Results

GEOTECHNICAL CONSULTANTS INC.

MAIN OFFICE
720 Greencrest Drive
Westerville, OH 43081
614.895.1400 **phone**
614.895.1171 **fax**

YOUNGSTOWN OFFICE
8433 South Avenue
Building 1, Suite 1
Boardman, OH 44514
330.965.1400 **phone**
330.965.1410 **fax**

DAYTON OFFICE
2380 Bellbrook Avenue
Xenia, OH 45385
937.736.2053 **phone**

www.gci2000.com

GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

BORINGS, SAMPLING AND GROUNDWATER OBSERVATIONS:

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standard methods of exploration of subsurface conditions. The borings were drilled using a truck-mounted drill rig using auger boring methods with standard penetration testing performed in each boring at intervals ranging from 1.5 to 5.0 feet. The stratification lines on the logs represent the approximate boundary between soil types at that specific location and the transition may be gradual.

Water levels were measured at drill locations under conditions stated on the logs. This data has been reviewed and interpretations made in the text of the report. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time the measurements were made.

The Standard Penetration Test (ASTM-D-1586) is performed by driving a 2.0 inch O.D. split barrel sampler a distance of 18 inches utilizing a 140 pound hammer free falling 30 inches. The number of blows required to drive the sampler each 6 inches of penetration are recorded. The summation of the blows required to drive the sampler for the final 12 inches of penetration is termed the Standard Penetration Resistance (N). Soil density/consistency in terms of the N-value is as follows:

COHESIONLESS DENSITY		COHESIVE CONSISTENCY	
0-10	Loose	0-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	Very Stiff
		30 +	Hard

SOIL MOISTURE TERMS

Soil Samples obtained during the drilling process are visually characterized for moisture content as follows:

MOISTURE CONTENT	DESCRIPTION
Damp	Soil moisture is much drier than the Atterberg plastic limit (where soils are cohesive) and generally more than 3% below Standard Proctor “optimum” moisture conditions. Soils of this moisture generally require added moisture to achieve proper compaction.
Moist	Soil moisture is near the Atterberg plastic limit (cohesive soils) and generally within ±3% of the Standard Proctor “optimum” moisture content. Little to no moisture conditioning is anticipated to be required to achieve proper compaction and stable subgrades.
Very Moist	Soil moisture conditions are above the Atterberg plastic limit (cohesive soils) and generally greater than 3% above Standard Proctor “optimum” moisture conditions. Drying of the soils to near “optimum” conditions is anticipated to achieve proper compaction and stable subgrades.
Wet	Soils are saturated. Significant drying of soils is anticipated to achieve proper compaction and stable subgrades.

SOIL CLASSIFICATION PROCEDURE:

Soil samples obtained during the drilling process are preserved in plastic bags and visually classified in the laboratory. Select soil samples may be subjected to laboratory testing to determine natural moisture content, gradation, Atterberg limits and unit weight. Soil classifications on logs may be adjusted based on results of laboratory testing.

Soils are classified in accordance with the ASTM version of the Unified Soil Classification System. ASTM D-2487 “Classification of Soils for Engineering Purposes (Unified Soil Classification System) describes a system for classifying soils based on laboratory testing. ASTM D-2488 “Description and Identification of Soil (Visual-Manual Procedure) describes a system for classifying soils based on visual examination and manual tests.

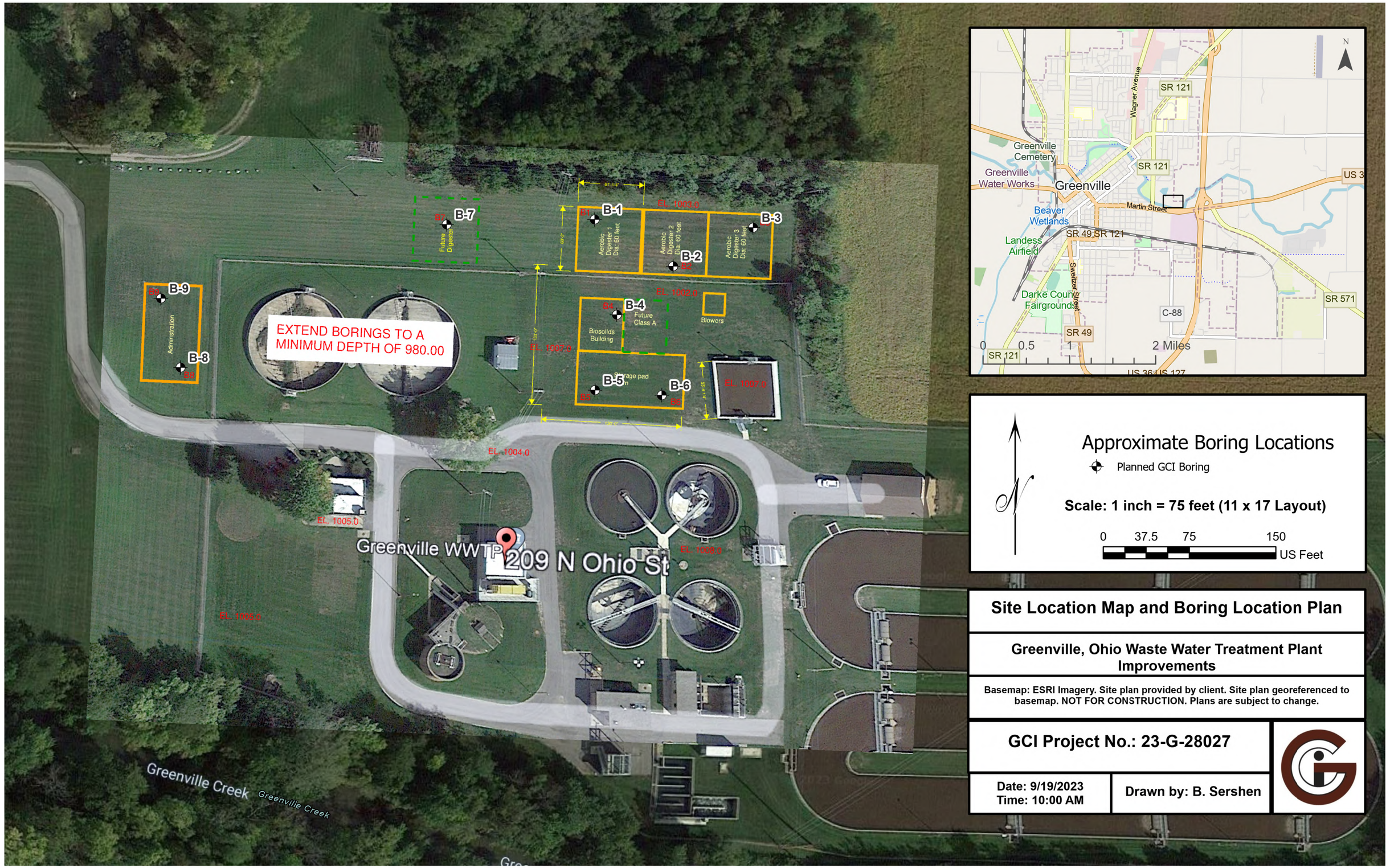
Soil classifications are based on the following tables (see reverse side):

GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

PARTICLE SIZE DEFINITION		
Boulders:		>12"
Cobbles:		3" to 12"
Gravel:	Coarse:	3/4" to 3"
	Fine:	No. 4 (3/16") to 3/4"
Sand:	Coarse	No. 10 (2.0mm) to No. 4 (4.75mm)
	Medium	No. 40 (0.425mm) to No. 10 (2.0mm)
	Fine	No. 200 (0.074mm) to No. 40 (0.425mm)
Silt & Clay		<0.074mm; classification based on overall plasticity; in general clay particles <0.005mm.

CONSTITUENT MODIFIERS	
Trace	Less than 5%
Few	5-10%
Little	15-25%
Some	30-45%
Mostly	50-100%

ASTM/UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
COARSE-GRAINED SOILS (more than 50% of materials is larger than No. 200 sieve size)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	*Clean Gravel (less than 5% fines)*	
	GW	Well-graded gravel, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel sand mixtures, little or no fines
	Gravels with fines (more than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS More than 50% of coarse fraction smaller than No. 4 sieve size	*Clean Sands (Less than 5% fines)*	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly-graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent ……GW, GP, SW, SP Greater than 12 percent ……GM, GC, SM, SC 5 to 12 percent ……Borderline cases requiring dual symbols: SP-SM, GP-GM, etc.		
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)		
SILTS AND CLAYS Liquid Limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	CL-ML	Inorganic silty clay of slight plasticity, P.I. between 4 and 7
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid Limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays or medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils



Approximate Boring Locations

Planned GCI Boring

Scale: 1 inch = 75 feet (11 x 17 Layout)

0 37.5 75 150 US Feet

Site Location Map and Boring Location Plan

Greenville, Ohio Waste Water Treatment Plant Improvements

Basemap: ESRI Imagery. Site plan provided by client. Site plan georeferenced to basemap. NOT FOR CONSTRUCTION. Plans are subject to change.

GCI Project No.: 23-G-28027

Date: 9/19/2023
Time: 10:00 AM

Drawn by: B. Sershen

Summary of Encountered Subsurface Conditions

Greenville WWTP Improvements
209 North Ohio Street - Greenville, Ohio
GCI Job Number: 23-G-28027

Borehole	Surface Elevation (feet) *	Surface Layer	Topsoil Thickness (ft.)	Bottom of Fill Cover (feet)	Groundwater: Level Encountered (ft)		Groundwater: Level at Completion (ft)		Groundwater: Extended Time Reading			Depth to Top of Lean Clay (ft)	Depth to Top of Sand/Gravel (ft)	Bottom of Boring Depth (ft)
					Depth	Elevation*	Depth	Elevation*	Depth (ft)	Elev. (ft)*	Time			
B-1	1005.0	Topsoil	0.3	5.0	7	998.0	7.5	997.5	--	--	--	5.0	7.0	25.0
B-2	1004.0	Topsoil	0.3	8.0	7	997.0	7	997.0	--	--	--	8.0	10.0	25.0
B-3	1005.5	Topsoil	0.3	4.0	8	997.5	5	1000.5	8	997.5	7	5.0	8.0	25.0
B-4	1004.0	Topsoil	0.3	4.0	7	997.0	6	998.0	--	--	--	--	6.5	30.0
B-5	1004.5	Topsoil	0.3	4.0	10	994.5	7.5	997.0	--	--	--	--	8.0	25.0
B-6	1005.0	Topsoil	0.3	4.5	8	997.0	6	999.0	--	--	--	5.0	8.0	25.0
B-7	1005.5	Topsoil	0.3	2.0	8	997.5	7	998.5	--	--	--	--	2.0	25.0
B-8	1003.0	Topsoil	0.3	3.0	6	997.0	5.5	997.5	5.6	997.4	7	--	4.0	25.0
B-9	1005.0	Topsoil	0.3	6.0	8	997.0	6	999.0	--	--	--	--	6.0	25.0

Average Topsoil Depth at boring locations: 0.3 feet

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-1**

PROJ. SURF. ELEV. **1005.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

7.5 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	4.5	0.0-1.5	SS	4	3	3	Dry	0.3	3" topsoil
									FILL - Black/Dark Brown Sandy Lean Clay (CL)
	4	2.0-3.5	SS	3	3	2	Dry		
	2	4.0-5.5	SS	1	2	3	Moist	5.0	
5									Brown Sandy Lean Clay (CL) - low to moderate plasticity, little/some sand, trace gravel - appears natural
								7.0	Water Seepage at 7 feet
									Gray to Brown Poorly Graded Sand with Silt (SP-SM) - f/c sand, few gravel, few silt
		8.5-10.0	SS	3	3	4	Wet		
10									
		13.5-15.0	SS	6	6	6	Wet		More gravel in sample at 13.5 feet
15									
		18.5-20.0	SS	9	11	14	Wet		
20									
		23.5-25.0	SS	14	14	17	Wet		
25								25.0	BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-2**

PROJ. SURF. ELEV. **1004.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

7.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0 - 10	Loose	0 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	4.5	0.0-1.5	SS	5	11	7	Dry	0.3	3" topsoil
									FILL - Black/Dark Brown Sandy Lean Clay to Sandy Lean Clay with Gravel (CL) - with rock fragments
	4.5	2.0-3.5	SS	5	5	4	Dry		piece of plastic
									Brown Clayey Sand with Gravel (SC)
	4.5	4.0-5.5	SS	6	8	12	Dry		
5									asphalt
								8.0	
		8.5-10.0	SS	4	12	10	Very Moist		Dark Brown Sandy Lean Clay (CL) - low to moderate plasticity, little/some sand, trace gravel - appears natural
								10.0	Water Seepage at 8 feet
10									Gray to Brown Poorly Graded Gravel with Silt and Sand (GP-GM) - mostly gravel, some sand, few silt
		13.5-15.0	SS	8	6	5	Wet		
15									
		18.5-20.0	SS	7	6	7	Wet		layer of Gray Silty Sand (SM) - f/c sand, few silt, trace to few gravel
20									
		23.5-25.0	SS	12	13	14	Wet		
25								25.0	
									BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-3**

PROJ. SURF. ELEV. **1005.5 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

5.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

8 FEET BELOW SURFACE AT **7** DAYS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	4.5	0.0-1.5	SS	8	10	11	Dry	0.3	3" topsoil
									FILL - Black/Dark Brown Sandy Lean Clay and Sandy Lean Clay with Gravel (CL)
	4	2.0-3.5	SS	5	6	5	Moist		
								4.0	
	1-2	4.0-5.5	SS	3	2	3	Moist	5.0	Dark Gray Stained Lean Clay (CL) - moderate plasticity, trace sand - original ground?
5									Dark Brown Stained Lean Clay (CL) - moderate plasticity, trace sand
								8.0	Water Seepage at 8 feet
		8.5-10.0	SS	5	6	6	Very Moist		Gray to Brown Poorly Graded Sand with Silt and Gravel (SP-SM) - f/c sand, little gravel, few silt
10									
		13.5-15.0	SS	5	6	7	Wet		layer of Gray Poorly Graded Gravel with Silt and Sand (GP-GM) - mostly gravel, some sand, few silt
15									
		18.5-20.0	SS	7	5	5	Wet		
20									
		23.5-25.0	SS	5	5	5	Wet		Gray to Brown Poorly Graded Sand with Silt (SP-SM) - f/c sand, few silt
25								25.0	
									BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-4**

PROJ. SURF. ELEV. **1004.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

6.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
		0.0-1.5	SS	2	3	4	Dry	0.3	3" topsoil
									FILL - Dark Brown Sandy Silt/Silty Clay (ML/CL-ML) - low plasticity
	4	2.0-3.5	SS	3	3	3	Dry		
								4.0	
	<1	4.0-5.5	SS	4	2	1	Very Moist		Black Stained Organic Soil (OL) - original ground?
5								6.5	Water Seepage at 7 feet
		8.5-10.0	SS	7	5	4	Wet		Gray to Brown Poorly Graded Gravel with Silt and Sand (GP-GM) - mostly gravel, some sand, few silt
10									Gray to Brown Poorly Graded Sand with Silt and Gravel (SP-SM) - f/c sand, little gravel, few silt
		13.5-15.0	SS	5	3	3	Wet		
15									
		18.5-20.0	SS	8	8	10	Wet		
20									
		23.5-25.0	SS	9	11	11	Wet		Gray to Brown Poorly Graded Sand with Silt (SP-SM) - f/c sand, few silt
25									
		28.5-30.0	SS	5	6	6	Wet		
								30.0	BOTTOM OF BORING: 30 feet
30									

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-5**

PROJ. SURF. ELEV. **1004.5 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

7.5 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	--	0.0-1.5	SS	5	5	6	Moist	0.3	3" topsoil
									Dark Brown Clayey Sand with Gravel (SC) - low plasticity
	---	2.0-3.5	SS	4	3	3	Moist		
								4.0	
	1	4.0-5.5	SS	2	2	2	Moist		Black to Gray Stained Organic Soil/Lean Clay with Sand (OL/CL) - original ground?
5									
								8.0	
		8.5-10.0	SS	10	12	13	Moist		Gray to Brown Poorly Graded Sand with Silt and Gravel (SP-SM) - f/c sand, little/some gravel, few silt
10									
									Water Seepage at 10 feet
		13.5-15.0	SS	7	7	9	Wet		
15									
		18.5-20.0	SS	20	20	21	Wet		
20									
		23.5-25.0	SS	---	---	---	Wet		
								25.0	
25									BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-6**

PROJ. SURF. ELEV. **1005.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

6.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	4.5	0.0-1.5	SS	6	6	7	Damp	0.3	3" topsoil
									FILL - Dark Brown Clayey Sand with Gravel (SC)
	4	2.0-3.5	SS	10	7	6	Damp		
									FILL - Black Stained Sandy Lean Clay (CL)
	1	4.0-5.5	SS	3	3	3	Moist	4.5	
5								5.0	Black Organic Soil (OL) - original ground?
									Gray to Brown Stained Lean Clay with Sand (CL) - moderate plasticity, few sand, slight organic content
								8.0	Water Seepage at 8 feet
		8.5-10.0	SS	5	5	6	Very Moist		Gray Silty Gravel with Sand (GM) - mostly gravel, f/c sand, little silt
10									
		13.5-15.0	SS	2	2	5	Wet		Gray to Brown Well Graded Sand with Silt and Gravel (SW-SM) - f/c sand, little to some gravel, few silt
15									
		18.5-20.0	SS	8	12	13	Wet		
20									
		23.5-25.0	SS	5	6	7	Wet		
25								25.0	
									BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-7**

PROJ. SURF. ELEV. **1005.5 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

7.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
		0.0-1.5	SS	9	17	14	Moist	0.3	3" topsoil
								2.0	FILL - Brown Broken Gravel, Sand, and Silt
		2.0-3.5	SS	4	3	2	Moist		Brown to Gray Poorly Graded Sand with Silt to Poorly Graded Sand with Silt and Gravel (SP-SM) - f/m to f/c sand, trace to some gravel, few silt
		4.0-5.5	SS	2	1	2	Moist		
5									
									Water Seepage at 8 feet
		8.5-10.0	SS	3	3	3	Very Moist to Wet		
10									
		13.5-15.0	SS	8	8	8	Wet		
15									
		18.5-20.0	SS	7	9	12	Wet		
20									
		23.5-25.0	SS	9	13	13	Wet		
25								25.0	BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-8**

PROJ. SURF. ELEV. **1003.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

5.5 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

5.6 FEET BELOW SURFACE AT **7** DAYS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
		0.0-1.5	SS	18	12	16	Moist	0.3	3" topsoil
									FILL - Black and Dark Brown Lean Clay with Sand to Lean Clay (CL)
	4	2.0-3.5	SS	26	30	29	Moist	3.0	
								4.0	Possible original topsoil - Black/Dark Brown Stained Lean Clay (CL) - moderate plasticity
		4.0-5.5	SS	3	5	5	Very Moist		Brown Silty Sand (SM) - f/m sand, little silt
5								6.0	Water Seepage at 6 feet
									Brown to Gray Poorly Graded Gravel with Silt and Sand to Poorly Graded Sand with Silt and Gravel (SP-SM) - mixtures of sand and gravel, with few silt
		8.5-10.0	SS	10	10	17	Very Moist		
10									
		13.5-15.0	SS	14	12	13	Very Moist to Wet		
15									
		18.5-20.0	SS	9	11	14	Wet		
20									
		23.5-25.0	SS	5	9	10	Wet		
25								25.0	BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio** BORING NO. **B-9**

PROJ. SURF. ELEV. **1005.0 ±**

CLIENT **Jones & Henry Engineers** NO. **23-G-28027** DATE DRILLED **9/26/2023**

GROUND WATER OBSERVATION

6.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	4	0.0-1.5	SS	5	4	4	Dry	0.3	3" topsoil
									FILL - Dark Brown Clayey Sand with Gravel (SC)
	4	2.0-3.5	SS	4	4	4	Dry		FILL - Dark Brown Lean Clay with Sand (CL)
								4.0	
	--	4.0-5.5	SS	3	6	7	Moist		Possible FILL - Dark Brown, Silty Clayey Sand with Gravel (SM) - f/c sand, some silty clay, little gravel
5								6.0	
									Brown to Gray Silty Gravel with Sand (GM) to Poorly Graded Sand with Silt and Gravel (SP-SM) - mixtures of sand and gravel, with few silt
		8.5-10.0	SS	5	5	3	Wet		Water Seepage at 8 feet
10									
		13.5-15.0	SS	5	6	6	Wet		Layer of Gray Poorly Graded Sand with Silt (SP-SM) - f/c sand, few silt
15									
		18.5-20.0	SS	7	9	7	Wet		
20									
									Gray Well-Graded Sand with Silt and Gravel (SW-SM) - f/c sand, little to some gravel, few silt
		23.5-25.0	SS	16	19	17	Wet		
25								25.0	
									BOTTOM OF BORING: 25 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

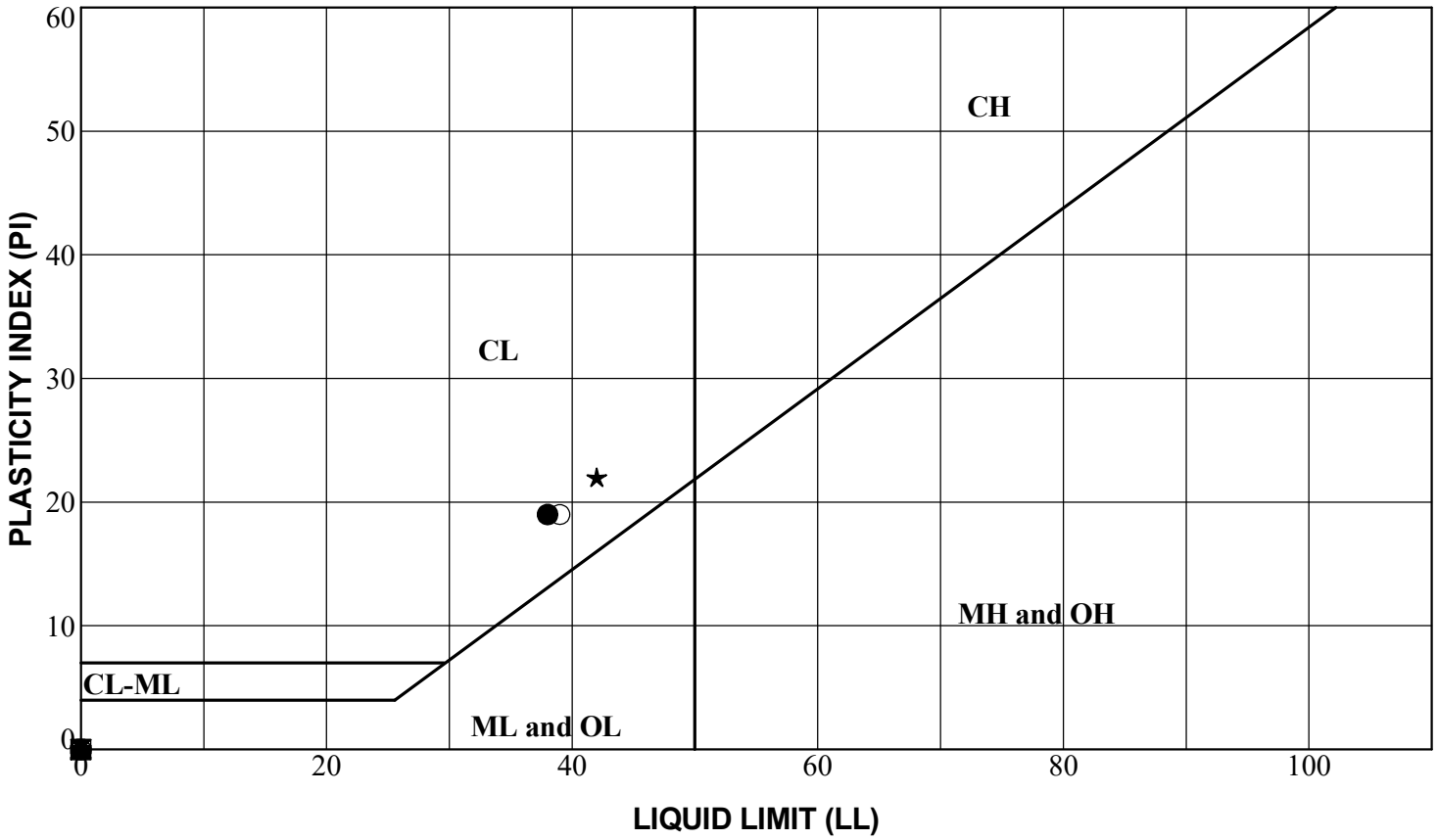
720 Greencrest Drive • Westerville, Ohio 43081 • 614-895-1400

Summary of Laboratory Results

Greenville WWTP Improvements
209 North Ohio Street - Greenville, Ohio
GCI Job Number: 23-G-28027

Test Hole	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Fines (< #200 Sieve)	% Clay (< 0.005 mm)	Organic Content (%)	ASTM Class-ification	ASTM Description
B-2	2.0	13.5	38	19	19	49.2	23	-	SC	Clayey Sand With Gravel
B-2	13.5	9.3	NP	NP	NP	11.0		-	GP-GM	Poorly Graded Gravel With Silt And Sand
B-2	18.5	13.5	NP	NP	NP	13.0		-	SM	Silty Sand
B-4	4.0	44.8						7.4		
B-6	2.0	12.5	42	20	22	52.7	27	-	CL	Sandy Lean Clay
B-6	4.0	26.7						2.1		
B-6	8.5	9.3	NP	NP	NP	14.0		-	GM	Silty Gravel With Sand
B-6	18.5	10.1	NP	NP	NP	8.9		-	SW-SM	Well-Graded Sand With Silt And Gravel
B-9	0.0	11.5	39	20	19	43.2	21	-	SC	Clayey Sand With Gravel
B-9	8.5	8.3	NP	NP	NP	14.0		-	GM	Silty Gravel With Sand
B-9	23.5	10.9	NP	NP	NP	8.9		-	SW-SM	Well-Graded Sand With Silt And Gravel

October 2023



LEGEND:

	TEST HOLE	DEPTH	w_n	LL	PL	PI	ASTM CLASSIFICATION
●	B-2	2.0	13.5	38	19	19	SC
⊠	B-2	13.5	9.3	NP	NP	NP	GP-GM
▲	B-2	18.5	13.5	NP	NP	NP	SM
★	B-6	2.0	12.5	42	20	22	CL
⊙	B-6	8.5	9.3	NP	NP	NP	GM
✿	B-6	18.5	10.1	NP	NP	NP	SW-SM
○	B-9	0.0	11.5	39	20	19	SC
△	B-9	8.5	8.3	NP	NP	NP	GM
⊗	B-9	23.5	10.9	NP	NP	NP	SW-SM

Job No: *23-G-28027*

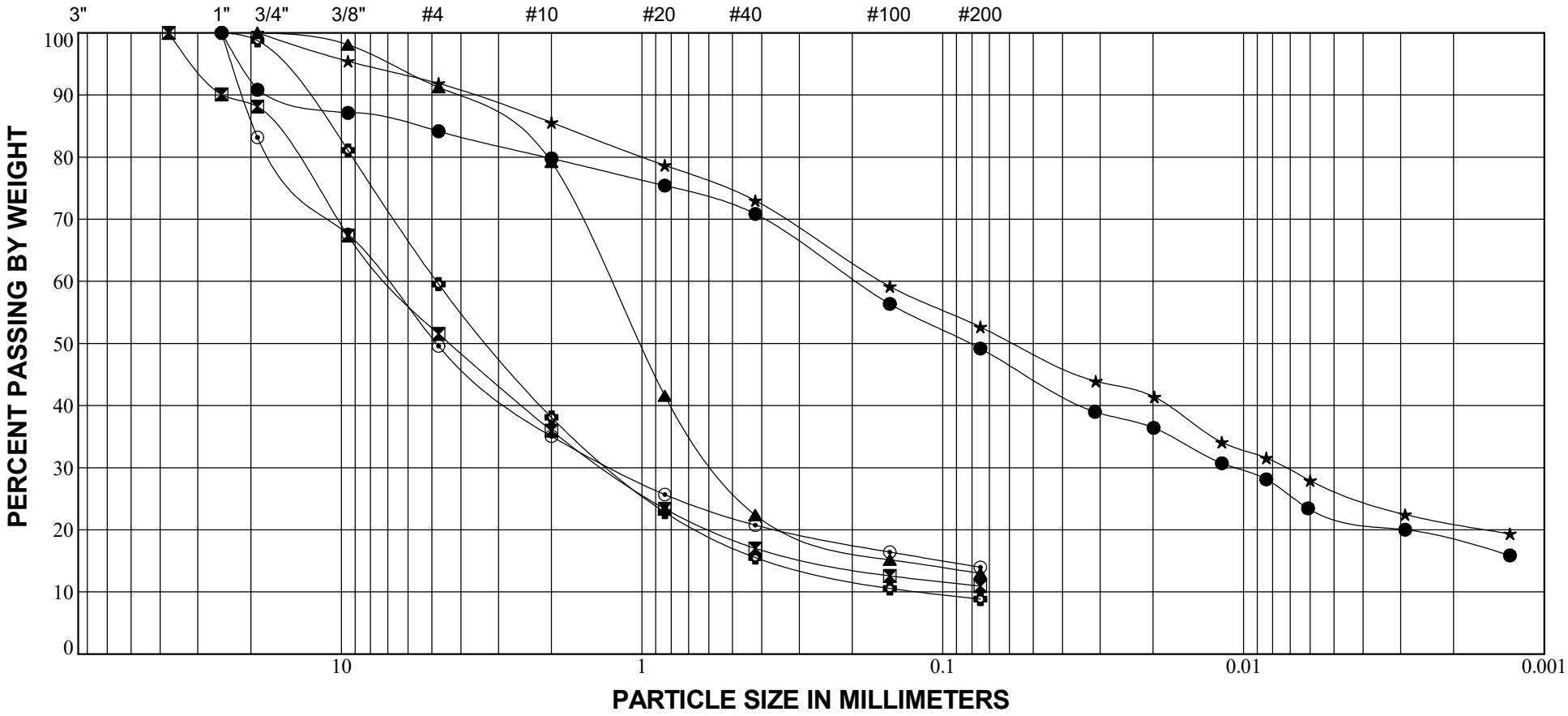
Method: *ASTM D4318*

Date: *October 2023*

ATTERBERG LIMITS TEST RESULTS

Greenville WWTP Improvements
209 North Ohio Street - Greenville, Ohio

Geotechnical Consultants, Inc. - Westerville, Ohio 43081



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

LEGEND:

	TEST HOLE	DEPTH	LL	w_n	PL	ASTM CLASSIFI-CATION	ASTM SOIL DESCRIPTION
●	B-2	2.0	38	13.5	19	SC	Clayey Sand With Gravel
⊠	B-2	13.5	NP	9.3	NP	GP-GM	Poorly Graded Gravel With Silt And Sand
▲	B-2	18.5	NP	13.5	NP	SM	Silty Sand
★	B-6	2.0	42	12.5	20	CL	Sandy Lean Clay
⊙	B-6	8.5	NP	9.3	NP	GM	Silty Gravel With Sand
✿	B-6	18.5	NP	10.1	NP	SW-SM	Well-Graded Sand With Silt And Gravel

Job No.: *23-G-28027*

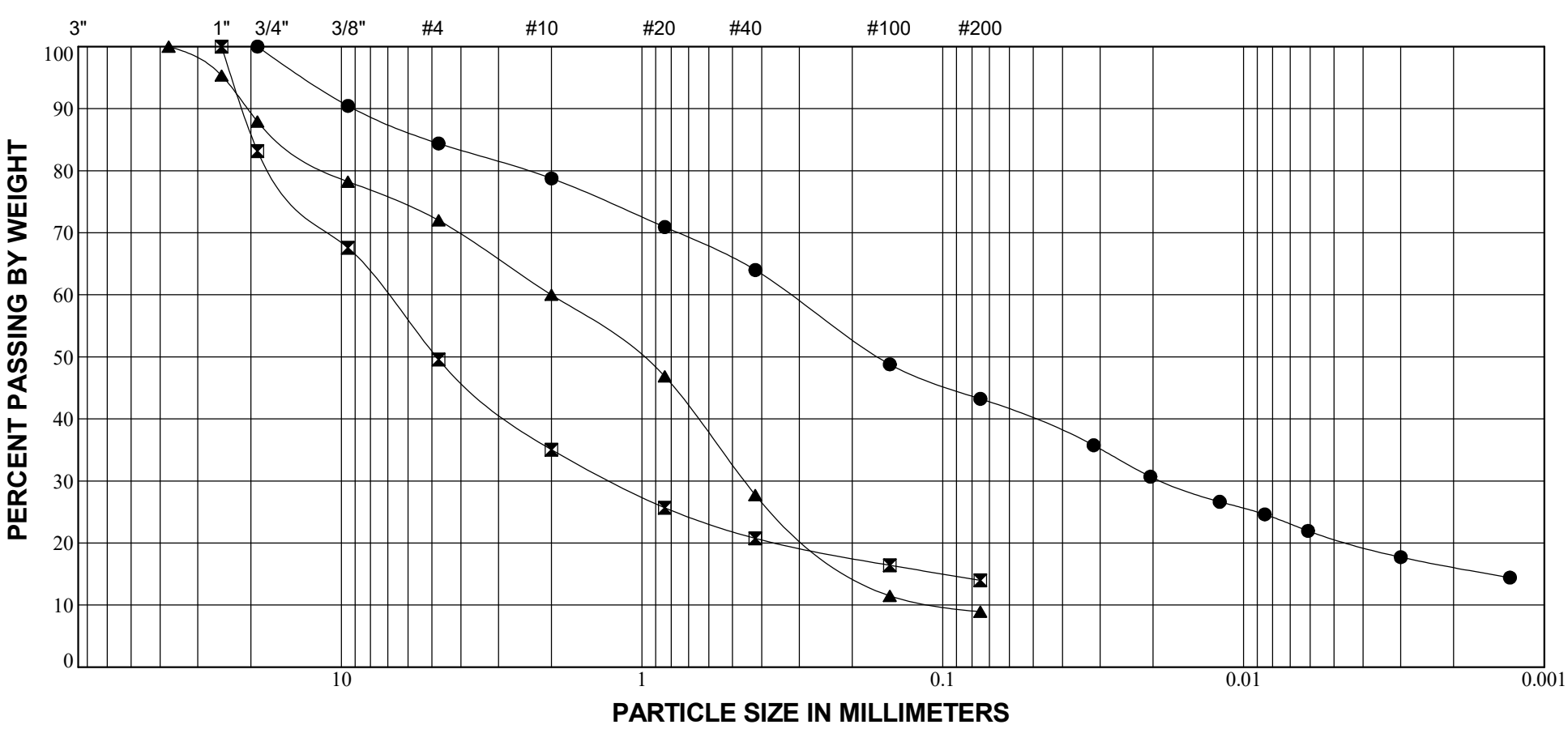
Method: *ASTM D421 D422*

Date: *October 2023*

COMBINED PARTICLE SIZE DISTRIBUTION

Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio

Geotechnical Consultants, Inc. - Westerville, Ohio 43081



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

LEGEND:

	TEST HOLE	DEPTH	LL	w_n	PL	ASTM CLASSIFICATION	ASTM SOIL DESCRIPTION
●	B-9	0.0	39	11.5	20	SC	Clayey Sand With Gravel
⊠	B-9	8.5	NP	8.3	NP	GM	Silty Gravel With Sand
▲	B-9	23.5	NP	10.9	NP	SW-SM	Well-Graded Sand With Silt And Gravel

Job No.: *23-G-28027*

Method: *ASTM D421 D422*

Date: *October 2023*

COMBINED PARTICLE SIZE DISTRIBUTION

Greenville WWTP Improvements - 209 North Ohio Street - Greenville, Ohio

Geotechnical Consultants, Inc. - Westerville, Ohio 43081

Summary of Laboratory Results

Greenville WWTP Improvements
209 North Ohio Street - Greenville, Ohio
GCI Job Number: 23-G-28027

Test Hole	Depth	Moisture	pH	Resist-ivity (ohm-cm)	Redox Potential (mV)	Sulfide
Existing Fill	Varies	Fair	7.8	3,500	414.0	Positive
Nat. Clay	Varies	Fair	8.1	2,900	232.0	Positive
Nat. Sand	Varies	Poor	8.0	3,100	226.0	Positive

November 2023

CITY OF GREENVILLE, OHIO
WWTP SOLIDS HANDLING FACILITY AND ADMINISTRATION BUILDING

ADVERTISEMENT FOR BIDS

Sealed Bids for **WWTP Solids Handling Facility And Administration Building Project**, will be received by the **City of Greenville, at the City of Greenville Council Chambers, ~~Planning and Zoning Department,~~ 100 Public Square, Greenville, Ohio 45331**, until **2 PM EST, local time, on January 22, 2025**, at which time they will be publicly opened and read. ***(Addendum 1, Issued December 16, 2024)***

In general, the work consists of below:

1. The proposed solids handling improvements include:
    a. Three aerobic digesters. Some of the major process equipment includes submersible pumps one/tank), and coarse bubble diffuser systems (one/tank).
    b. Solids Handling Building with process, electrical and HVAC equipment. Some of the major process equipment include blowers, sludge storage day tank, two progressive cavity pumps, solids dewatering press, booster pumps and polymer system.
    c. Biosolids Storage Building with a shaftless screw conveyor system.
    d. The existing sludge holding tank, sludge pumping system, and digester will be demolished. The sludge storage lagoon and supernatant lagoon will be abandoned. The sludge force main from the WWTP to the lagoons will be abandoned in place.
    e. A new administration building will be built that will include a laboratory, office rooms, conference room, restrooms, locker rooms, and a garage. The old administration building will be left as is.

The issuing office is Jones & Henry Engineers, Ltd., **4357 Ferguson Drive, Suite 220, Cincinnati, Ohio 45245**. Copies of the Bidding Documents may be examined at the Owner's office listed above or the issuing office, without charge.

Technical questions regarding the project should be e-mailed to the **Project Manager Dinesh Kumar Palaniswamy; dpalaniswamy@jheng.com** at Jones & Henry Engineers, Ltd.

Copies of Bidding Documents and Contract Documents may be obtained electronically from www.jhplanroom.com. There is no charge to download from the digital print-room, however, registration is required. If hard copies of the bidding documents are needed, they can be ordered from the print-room for a fee. If you have any problems using the digital print-room, you are encouraged to contact either the Engineer's Project Manager, or Eastern Engineering at 419-661-9841.

Neither Owner nor Engineer has any responsibility for the accuracy, completeness or sufficiency of any bid documents obtained from any source other than the source indicated in these documents. Obtaining these documents from any other source(s) may result in obtaining incomplete and inaccurate information. Obtaining these documents from any source other than directly from the source listed herein may also result in failure to receive any addenda, corrections, or other revisions to these documents that may be issued.

Bids must be submitted on the forms bound herein, must contain the names of every person or company interested therein, and shall be accompanied by either a Bid Guaranty and Contract Bond in the amount of 100% of the amount bid with satisfactory corporate surety, or by a certified check on a solvent bank in the amount of not less than 10% of the amount of the Bid, subject to conditions provided in the Instructions to Bidders. The successful bidder will be required to furnish satisfactory Performance Bond and Maintenance and Guarantee Bond in the amount of 100% of the Bid.

The Contractor shall be required to pay not less than the prevailing wage rates established by the Ohio Bureau of Employment Services, Wage and Hour Division.

Any Bid may be withdrawn prior to the scheduled closing time for receipt of Bids, but no bidder shall withdraw his Bid within 90 days after the actual opening thereof.

Special Attention must be given to all requirements of Ohio Public Works Commission funding including:

1. Ohio Preference. The Recipient shall, to the extent practicable, use and shall cause all of its Contractors and subcontractors to use Ohio products, materials, services and labor in connection with the Project pursuant to Section164.05 (A)(6) of the Revised Code;
2. Domestic Steel. The Recipient shall, to the extent practicable, use and shall cause all of its Contractors and subcontractors to comply with domestic steel use requirements pursuant to Section 153.001 of the Ohio Revised Code;
3. Prevailing Wage. The Recipient shall require that all Contractors and subcontractors working on the Project comply with the prevailing wage requirements contained in Revised Code Sections 164.07 (B) and 4115.03 through 4115.16;

Equal Employment Opportunity. The Recipient shall require that all Contractors secure a valid Certificate of Compliance.

The Owner reserves the right to reject any or all Bids, waive irregularities in any Bid, and to accept any Bid which is deemed most favorable to the Owner.

Engineers Estimate is **$16,682,155**

A pre-bid conference will be held on **Wednesday December 18th at 10:00 A.M**. local time at the **City of Greenville Conference Room, 100 Public Square, Greenville, Ohio 45331. This will be followed by a visit to Greenville** wastewater treatment plant **located at 209 N Ohio Street, Greenville, OH 45331.** Attendance at the pre-bid conference **and visit to Greenville wastewater treatment plant** is highly encouraged but is not mandatory. ***(Addenda 1, Issued December 16, 2024)***

Bidders are advised that the plant will be open 7:30 a.m. - 3:00 p.m. on **Wednesday December 18th** for self-guided tours~~., this is the only time that the plant will be accessible~~. Any other site visits on other dates need to be coordinated with Mr. Dave Sturgill (Greenville Wastewater Superintendent; email: dsturgill@cityofgreenville.org). ***(Addendum 1. Issued December 16, 2024)***

The American Iron and Steel (AIS) provisions as required by WPCLF funding shall be implemented on this project. Project is exempted from BABA requirements.

Owner: City of Greenville, Darke County, Ohio

Dated:

CITY OF GREENVILLE
BASE BID MANUFACTURER'S SCHEDULE

Contract Documents have been prepared using specific manufacturers for certain equipment and materials and the prices provided by bidder shall be based on the manufacturers specified and listed below as base bid manufacturers. For items that list only one manufacturer, that manufacturer's equipment or material shall be include in the base bid. For items that list more than one manufacturer, bidder shall indicate, by circling the manufacturer proposed to be furnished as part of the base bid. One and only one selection shall be entered for each base bid item with more than one listed manufacturer. If bidder circles more than one manufacturer or fails to circle one where required for a piece of equipment or material, the equipment or material provided under the contract shall be that as selected by Owner from the listed base bid manufacturers.

Base Bid List										
Specification Section	**Specification Name**	**Manufacturers** Select One by Circling								
11104	Air Diffusion Equipment	Sanitaire		EDI		SSI				
11222	Biosolids Storage Day Tank	Poly Processing				Assman Tanks				
11233	Liquid Polymer Equipment	USGI Chemical Feed				VeloDyne USA				
11239	Rotary Lobe Blower	Aerzen	Kaeser			Atlas Copco	Universal			
11441	Sludge Macerator	JWC Environ.	Seepex			Moyno EZ Strip	Vogolsang			
11735 4.02 (Booster Pump Skid)	Pumping Equipment	Grundfos				Metropolitan Industries				
11735 4.03 (Digester Pumps)	Pumping Equipment	Flygt		Sulzer		KSB	Ebara-Hayward Gordon			
11735 4.04 (Pressate Pump)	Pumping Equipment	Flygt		Sulzer		KSB	Ebara-Hayward Gordon			
11735 4.05 (Volute Dewatering Press Pump)	Pumping Equipment	Moyno				Seepex				
11735 4.06 (Day tank Recirculation Pump)	Pumping Equipment	Vaughan				Ebara-Hayward Gordon				
11835	Volute Dewatering Press	Process Wastewater Technologies LLC (PW) Tech								
14551	Shaftless Screw Conveyors	Spirac	Keystone			JDV	JMS	KWS		

(Addendum 1, December 16, 2024)

BID FORM

WWTP SOLIDS HANDLING FACILITY AND ADMINISTRATION BUILDING PROJECT

CONTRACT 2305

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Greenville, Planning and Zoning Department, 100 Public Square, Greenville, Ohio 45331

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	Addendum, Date
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary

Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

UNIT PRICE BID

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Item No.	Description	Estimated Quantity	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
1	Solids Handling Facility and Administration Building.	1	LS					
2	Existing Sludge Storage System Demolition	1	LS					
3	Additional Excavation	500	CY					
4	Additional Special Backfill	500	CY					
5	Additional Pipe Aggregate Bedding Backfill	150	CY					
6	Additional Selected Backfill	200	CY					
7	Additional ~~Class A~~ Concrete ***(Addendum 1, December 16, 2024)***	100	CY					
8	Additional Concrete Reinforcing Steel ***(Addendum 1, December 16, 2024)***	1,000	Lbs.					

Item No.	Description	Estimated Quantity	Unit	Unit Cost in Numbers		Unit Price in Words	Total Estimated Cost of Item	
9	Additional Asphalt Pavement Restoration	2,500	SF					
8	Additional Concrete Sidewalk	1,000	SF					
11	Cellular Concrete Fill	1	CY					
A1.	Gas Service Installation and Connection Allowance	1	LS	$10,000	00			
A2.	Laboratory Glassware and Miscellaneous Equipment Allowance	1	LS	$50,000	00			
A3.	Landscaping Allowance	1	LS	$25,000	00			
A4.	Administration Building Furniture Allowance	1	LS	$50,000	00			
A5	SCADA Programming Allowance	1	LS	$100,000	00			
A6	WWTP Access Control System Installation Allowance	1	LS	$50,000	00			
A7	General Contingency Allowance	1	LS	$500,000	00			
Total Estimated Construction Cost:								

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete within 800 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 834 calendar days after the date when the Contract Times commence to run.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security; and

B. Evidence of authority to do business in the state of the Project; and

C. List of Proposed Subcontractors; and

D. List of Proposed Suppliers; and

E. List of Project References; and

F. Contractor Equal Employment Opportunity Certification; and

G. Certification Regarding Debarment, Suspension, and Other Responsibility Matters; and

H. Disadvantaged Business Enterprises Forms 6100-3, 6100-4, and 6100-2; and

I. American Iron and Steel Acknowledgement.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

Bidder's License No.: _____
(where applicable)

PERSONAL PROPERTY TAX AFFIDAVIT

STATE OF OHIO)

)ss.

COUNTY OF _____)

_____, being first duly sworn, deposes and says as follows: answering whichever is applicable by placing an "X" before items 1 or 2.

1. ( ) We are not charged with any delinquent personal property taxes on the general tax list of personal property in _____ County, Ohio.

2. ( ) We are charged with delinquent personal property taxes on the general tax list of _____County, Ohio including unpaid penalties and interest in the amount of $_____.

_____
Bidder

By: _____

Title: _____

Sworn and subscribed before me this _____ day of _____ 20 _____.

_____
Notary Public in and for

_____ State

My Commission Expires:

_____ 20_____

C-410 – Exhibit A- Proposed Subcontractor List

Trade/Type of Work	Sub-Contractor	Dollar Amount

If more space is needed, please attach additional sheets.

C-410 – Exhibit B- Proposed Supplier

Specification Section	Manufacturer/Supplier	Dollar Amount

If more space is needed, please attach additional sheets.

SECTION 01010
DEFINITION OF CONTRACT ITEMS

PART 1 GENERAL

1.01 FOREWORD

A. This Section describes the various Contract Items listed in the Bid.

1.02 WORK INCLUDED

A. Under each Item the Contractor shall furnish all labor, materials, tools, plant equipment, supplies, maintenance of equipment, heating, lighting and power, insurance and bonds, coordination, and all Work and in accordance with the Specifications Parts A, B, and Divisions 1 through 16 of Part C and necessary to complete the Work in accordance with the obvious or expressed intent of the Contract Documents.

1.03 WORKMANSHIP AND MATERIALS

A. The quality of workmanship and materials entering into any and all of the Items and the Work included shall conform to pertinent sections, paragraphs, sentences, and clauses, both directly and indirectly applicable thereto, contained in the Contract Documents, whether or not direct reference to such occurs under each Item in this Section.

1.04 PAYMENT

A. The lump sum and unit prices stated in the Bid shall be payment in full for the completion of all Work specified and described or required to be included in the Contract, complete, and ready for use.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 SPECIAL PROVISIONS

4.01 CONTRACT ITEMS

A. The contract items are defined on the following pages.

ITEM 1
GENERAL SOLIDS HANDLING FACILITY AND ADMINISTRATION BUILDING WORK

1.01 DESCRIPTION

A. This Item is intended to pay non-recurring cost to the Contractor not recovered under other pay Items of the Contract.

B. This Item shall include, but not be limited to, the cost for moving equipment in and out, performance and payment bonds, insurance, permits, utility connection cost, and other expenses associated with preparation for construction in accordance with the requirements of the Contract Documents.

Under this Item, the Contractor shall furnish all materials, equipment, labor supervision and coordination as specified , shown on the Drawings or otherwise required to complete and place in operation the work for the Contract.

C. Item 1 includes all work shown on the Drawings and specified in Parts A, B and Divisions 1 through 16 of Part C unless specifically included for payment under other Items except Items covered under Item 2

1.02 PAYMENT

A. The lump sum price stated in Bid shall be full compensation for all work required under Item 1.

ITEM 2
EXISTING SLUDGE STORAGE (LAGOON) SYSTEM DEMOLITON WORK

2.01 DESCRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the demolition of existing sludge storage lagoon system and all related infrastructure associated with the lagoon system noted in Drawings R100.1, R100.2, R100.3 and R100.4.

B. Under this Item, the Contractor shall furnish all materials, equipment, labor supervision and coordination as specified, shown on the Drawings or otherwise required to complete and place in operation the work for the Contract.

2.02 PAYMENT

A. The lump sum price stated in Bid shall be full compensation for all work required under Item 2.

ITEM 3
ADDITIONAL EXCAVATION

3.01 DESCRIPTION

A. Under this Item, the Contractor shall excavate additional earth material as ordered by the Engineer. This work shall include excavation, hauling, disposal of soil material, groundwater control and slope stability provisions.

B. This work shall be done only upon authorization by the Engineer and to the extent specifically ordered by the Engineer. All work done under this Item shall comply with the provisions of Section 02200.

C. The additional work resulting from the provisions of this item will be paid as described herein. If a change in the work results in a net reduction in the quantity of excavation required by the Bid item 1, the lump sum price stated for Bid item 1 will be reduced by a sum based of the unit prices stated under Bid item 3 and Bid for Items 4 through 6. ***(Addendum 1, December 16, 2024)***

D. The scope of work under this Item covers the following:

1. Excavation of Unsuitable Material – This work includes the excavation of unusable soil materials as determined by an independent testing laboratory, and the general provision provided above.

2. Additional Excavation for Structures – Such changes may be due to changes in the size, number, or nature of structures. This work includes the clearing of vegetation, and the stripping topsoil, and the general provision provided above.

3. Additional Trench Excavation – Such changes may be due to changes in the size, elevation, length, or location of a pipeline. This work includes the clearing of vegetation and the stripping topsoil, and the general provisions provided above. Pipe trench excavation dimensions shall follow the limits provided by the pipe trench details provided by the Contract Drawings.

3.02 WORK NOT INCLUDED

A. Work included under Item1.

3.03 MEASUREMENT

A. The quantities to be paid for under this Item shall be determined by the in-situ volume of the soil material excavated as measured in cubic yards.

3.04 PAYMENT

A. The unit price stated in the Bid shall be full compensation for each cubic yard of additional excavation ordered under the provisions of Item 3.

ITEM 4
ADDITONAL SPECIAL BACKFILL MATERIAL

4.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish and install special backfill material as required by Item 3, and as ordered by the Engineer. The work shall include the hauling of the material to the excavation and the compaction of the material in the excavation as required by Section 02200.

4.02 WORK NOT INCLUDED

A. Work included under Item 1.

4.03 DEFINITION OF ITEM

A. Item 4 - Special Backfill Material as defined by Section 02200.

4.04 MEASUREMENT

A. The quantities to be measured for payment under this Item shall be the volume of compacted backfill material used to fill the void created by the excavation.

B. Where no excavation of unsuitable material has taken place the quantity to be paid for under this Item will be the measured volume of compacted material using average fill area and depth.

C. Delivery tickets shall not be utilized for determining the quantity.

4.05 PAYMENT

A. For Item 4, the unit price stated shall be full compensation for each cubic yard of backfill material compacted into place.

ITEM 5
ADDITONAL PIPE AGGREGATE BEDDING BACKFILL

5.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish and install Aggregate Bedding Material as required by Item 3, and as ordered by the Engineer. The work shall include the hauling of the material to the excavation and the compaction of the material in the excavation as required by Section 02200.

5.02 WORK NOT INCLUDED

A. Work included under Item 1.

5.03 DEFINITION OF ITEM

A. Item 5 – Aggregate Bedding Material as defined by Section 02200.

5.04 MEASUREMENT

A. The quantities to be measured for payment under this Item shall be the backfill volume of compacted material used to fill the void created by the pipe trench excavation to the limits provided by the pipe trench details provided by the Contract Drawings

5.05 PAYMENT

A. For Item 5, the unit price stated shall be full compensation for each cubic yard of backfill material compacted into place.

ITEM 6
ADDITONAL ~~SPECIAL~~ SELECTED BACKFILL (Addendum 1, Issued December 16, 2024)

6.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish and install Selected Backfill material as required by Item 3, and as ordered by the Engineer. The work shall include the hauling of the material to the excavation and the compaction of the material in the excavation as required by Section 02200.

6.02 WORK NOT INCLUDED

A. Work included under Item 1.

6.03 DEFINITION OF ITEM

A. Item 6 – Selected Backfill as defined by Section 02200.

6.04 MEASUREMENT

A. The quantities to be measured for payment under this Item shall be the volume of compacted backfill material used to fill the void created by the excavation.

B. Where no excavation of material has taken place the quantity to be paid for under this Item will be the measured volume of compacted material using average fill area and depth.

6.05 PAYMENT

A. For Item 6, the unit price stated shall be full compensation for each cubic yard of backfill material compacted into place.

ITEM 7
ADDITIONAL ~~CLASS A~~ CONCRETE (Addendum 1, Issued December 16, 2024)

7.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish, transport, place, finish, and cure ~~Class A~~ concrete not shown on the Drawings and ordered by the Engineer. All associated water stops, scaffolding, and forming are included in this Item.

B. This work shall be done only upon authorization of the Engineer and to the extent specifically ordered by the Engineer.

C. The additions which are made under the provisions of this Item will be paid for as described herein. If a change in the work results in a net reduction in the quantity of Class A concrete from that shown on the Drawings, the lump sum price stated in the Bid for Item 1 will be reduced by a sum based on the unit price stated in the Bid for Item ~~5~~7. **(Addendum 1, Issued December 16, 2024)**

7.02 DEFINITION OF ITEM

A. Item 7 – Class A-1 concrete as defined by Section 03300. **(Addendum 1, Issued December 16, 2024)**

7.03 WORK NOT INCLUDED

A. Work included under Item 1. **(Addendum 1, Issued December 16, 2024)**

7.04 MEASUREMENT

A. The quantity to be paid for under this Item shall be the actual measured volume of the concrete poured in place. **(Addendum 1, Issued December 16, 2024)**

7.05 PAYMENT

A. The unit price stated in the Bid shall be full compensation for each cubic yard of concrete ordered under the provisions of Item 7. **(Addendum 1, Issued December 16, 2024)**

ITEM 8
ADDITIONAL CONCRETE REINFORCING STEEL (Addendum 1, Issued December 16, 2024)

8.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish and place additional reinforcing steel not shown on the Drawings, and as ordered by the Engineer.
(Addendum 1, Issued December 16, 2024)

B. This work shall be done only upon authorization of the Engineer and to the extent specifically ordered by the Engineer.

C. The additions which are made under the provisions of this Item will be paid for as described herein. If a change in the work results in a net reduction in the quantity of reinforcing steel required for concrete shown on the Drawings, the lump sum price stated in the Bid for Item 1 will be reduced by a sum based on the unit price stated in the Bid for Item ~~6~~8. **(Addendum 1, Issued December 16, 2024)**

4.02 DEFINITION OF ITEM

A. Item 8 – Steel reinforcing and placement as defined by Section 03200.
(Addendum 1, Issued December 16, 2024)

8.02 WORK NOT INCLUDED

A. Work included under Item 1.

8.03 MEASUREMENT

A. The quantities to be paid for under this Item shall be the weight of the reinforcing steel furnished and placed as ~~and is not shown on the Drawings~~ but was ordered by the Engineer under the provisions of this Item. The weight so measured shall not include the weight of ties, chairs, and other positioning aids.
(Addendum 1, Issued December 16, 2024)

8.04 PAYMENT

A. The unit price stated in the Bid shall be full compensation for each pound of reinforcing steel ordered under the provisions of Item 8.

ITEM 9
MILL AND REPLACE ADDITIONAL ASHPALT PAVEMENT

9.01 DESCRIPTION

A. Under this Item, the Contractor shall mill and replace asphalt pavement or various widths and lengths as ordered by the Owner.

B. The preparation of the subgrade material prior to the placement of roadway base is included in these Items.

C. The construction of pavement base and flexible and rigid pavement courses as scheduled, shown on the Drawings and specified herein are included in these Items. The proper compaction including testing to confirm acceptable construction shall be included in these Items.

D. Bonding coats such as prime and tack coats shall be included under these Items.

E. These Items include saw cutting existing pavement courses as required and sealing joints as specified or shown on the drawings.

F. Disposal of roadway excavation is included under these Items.

9.02 WORK NOT INCLUDED

A. Pavement, damaged or destroyed beyond the work shall be replaced at the Contractor's expense.

B. Work included under Item 1.

9.03 DEFINITION OF ITEM

A. Item 9 - Includes asphalt pavement

9.04 MEASUREMENT

A. For Item 9, the quantities to be paid for under these Items shall be the measured area of all pavement restoration as ordered.

B. Quantities to be paid for under these Items shall be the actual quantity constructed, measured in place within the limits as defined below, and scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions. Bituminous materials will be measured in gallons at 60 degrees F applied at the specified rates and within the pay limits.

C. Pay Limits:

1. Depth - As specified, scheduled, or directed by the Engineer.

2. Length - The actual length measured.

3. Width - The actual width measured.

9.05 PAYMENT

A. For Item 9, the unit price stated in the Bid shall be full compensation for each square foot of restored asphalt pavement, so measured, as ordered.

ITEM 10
ADDITIONAL SIDEWALKS

10.01 DESCRIPTION

A. Under this Item, the Contractor shall install additional concrete sidewalks at various widths and lengths as ordered by the Owner.

10.02 WORK NOT INCLUDED

A. Sidewalks, damaged or destroyed beyond the work shall be replaced at the Contractor's expense.

B. Work included under Item 1.

10.03 MEASUREMENT

A. The quantities to be paid for under these Items shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:

1. Depth - As specified, scheduled, or ordered.

2. Length - The actual length ordered.

3. Width - The actual width ordered.

10.04 PAYMENT

A. For Item 10, the unit price stated in the Bid shall be full compensation for each square foot of sidewalk, so measured, as ordered.

ITEM 11
CELLULAR CONTRETE FILL

11.01 DESCRIPTION

A. Under this item the contractor shall provide additional cellular concrete fill to fill abandoned pipelines, as ordered by the Engineer.

11.02 WORK NOT INCLUDED

A. Work included under Item 1.

11.03 MEASUREMENT

A. The quantity to be paid for under this Item shall be the actual measured volume of the cellular concrete fill poured into place.

11.04 PAYMENT

A. For Item 11, the unit price stated shall be full compensation for each cubic yard of cellular fill poured into place.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing, placing, finishing, and curing cast-in-place concrete. Miscellaneous materials required for concrete construction are included.

B. Anchor bolts and other cast-in items are furnished under other Sections.

C. The Contractor, before commencing Work, shall examine all adjoining Work on which this Work is dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Engineer any condition which prevents this Contractor from performing first class work.

D. Laboratory services for quality control shall be furnished in accordance with requirements of Section 01410.

E. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. Concrete mix designs including substantiating data and test records. Concrete Mix Design, Proportioning.

   b. Product literature for admixtures, curing compounds, and miscellaneous materials.

   c. Locations of construction and control joints not shown on Drawings, and proposed changes in locations.

   d. Material certifications.

   e. Aggregate gradation and percentages of deleterious substances.

   f. Batch plant certification.

2. Information for the Record:

   a. Manufacturer’s application instructions for miscellaneous materials.

   b. Quality control test reports.

B. Copy of concrete delivery ticket shall be presented to Resident Project Representative for each batch. Delivery ticket shall indicate:

1. Name of ready-mixed company and plant designation.
2. Truck number.
3. Concrete class.
4. Quantity of concrete.
5. Date.
6. Time when batch was loaded.
7. Type and name of admixtures.
8. Actual batch weights of cement, fly ash, aggregates, and water.
9. Location of pour and time of unloading shall be added to the ticket at Site.

1.03 QUALITY ASSURANCE

A. Batch Plant:

1. Batch plant shall be central batch plant with automatic or semi-automatic control. Concrete may be mixed using either central-mixed, shrink-mixed, or truck-mixed methods. If concrete is shrink-mixed or truck-mixed, the truck and concrete shall conform to ASTM C94.
2. Batch plant shall be certified by the Department of Transportation, National Ready Mixed Concrete Association (NRMCA) or an independent certification using NRMCA “Check list for Certification of Ready Mixed Concrete Production Facilities” executed and certified by independent Professional Engineer registered in state of Site. Evidence of current certification shall be submitted.

B. Pre-installation Conferences:

1. Before beginning concrete work, Contractor shall hold a meeting to review detailed requirements for preparing concrete mix designs and to determine proper procedures for concrete construction. A representative of Contractor, testing laboratory, concrete producer, concrete pumping contractor, and Engineer shall be in attendance.
2. Contractor shall submit for Engineer review a plan showing the locations of all proposed construction and control joints, which are not shown on the construction Drawings, and a schedule that incorporates the alternating pour sequences required to allow for strength gain and control of volumetric shrinkage changes.
3. When dry-shake floor hardener or metallic topping is specified, manufacturer’s representative shall instruct Contractor on proper equipment and application procedures.

C. Concrete work shall be in accordance with the current edition of the following codes, standards and specifications:

1. American Concrete Institute (ACI).

2. “Manual of Standard Practice”, Concrete Reinforcing Steel Institute (CRSI).

1.04 DELIVERY AND HANDLING

A. Concrete shall be delivered in accordance with ASTM C94 except the time limit for discharging of concrete during hot weather shall be reduced as specified.

B. Concrete shall be delivered in agitating trucks or in mixing trucks operating at agitating speed.

1.05 ENVIRONMENTAL CONDITIONS

A. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow, or when inclement weather is imminent.

B. Cold Weather:

1. Cold weather concreting procedures per “Cold Weather Concreting,” ACI 306R, shall be followed whenever any one of the following conditions occur or are expected to occur:

a. The air temperature is below 40 degrees F at the time of concrete placement.

b. The average daily air temperature is below 40 degrees F for three consecutive days immediately prior to the day of concrete placement.

c. An average daily air temperature below 40 degrees F is foreseen or occurs during any day of the specified concrete curing period.

2. For purposes of the paragraphs above, the average daily temperature is defined as the arithmetic mean of the highest and lowest temperature during the period from midnight to midnight. All air temperatures are to be measured at the Site.

C. Hot Weather:

1. Hot weather concreting procedures per “Hot Weather Concreting,” ACI 305R, shall be followed whenever any one of the following conditions occur or are expected to occur:

a. The air temperature is above 90 degrees F at the time of concrete placement.

b. Whenever conditions of concrete temperature, air temperature, wind velocity, and relative humidity combine to cause flash set, excessively low slump, cold joints, plastic shrinkage cracking, or otherwise impair the quality of concrete.

2. When the evaporation rate of bleed water exceeds 0.1 pounds per square foot per hour, steps shall be taken to prevent plastic shrinkage cracking. Evaporation rate shall be determined by the method presented in "Hot Weather Concreting," ACI 305R.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement - ASTM C150 Type I or II, unless indicated otherwise. All cement shall be from the same mill. Cement for Class A-2 concrete shall contain less than 8% tricalcium-aluminate (C3A).

B. Coarse Aggregate - Aggregates for normal weight concrete shall be crushed limestone conforming to ASTM C33, Class 4S. Aggregates for lightweight concrete shall meet the requirements of ASTM C330. Aggregates shall satisfy all quality requirements specified therein (i.e. grading, limits on deleterious substances, etc.).

C. Fine Aggregate - ASTM C33.

D. Fly Ash - ASTM C618, Class C or Class F, including supplementary chemical requirements and supplementary physical requirements, except loss-on-ignition shall be less than 5%. The use of fly ash shall be in accordance with "Use of Fly Ash in Cement (ACI-232.2R").

E. Silica Fume - ASTM C1240.

F. Ground Granulated Blast Furnace (GGBF) slag shall be in accordance with ASTM C989 Grade 100 or 120. Slag for Class A-1 concrete shall contain less than 12% tricalcium-aluminate (C3A) and slag for Class A-2 concrete shall contain less than 8% tricalcium-aluminate (C3A).

G. Admixtures - The use of all admixtures shall be in accordance with "Chemical Admixtures for Concrete (ACI 212.3R"), and "Guide for the Use of High Range Water Reducing Admixtures in Concrete (ACI 212.4R)."

1. Air entraining - ASTM C260.

2. Water-reducing - ASTM C494.

3. Accelerator - ASTM C494, Type C or E, admixture shall be non-corrosive as verified by long-term accelerated corrosion testing by an independent laboratory.

4. Anti-washout admixture - Master Builders "Rheomac UW450", or equal.

5. Only those admixtures expressly stated by the manufacturer as being chloride-free shall be used.

6. The maximum water-soluble chloride ion content, expressed as a percentage by weight of the cement, contributed from all concrete ingredients shall not exceed 0.10% for non-prestressed concrete structures. Written certification of

chloride ion content shall be submitted. Testing for Chloride Ion content shall conform to ASTM C1218.

7. If more than one admixture is used, the admixtures shall be compatible with each other and shall be incorporated into the concrete mix in correct sequence and timing so that desired effects of all admixtures are realized and harmful effects are avoided.

8. Air-entraining and chemical admixtures shall be incorporated into the concrete mix in a water solution. The water so included shall be considered to be a portion of the allowed mixing water.

H. Water shall conform to ASTM C94. Mixing water, including that contributed by aggregates and admixtures, shall be clean, and free from injurious amounts of oils, acids, alkalis, organic materials, chloride ions, or other substances that are deleterious to concrete or reinforcement. Non-potable water shall not be used.

2.02 ACCESSORIES

A. Curing Compound - Compound shall be membrane-forming, liquid applied, non-yellowing, VOC-compliant, water-based acrylic polymer resin conforming to ASTM C309, Type 1 and ASTM C1315, Type 1, Class A. The compound shall include sealing and dustproofing properties. Minimum solids content shall be 25%. Compound shall not permit a moisture loss in excess of 0.40 kilograms per square meter (0.082 pounds per square feet) in 72 hours. Sodium silicate based products are not acceptable. Compound shall be Dayton Superior “Cure & Seal 1315 J22WB”, SpecChem, LLC. “Cure & Seal WB 25”, L&M Construction Chemicals, Inc. “Lumiseal WB Plus” or equal. Curing compound in potable water treatment plant construction shall be non-toxic and free of taste and odor.

B. Bonding Adhesive for Cracks, etc. - ASTM C881 100% solids, 100% reactive two component epoxy bonding adhesives. Sika Corporation, “Sikadur 32, Hi-Mod”, Dayton Superior “Sure Bond (J-58)”, The Euclid Co. “Dural 452 Gel”, Master Builders “MasterEmaco ADH326”, or equal.

C. Bonding Adhesive for Vertical Joints - Non-vapor barrier forming, solvent-free, moisture insensitive, epoxy modified cementitious product Sika Corporation “Sika Armatec 110 Epocem”, Euclid Co. “Duralprep A.C.” or equal.

D. Bonding Grout - Identical concrete mix as approved for each concrete Class, except that an identical quantity of the fine aggregate shall be substituted for all coarse aggregate.

E. Liquid Floor Hardener – A VOC compliant, Non-yellowing, dust proofing, liquid applied hardener with non-slip properties that dies to a clear finish. Curecrete Distribution, Inc. “Ashford Formula”, ~~L&M Construction Chemicals “Seal Hard”, W.R. Meadows “LiquiHard”. Chemisil Plus”,~~ equal. Apply after concrete has cured as recommended by the manufacturer. ***(Addendum 1, Issued December 16, 2024)***

F. Bond Breaker - Bond breaker shall be non-staining type which will provide a positive bond prevention, such as SpecChem “SpecTilt 100”, Nox-crete “Silcoseal Classic”; or equal.

G. Premolded Expansion Joint Fillers:

1. Exterior Walks and Pavements - Asphalt impregnated cellular fibers securely bonded together, in conformance with ASTM D1751. W. R. Meadows “Fibre Expansion Joint”, J D Russell Company “Fiberflex”, or equal.

2. Other Locations - Self expanding cork type in conformance with ASTM D1752, Type III. W.R. Meadows, Inc. “Sealtight - Self-Expanding Cork Joint Filler”, Masco “Self Expanding Cork”, or equal.

H. Isolation Joints - Flexible foam expansion joint filler, W.R. Meadows “Sealtight - Ceramar”, or equal.

I. Compressible Material - Rigid extruded polystyrene from Board Foamular 150 (15psi) by Owens Corning Company or compressible fill material by Plasti-Fab or equal. Provide foam board, unless noted otherwise.

J. Epoxy Joint Filler - Two component, 100% solids, flexible epoxy filler with minimum Shore D hardness of 50. The Euclid Chemical Company “Euco 700”, Sika Corporation “Sikadur 51 SL”,W.R. Meadows, Inc “Rezi-Weld Flex”, or equal. Only to be used to fill interior non-moving saw cut or tooled construction or control joints and shrinkage cracks. Not suitable for constant immersion.

K. Non-slip Aggregate Floor Treatment - Aluminum oxide or emery grit. BASF chemical company “Master Top 120SR”, Dayton Superior “Emery Non-slip”, or equal.

L. Vapor Barrier - 6 mil polyethylene, ASTM D2103.

2.03 CONCRETE MIXES

A. Contractor shall design and be responsible for the performance of all concrete mixes. Mixes shall have the required quality, consistency, and workability to permit concrete to be readily worked into forms and around reinforcement without segregation or excessive bleeding. Hardened concrete shall develop all characteristics required by Contract Documents

B. Proportioning:

1. Concrete mixes shall be proportioned to maximize durability and water tightness. To this end the total water content shall be reduced to the lowest practical amount that is consistent with placing and consolidation methods. Water reducing and high range water reducing admixtures shall be used as required to maintain workability. Specified water/cementitious ratio shall not be exceeded.

2. Concrete proportions shall comply with ACI 211.1, ACI 301, ACI 318 and for the environmental components of the Work ACI 350.

   a. Proposed mix designs proportioned by field test data or trail mixes shall be accompanied by a complete standard deviation analysis and calculations for the required average compression strength F`cr. Test records used for determining standard deviation and average strength shall have been made within the past 12 months. These test records must represent materials, quality control procedures and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for the proposed Work. A minimum of ten concrete compressive test records are required if field test data is selected as the method to determine the validity of the proposed mix design.

   b. Proportioning by empirical methods on basis of water/cement ratio is not permitted.

   c. Concrete mix proportions are subject to Engineer's approval.

C. Design mixes shall have following requirements:

1. Three normal weight concrete mixes are generally required; Class A-1, A-2and Class B. Concrete mixes shall be as follows:

	Class A-1	**Class A-2 (Wastewater)**	**Class B**
28-Day Compressive Strength f'c (psi)	4500	4500	3000
Maximum Water/Cementitious Ratio:	0.44	0.42	.66
Minimum Cementitious Content (Lbs/CY)	600	650	480
Maximum Cementitious Content (Lbs/CY)	800	800	650
Slump (Inches)	See below	See below	See below

For calculating water/cementitious ratio of the mix, the weight of the water shall be that of the total free water in the mix, which includes the mixing water, the water in any admixture solutions, and any water in the aggregates in excess of that needed to reach a saturated surface dry condition.

2. Concrete placed under water shall contain an approved anti-washout admixture and shall contain a minimum of 600 pounds of cement per cubic yard. Fly ash or GGBF slag shall not be used in the concrete mix.

D. Slump:

1. When superplasticizer is not included in the mix, slump shall be 2-4 inches.

2. When superplasticizer is included in the mix, the maximum slump measured upon delivery to the construction site shall be 3 inches. Superplasticizer shall be

added at the Site after verification of slump to increase slump to the desired amount.

3. Tolerance of 1 inch above the maximum specified slump will be permitted for one batch in any five consecutive batches.

4. Concrete of lower slump than specified may be used provided it is properly placed and consolidated. Field adjustment of slump by addition of water is not permitted.

E. Air Content:

1. All concrete shall be air entrained unless specified or noted otherwise on the Drawings.

2. Concrete to be air-entrained shall have an air content as schedule below, unless specified otherwise:

Nominal maximum size of coarse aggregate (inch)	ASTM C33 Aggregate Size number	Total air content percent by volume
3/8	8	7.5
1/2	7	7.0
3/4	67	6.0
1	57	6.0
1-1/2	467	5.5

3. Allowable deviation from specified air content is plus or minus 1%.

4. Interior floor slab specified to receive a trowel finish shall not be air entrained. Maximum air content shall be 3%.

5. Floors receiving dry-shake hardeners or heavy-duty topping shall not be air-entrained. Maximum air content shall be 3%.

6. Air entrainment is not required for Class B concrete.

F. Coarse Aggregate Size:

1. Nominal maximum size of aggregate shall not be more than one-fifth of narrowest dimension between side forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between reinforcing bars.

2. Coarse aggregate shall be largest size consistent with placing methods and specified constraints. Minimum coarse aggregate shall be Size Number 57, unless smaller size is required by dimensional or reinforcement spacing constraints.

G. Cementitious Material:

1. The cementitious mixture shall contain cement and either fly ash or GGBF slag, but not both.

2. When fly ash is used in the concrete mixture, it shall comprise between 15% to 25% of the total cementitious mixture. When slag is used in the concrete mixture, it shall comprise between 25% to 50% of the total cementitious mixture. The percentages are based on weight of the total cementitious mixture.

3. For concrete in contact with wastewater, Class A-2, the cementitious design mixture shall consist of ASTM C150 Type II cement and slag or ASTM C150 Type II cement and Class F fly ash. Alternately, ASTM C150 Type I cement and Class C fly ash may be used provided the design cementitious mixture is tested per ASTM C1012 to have 0.10% or less expansion in 6 months. The test results shall be submitted with the proposed concrete mix design.

4. Air content for concrete containing fly ash shall be closely monitored and the dosage of air-entraining admixture shall be modified as required.

2.04 CONCRETE PRODUCTION

A. Ready-mixed concrete is to be used unless otherwise specified. It shall be batched, mixed, and transported in accordance with ASTM C94.

B. Admixtures other than air-entraining admixture shall not be added without Engineer's written approval.

C. Admixtures shall be charged into mixer as solutions and shall be measured by means of acceptable dispensing device. If two or more admixtures are used, they shall be added separately. Admixtures shall be used in accordance with manufacturer's instructions.

D. During cold or hot weather conditions, special precautions, as specified in ACI 306R or ACI 305R, respectively, shall be taken during batching, mixing, and curing.

2.05 STORAGE OF MATERIALS

A. Cement shall be stored in weathertight containers.

B. Aggregate stockpiles shall be arranged to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. Frozen or partially frozen aggregates shall not be used.

C. Sand stockpiles shall be allowed to drain to ensure a relatively uniform moisture content throughout the stockpile.

D. Admixtures shall be stored in a manner to prevent contamination, evaporation, freezing, or damage. Admixtures in the form of suspensions or nonstable solutions shall be agitated to assure thorough distribution of ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

PART 3 EXECUTION

3.01 COORDINATION

A. Reinforcement, sleeves, inserts, anchors, and embedded items shall be accurately placed, supported, and tied prior to concrete placement. Other trades and contractors required to furnish embedded items shall be given ample notice of concrete placement. Reinforcement and embedded items shall be subject to review of Resident Project Representative prior to placing concrete.

B. Contractor shall notify Resident Project Representative a minimum of 24 hours before placing concrete, excluding non-working days.

C. Concrete shall be placed only between hours of 8:00 a.m. and 6:00 p.m. unless otherwise permitted. Concrete shall not be placed after 12:00 noon on last working day of week.

3.02 PREPARATION

A. Hardened concrete and foreign materials shall be removed from inner surfaces of conveying equipment.

B. Waterstop shall be secured in place to ensure that it cannot bend to form cavities during concreting.

C. Formwork shall be completed and snow, ice, and water shall be removed from forms. Before placing reinforcing steel or concrete, the surfaces of the forms shall be covered with an acceptable coating material, or form liner may be used.

D. The space to receive concrete shall be free of laitance, dirt, and other debris. Laitance shall be removed by wire brushing.

E. Reinforcement and embedded items shall be checked for proper placement and adequate support. All reinforcement at the time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Aluminum conduits or pipes shall not be embedded in concrete unless approved by the Engineer and effectively coated to prevent aluminum-concrete reaction.

F. Preparation of grade shall be as specified for slabs. Concrete shall not be placed on frozen ground. There shall be no standing water on the subgrade, nor any muddy or soft spots when the concrete is placed.

G. A final detailed inspection of the foundation, construction joints, forms, waterstops, embedments, reinforcements, and other items of the placement shall be made immediately before the concrete is placed.

3.03 PLACING CONCRETE

A. Conveying:

1. Concrete shall be handled from mixer to place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will ensure that required quality of concrete is maintained. Conveying systems shall not impair the strength, slump, or air content of the concrete. Concrete shall be placed and consolidated prior to initial set, and in no case more than 1-1/2 hours after the cement is added to the mix.

2. Chutes shall be metal (except aluminum), or wood with metal lining and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-feet long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.

3. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled to prevent segregation. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 inch.

4. Concrete shall not be permitted to drop more than 4 feet freely, or through a cage of reinforcing steel, from conveying device. Concrete shall be deposited through drop chutes, elephant-trunks, or tremies as required. Temporary openings in wall or column forms may be used to limit the free fall of concrete to less than four feet. The openings should be spaced no more than six to eight feet apart.

5. Concrete shall not be conveyed through pipes made of aluminum or aluminum alloy.

B. Depositing:

1. Concrete shall be deposited continuously or in layers of such thickness that no concrete will be deposited which has hardened sufficiently to cause planes of weakness within the sections. No interruption in concrete placement shall exceed 30 minutes to avoid cold joints in the structural elements being placed. Alternate placing equipment shall be immediately available for use in the event that the primary placing equipment or system breaks down.

2. Placing shall proceed at such a rate that concrete which is being integrated with fresh concrete is still plastic.

3. Concrete which has partially hardened or has been contaminated shall not be deposited.

4. Placing of concrete for supported elements, such as beams and elevated slabs, shall not begin until supporting elements, such as columns and walls, have cured for a minimum of 7 days, unless the concrete has attained 80% of the specified

design compression strength or the shoring for the supporting elements has been designed to carry the weight of the supported elements and their construction load.

5. Concrete shall be placed continuously between construction, isolation, and expansion joints. Where joints are spaced greater than 25 feet apart the placing of concrete adjacent to previously placed concrete shall not begin until 48 hours after completion of previous placement, unless otherwise noted. Concrete shall be deposited as nearly as practical in its final position and shall be carried up evenly in forms to avoid segregation due to rehandling or flowing. Layers shall not exceed 24 inches. Concrete shall not be permitted to flow laterally in forms.

6. The temperature of the concrete mixture immediately before placement shall be between 50 degrees F and 90 degrees F, except as provided under cold weather and hot weather concreting.

C. Consolidating:

1. Concrete shall be consolidated by vibrating, so that concrete is thoroughly worked around reinforcement and embedded items, and into corners and angles of forms, eliminating air and stone pockets. Vibrators shall extend into underlying layers to bond two layers together. To avoid excessive pressure on the forms, the vibrator should penetrate no more than two feet into the underlying layer.

2. Vibrators shall be the largest size and most powerful that can be used properly in the Work, as described in “Recommended Practice for Consolidation of Concrete” (ACI 309R). A minimum of one spare operable vibrator shall be available on site. Mechanical high frequency vibrators with a minimum frequency of 8,000 revolutions per minute are preferred for consolidation of concrete within the forms.

3. Vibrators shall not be used to transport or drag concrete within forms. Vibrators shall be inserted and withdrawn from the concrete slowly.

4. Vibrators shall be inserted in the fresh concrete at points approximately 18 inches apart or as recommended by the vibrator manufacturer. The vibration shall be of sufficient duration and intensity to thoroughly consolidate the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.

D. Under Water Concreting:

1. Concrete shall not be placed under water unless otherwise indicated or permitted. The recommendations given for concrete placed under water in Chapter 8 of ACI 304 shall be followed subject to the requirements specified herein.

2. Concrete shall be deposited by tremie or other acceptable method such that fresh concrete enters mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the surface of the concrete.

3. Concrete shall not be disturbed after placement.

E. Defective Concrete:

1. Defective concrete is defined as concrete in place which does not conform to specified design strength, required percent air, shapes, alignments and elevations, as shown on the Drawings and/or which presents faulty surface areas. Evaluation and acceptance of concrete shall conform to ACI 318 and as determined by Engineer.

2. All defective concrete shall be removed and replaced in a manner meeting with the Engineer's approval. Should surface imperfections occur, they may be patched at the discretion of, and in a manner satisfactory to the Engineer. The Engineer reserves the right to require complete removal and replacement of such defective Work should the patching fail to satisfactorily restore the required quality and appearance of the Work. All such Work shall be performed at the Contractor's expense, without extension of time.

3. If for any reason, in the opinion of the Engineer, the testing of any section of the completed structure is necessary, a superimposed load shall be applied by the Contractor and the test conducted in accordance with the current Building Code at the Contractor's expense irrespective of the results of such tests. In cases where failure is declared, the Engineer shall have the authority to order the defective construction removed. All expense of removing such defective construction and substituting new construction, including expense of removing and replacing the Work of others, or protecting and repairing the Work of others, shall be borne by this Contractor.

3.04 JOINT INSTALLATION

A. Construction Joints:

1. Construction joints shall not be spaced further apart than 60 feet, unless noted otherwise. Where construction joint spacing exceeds 25 feet concrete placement shall be alternated so that adjacent sections are placed a minimum of 48 hours apart to allow for volumetric change of adjacent pours due to shrinkage and to help minimize cracks. Joints shall be located where they will least impair the strength, watertightness, and architectural design of the finished structure. Joint types and locations shall be subject to Engineer's approval. Construction joints shall not be located less than 5 feet from any other joint to which they are parallel.

2. Joints in walls and columns shall be placed at the tops of footings and mat foundations, unless shown otherwise. Joints should be made perpendicular to the main reinforcement where practical.

3. Joints shall be constructed straight by means of a temporary straight edge or rustication strip placed in forms. Joints shall be perpendicular to reinforcement.

4. Reinforcement shall be continuous across construction joints unless otherwise indicated. Unless otherwise specified or shown on Drawings, longitudinal keys at least 1-1/2 inches deep by 3-1/2 inches wide shall be provided in all joints in walls, and between walls and slabs or footings.

5. Surface of concrete shall be thoroughly cleaned and laitance shall be removed by wire brushing prior to placing adjoining concrete.

6. At all vertical joints in new concrete and in new against previously existing concrete, and wherever else called for on the Drawings, bonding adhesive paste shall be applied per the manufacturer's directions.

7. At all horizontal joints in new concrete and in new against previously existing concrete, and wherever else called for on the Drawings, bonding grout shall be applied in a 2-inch-thick layer.

B. Expansion and Isolation Joints:

1. Expansion and isolation joints shall be located and constructed as shown. Generally, joints shall be located at the perimeter of slabs-on-grades and other locations shown. These joints shall have filler material and have exposed faces sealed.

2. Reinforcement and other embedded metal items shall not extend continuously through expansion or isolation joints unless shown otherwise.

3. Unless polystyrene foam boards are called for on Drawings, premolded type joint fillers shall be installed for expansion joints in accordance with manufacturer's instructions. Joint filler shall be accurately placed and secured. Fillers for each joint shall consist of as few pieces of material as possible. Pourable or non-sag joint sealants per Section 07900 shall be placed in top or face of joints, as applicable, per manufacturer's instructions. All joints in tanks and within buildings shall be sealed unless otherwise shown. Where called for on the Drawings, exterior joints in or around walks and pavement shall be sealed.

C. Control Joints:

1. Unless indicated otherwise on the Drawings, control joints in slabs shall be located at a maximum spacing of 30 times the slab thickness in both directions with a maximum aspect ratio not to exceed 2 to 1. These joints shall preferably be located on column lines with joints also located between column lines if required to satisfy maximum spacing. Driveways and sidewalks shall have

control joints spaced at intervals approximately equal to the slab width. Drives and walks wider than 12-feet shall have longitudinal and transverse joints at 12-feet maximum spacing. All control joints shall be continuous, not staggered or offset. Control joints shall not be located in liquid containing or conveying structures, such as tank, channels and etc.

3.05 FINISHING OF FORMED SURFACES

A. Surface defects shall be patched. Patching procedures shall be as follows:

1. Honeycombed and other defective concrete shall be removed to sound concrete. Cut or chip edges perpendicular to surface or slightly undercut; featheredging is not permitted. Area to be patched and surrounding area within at least 6 inches shall be dampened to prevent absorption of water from patching mortar.

2. Bonding grout consisting of 1-part cement and 1-part fine sand passing a No. 30 mesh sieve mixed to the consistency of a thick cream, shall be thoroughly brushed into surface immediately prior to applying patching mixture.

3. Patching mixture shall be composed of same proportions as used for concrete except that coarse aggregate shall be omitted and mixture shall not consist of more than 1-part cement to 2-1/2 parts sand by damp loose volume. Mixing water shall be no more than necessary for handling and placing. Patching mixture shall be prepared in advance and allowed to prehydrate with frequent manipulation with trowel, until stiffest consistency that will permit placement is obtained.

4. Where concrete is exposed to view, color of patching mixture shall be adjusted to match surrounding concrete by substituting appropriate amount of white cement for gray cement. Proper color shall be determined by trial patches.

5. Patching mixture shall be applied before bond coat begins to lose water sheen. Patching mixture shall be thoroughly consolidated and struck off so as to leave patch slightly higher than surrounding surface. Patch shall be left undisturbed for one hour after which time it shall be finished with metal tools. Patched area shall be moist cured for not less than 7 days.

B. Tie holes shall be patched as follows:

1. The holes shall be plugged, unless stainless steel noncorrosive or acceptably coated ties are used, as approved by Engineer.

2. Tie holes shall be cleaned and dampened prior to patching with a non-metallic, non-shrink grout. Patching material shall be packed solid into hole.

3. Contractor may substitute alternate materials and procedures subject to the approval of Engineer. These materials shall be applied in accordance with manufacturer’s written recommendations wherever applicable.

C. Stains, rust, efflorescence, and surface deposits on exposed concrete shall be removed by methods acceptable to Engineer.

D. After removal of forms, the surface of concrete shall be given one or more of the finishes specified below as scheduled in the Finishing Schedule of this specification.

1. Rough Form Finish - Fins exceeding 1/8 inch in height shall be removed. Otherwise surfaces shall be left with texture imparted by forms.

2. Smooth Form Finish - The form facing material with or without form-liner shall produce a smooth, hard, uniform texture in the concrete. The type of facing material or form-liner selected is dependent upon the type of smooth finish desired and shall be approved by the Engineer. Tie holes and defects shall be patched. All fins shall be completely removed.

3. Special Architectural Finishes - This shall be produced in accordance with Section 6 of ACI 301R.

4. Smooth Rubbed Finish - The smooth rubbed finish shall be produced on a concrete with smooth form finish as specified above.

   a. Forms shall have been removed and patching completed as soon after placement as possible without damaging or jeopardizing structure.

   b. Finishing shall be performed no later than the day following form removal.

   c. Surfaces shall be thoroughly wetted and rubbed with abrasive until form marks, fins, and irregularities are removed and uniform color and texture are produced. Cement grout shall not be used.

5. Grout Cleaned Finish - The grout cleaned finish shall be produced on a concrete with smooth form finish as specified above.

   a. Cleaning shall not begin until all contiguous surfaces to be finished are completed and accessible. Finishing as the Work progresses is not permitted. Finishing of an area shall be completed on day it is started.

   b. Finishing grout shall consist of 1-part cement and 1-1/2 parts fine sand with sufficient water to produce consistency of thick paint. Where concrete is exposed to view, color of grout shall be adjusted to match surrounding concrete by substituting appropriate amount of white cement for gray cement. Proper color shall be determined by trial patches.

   c. Wet surface sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray gun. Scrub surface vigorously with cork float to coat surface and fill air bubbles and holes. While grout is still plastic, remove excess grout with rubber float or burlap. After surface whitens from drying, rub vigorously with clean

burlap. Finish shall be kept damp for minimum of 36 hours after final rubbing.

E. Finishing of Related Unformed Surfaces:

1. Tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after placement and shall be floated to texture consistent with that of adjacent formed surface. Where smooth rubbed finish or grout cleaned finish is specified, finish shall continue uniformly across unformed surfaces.

3.06 SLAB INSTALLATION

A. Floor construction shall comply with ACI 302R. Floors shall be Class 5 except floors with heavy-duty topping shall be Class 7.

B. Preparation - Subgrade supporting slabs shall be well drained and of adequate and uniform load bearing capacity. Subgrade shall be free of frost before concrete is placed. Subgrade shall be moist at time of placement. Ground may be dampened with water, but there shall be no standing water on subgrade, nor muddy spots.

C. Vapor barriers shall be installed in all occupied spaces or where shown on Drawings. A minimum 4-inch layer of granular, self-draining compactable fill, shall be placed under the vapor barrier. Joints shall be lapped 6 inch minimum. Caution shall be taken during construction not to tear or otherwise damage the vapor barrier. Damaged vapor barriers shall be patched or replaced.

D. Floors and slabs shall be sloped to drains as shown maintaining thickness shown on Drawings as a minimum. When formwork is cambered, screeds shall be set to like camber to maintain proper concrete thickness.

E. A minimum of 1/4 inch per foot slope shall be provided for exterior slabs, driveways, and walks. Driveways and walks can be pitched to one side or crowned along the longitudinal centerline with drainage to both sides as most suitable to surrounding drainage pattern.

F. Concrete shall not be deposited more rapidly than it can be spread, straight-edged, and darby or bull-floated. These later operations shall be completed before bleed water collects on surface. Rakes shall not be used for spreading concrete to avoid segregation. Slabs shall be consolidated by internal vibrators of high frequency and low amplitude, or vibrating screeds.

G. Placement of large slab areas shall be sequenced to reduce initial shrinkage cracks. Such slabs can be poured in a series of long strips separated by similar long strips poured at another time. The adjacent pours shall be at least 48 hours apart. Placing sequence and number of pours are subject to the approval of Engineer.

H. Construction joints shall not be spaced further apart than 60 feet in both directions. Where construction joint spacing exceeds 25 feet concrete placement shall be alternated, in a strip or checkered fashion, so that adjacent sections can be placed a

minimum of 48 hours apart to allow for volumetric change of adjacent pours due to shrinkage and to help minimize cracks.

I. Control joints in slabs shall be located at a maximum spacing of 30 times the slab thickness, in both directions, with a maximum aspect ratio not to exceed 2 to 1, unless noted otherwise. These joints shall be located on column lines where practical. Driveways and sidewalks shall have control joints spaced at intervals approximately equal to the slab width. Drives and walks wider than 12-feet shall have longitudinal and transverse joints at 12-feet maximum spacing. All control joints shall be continuous, not staggered or offset, where practical. Saw-cutting of control joints shall be performed with “Soff-Cut” saw after final finishing as soon as the concrete surface is firm enough not be torn or damaged by the blades and prior to the application of curing compound. In any case, saw-cutting of joints shall be done within two hours after final finishing. Control joint shall be 1/8-inch-wide by one inch deep. Control joints shall not be located in liquid containing or conveying structures, such as tank, channels and etc.

J. Finishes:

1. Scratched Finish - After concrete has been placed, consolidated, struck off, and leveled, but prior to final set, surface shall be roughened with rakes.

2. Floated Finish - After concrete has been placed, consolidated, struck off, and leveled, surface shall not be worked further until ready for floating. Floating shall begin when bleed water sheen disappears and surface has stiffened sufficiently. Floating shall be performed with wood hand float or power float. During first floating, high spots shall be cut down and low spots shall be filled. Slab shall be refloated immediately to uniform sandy texture.

3. Troweled Finish - Surface shall first be float finished, followed by power trowel, and then hand troweled. Additional trowelings shall be performed after surface has hardened sufficiently. Final troweling shall be done when ringing sound is produced as trowel is moved over surface. Finished surface shall be free of trowel marks and uniformly smooth and hard. Dusting surface with cement is not permitted.

4. Broom Finish - Surface shall first be float finished and then given coarse texture by drawing broom over surface.

5. Non-Slip Finish - Non-slip abrasive aggregate shall be applied in accordance with manufacturer’s instructions.

K. Finishing Tolerances:

1. Floor flatness (FF) and floor levelness (FL) tolerance for slabs on grade with trowel finish shall be FF25/FL20. Minimum local tolerance over 2 bay shall be 2/3 of specified tolerance.

2. Floated finish surfaces shall be constructed to tolerance of FF 20/FL17.

3. FL shall not apply to slabs where slope is shown or specified.

L. Liquid hardener shall be applied to interior exposed concrete floors which do not receive paint, dry-shake hardener, or other coating, or floor coverings. Material shall be applied in accordance with manufacturer's instructions. Remove curing, sealer and dustproofing compounds prior to placing the liquid hardener.

M. Construction and control joints shall be filled with epoxy joint filler where shown. Joint filler shall be applied not sooner than 3 months after slab construction is completed and shall be installed in accordance with manufacturer's instructions.

N. Expansion and isolation joints shall be sealed using moisture insensitive and movement tolerating joint sealants per Section 07900.

3.07 CURING

A. Beginning immediately after placement, concrete curing shall be initiated to protect the concrete from moisture loss and premature drying. Concrete shall be continuously cured for a minimum of 7 days. Tanks and other liquid-retaining structures shall be cured for minimum of 10 days. Elevated slabs, joists, and beams shall be cured for at least 14 days and as many additional days as necessary for tests to verify that the concrete has attained 90% of its specified design strength up to a maximum of 21 days. For the entire duration of the curing period, the concrete shall be protected from detrimental weather conditions as specified elsewhere in this Section.

B. Curing procedures for each type of concrete section shall be submitted and shall be in accordance with ACI 308, "Standard Practice for Curing Concrete," subject to the additional requirements specified herein.

C. Concrete surfaces not in contact with forms shall be cured by one of following procedures:

1. Ponding, fog spraying, or continuous sprinkling with water. Care shall be taken to avoid thermal shock from use of cold curing water or excessive evaporation rates. Alternate drying and re-wetting of slabs during curing shall be avoided to avoid hairline cracks at the surface.

2. Application of burlap or absorptive mats kept continuously wet.

   a. Burlap shall be clean and thoroughly rinsed in water before it is used.

   b. Burlap and absorptive mats shall be soaked as frequently as required to maintain continuously wet surface.

   c. Burlap and absorptive mats shall remain in place unwetted for minimum of 3 days after end of curing period to permit concrete to dry slowly.

3. Application of waterproof sheet material conforming to ASTM C171.

   a. Sheet material shall be placed over the wet surface of fresh concrete as soon as possible without marring surface. Material shall be placed flat without wrinkles.

b. Sheet material shall cover all exposed surfaces and shall extend beyond edges of slab a distance of at least twice the thickness of the slab.

c. Sheet material shall be lapped a minimum of 6 inches. Windrows of earth or wood shall be placed along edges and laps to seal joints and secure material from displacement by wind.

4. Application of approved curing compound.

a. Curing compound shall be used only after receiving approval by the Engineer.

b. Curing compound shall not be used on walls to receive smooth rubbed or grout cleaned finishes, prior to the completion of the application of these finishes. Curing compound maybe applied, at contractor discretion, over these finishes to complete the curing processes.

c. Curing compound shall not be used on surfaces to receive paint, liquid hardener, coatings, sealers, floor hardeners, tile, adhesives, or other materials requiring bond, unless positive measures are taken to remove it completely from the areas to receive bonded application.

d. Curing compound shall be placed in accordance with manufacturer's instructions after finishing, and immediately after water sheen has disappeared from concrete surface.

e. Exposed steel, keyways, or concrete to be surfaced shall be protected from curing compounds, unless the manufacturer of the surfacing material submits written documentation approving the use of their material on concrete on which the specific curing compound was applied.

f. Curing compounds shall not be used on surfaces to receive concrete toppings. Refer to Section 03510.

D. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun shall be minimized by maintaining forms continuously wet.

1. Forms shall be continuously sprinkled or covered with wet burlap.

2. If forms are loosened but not removed, water shall be made to run down inside of form by use of soaker hoses.

3. If forms are removed prior to completion of curing period, concrete shall be cured by one of the methods specified for concrete surfaces not in contact with forms.

3.08 COLD WEATHER CONCRETING

A. Cold weather concreting procedures concerning production, transportation, placement, protection, curing, and temperature monitoring shall be submitted to Engineer for review prior to onset of cold weather.

B. Concrete Production:

1. Minimum concrete temperatures during mixing shall be as follows:

Air Temp	Least dimension less than 12 inch	Least dimension 12 inch or greater
30 to 45 degrees F	60 degrees F	55 degrees F
0 to 30 degrees F	65 degrees F	60 degrees F
Below 0 degrees F	70 degrees F	65 degrees F

2. The mixing temperatures shall not be more than 15 degrees F above the values given above. When necessary in order to produce concrete of the specified temperature, the mix water, the aggregates, or both, shall be heated prior to batching. Heating shall be done in a manner which is not detrimental to the mix and does not prevent the entrainment of the required amount of air. The methods used shall heat the materials uniformly. Aggregates shall not be heated directly by gas or oil flame, or on sheet metal over fire. Neither aggregates nor water shall be heated to over 150 degrees F. If either are heated to over 100 degrees F, they shall be mixed together prior to the addition of the cement so that cement does not come into contact with materials which are in excess of 100 degrees F.

C. Preparation - All snow, ice, and frost shall be removed from the surfaces, including reinforcement, against which the concrete is to be placed. Concrete shall not be placed around any embedment which is at 32 degrees F or less and is sufficiently massive as to cause the adjacent concrete to freeze.

D. Placing - Minimum concrete temperatures at the time of placement shall be 55 degrees F for sections with smallest dimension less than 12 inches, and 50 degrees F for larger sections. Maximum concrete temperature shall not exceed 20 degrees F above the minimum required temperatures at the time of placement.

E. Protection:

1. Protection shall be provided and shall be adequate to prevent the surface temperature of the concrete from falling below 50 degrees F for the duration of the specified curing period. During this period, the concrete surface shall not be exposed to heated air that is more than 20 degrees F above this minimum value. At the end of the protection period, concrete shall be allowed to cool gradually. Maximum decrease in surface temperature shall be 5 degrees F in a one-hour period and 40 degrees F in a 24-hour period.

2. At the time of placement, Contractor shall keep a record of the date, time, outside air temperature, temperature of concrete, and weather conditions

(calm, windy, clear, cloudy, etc.). After placement, the Contractor shall keep a record of the date, time, outside air temperature, inside enclosure air temperatures, concrete surface temperatures and weather conditions for the duration of the specified curing period. These conditions shall be recorded at regular intervals, but not less than twice per each 24-hour period, with no period exceeding 16 hours without recorded conditions. The concrete surface temperatures shall be recorded at several locations on the placed section including interior, edge and corner locations and their corresponding enclosure air temperatures at these locations where applicable. These records shall be submitted to the Engineer or resident field representative weekly. The Contractor shall place a sufficient number of thermometers on the concrete surfaces throughout the Work to allow monitoring of concrete surface temperatures representative of all the Work. The Contractor shall place a minimum of two thermometers, each capable of recording the high and low temperature.

3. Materials and equipment required for protection shall be available at Site before cold weather concreting commences.

4. Heated Enclosure:

   a. Enclosure shall be strong enough to be wind-resistant and weather-tight and ample space shall be provided between concrete and enclosure to permit free circulation of the warmed air.

   b. Maximum air temperature within enclosure shall be 70 degrees F.

   c. Heaters shall be indirect fired type and shall be vented outside of enclosure. Combustion products shall not be permitted to come in contact with protected concrete.

   d. Heaters and ducts shall be arranged so as not to cause areas of overheating or drying of concrete surface.

5. Insulation:

   a. Slabs not less than 12 inches thick placed on ground, elevated slabs, and walls may be protected by insulated forms and insulation blankets. Insulation shall be wind resistant and weather-tight.

   b. Insulation type and thickness shall be selected with due regard for concrete temperature, air temperature, and length of protection period in accordance with “Cold Weather Concreting” (ACI 306R). Special care shall be taken at corners and edges of structure. Insulation type, thickness, and “R” value shall be as indicated in cold weather concreting procedures.

   c. When minimum concrete temperature is not maintained, insulation shall be removed and immediately replaced by a heated enclosure. A

sufficient number of surface thermometers shall be furnished and installed as directed by Resident Project Representative.

F. Curing - If water curing is used, it shall be terminated at least 24 hours before concrete is exposed to freezing temperatures. Curing period shall be completed by non-water curing methods.

3.09 HOT WEATHER CONCRETING

A. Hot weather concreting procedures including production, transportation, placement, protection, and curing shall be submitted for Engineer's review prior to onset of hot weather.

B. Concrete Production and Delivery - The temperature of the concrete at time of placement shall be maintained within specified temperature by any combination of the following:

1. Type III cement is prohibited.

2. The temperature of the aggregates shall be kept low by shading the aggregate piles or sprinkling the aggregate with water.

3. Concrete ingredients shall be cooled before mixing or flake ice shall be substituted for all or part of mixing water as required to reduce concrete temperature. Mixing shall continue until ice is completely melted.

4. Delivery of concrete shall be scheduled so that concrete is deposited as soon as practicable. Concrete shall be completely discharged within 1 hour after introduction of mixing water to cement.

5. Water reducing or retarding admixtures with shrinkage compensating cement shall be used in such quantities as recommended by the manufacturer.

C. Preparation - Steel forms, reinforcement, and embedments shall be cooled to below 90 degrees F by means of spraying with water or other approved methods immediately prior to concrete placement.

D. Placing - Concrete shall be placed at lowest practicable temperature. Temperature of concrete as placed shall not cause difficulty from loss of slump, flash set, or cold joints and shall be between 75 degrees F and 90 degrees F and in no case shall exceed 90 degrees F.

E. Protection:

1. During hot weather conditions prior to the application of curing materials, the concrete being placed and finished shall be protected from damage due to rapid evaporation. Such protection shall be adequate to prevent premature crusting of surface or an increase in drying shrinkage and cracking. Such protection shall be provided by raising the humidity of the surrounding air by fog spraying, the use of wind breaks or sun shades, additionally reducing of the temperature of the concrete, scheduling placement during the cooler times of days or nights,

reducing time between placement of concrete and start of curing, or any combination thereof.

2. Forms shall be covered and kept moist.

F. Curing:

1. Curing shall be performed by water methods only unless approved otherwise.

2. When the use of waterproof sheet material is approved for hot weather concreting, the material shall be pigmented white.

3. Forms shall be loosened as soon as practicable and water curing shall be used as specified.

3.10 TESTING

A. Concrete materials and operations shall be tested as the Work progresses.

B. Duties of testing laboratory shall be as follows:

1. Review, check, and test proposed materials for compliance with Specifications before the start of the Work.

2. Sample aggregates from concrete production stockpiles, at least once a month, during the placement of concrete and test for compliance with the specifications. The moisture content of each sample shall be measured and recorded.

3. Review and test proposed mixture design when required by Engineer.

4. Randomly sample concrete during construction in accordance with ASTM C172 and perform scheduled tests.

C. Test Schedule:

1. Strength:

a. One strength test shall be made for each 50 cubic yards, or fraction thereof, of each class of concrete placed on any one day. Frequency of testing shall not provide less than 5 strength tests for each class of concrete.

b. Concrete strength test shall consist of three specimens from each sample molded and cured in accordance with the section of ASTM C31, “Curing Specimens for Checking the Adequacy of Mixture Proportions for Strength or as the Basis for Acceptance or Quality Control”.

c. Specimens shall be tested in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. Strength test result shall be average of strengths of 28-day specimens. If one specimen shows evidence of improper molding, handling, or testing, it shall be discarded and

remaining specimen shall be considered as strength test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.

2. Cold Weather Concreting and Form Removal:

   a. When cold weather concreting procedures apply or when form removal provisions of Section 03100 apply, field cured specimens shall be made to determine when protection procedures may be terminated or when forms may be removed. These field cured specimens shall be in addition to strength tests and shall be made at same time as strength specimens.

   b. Specimens shall be molded and cured in accordance with the section of ASTM C31, "Curing for Determining Form Removal Time or When a Structure May be Put into Service". Contractor shall determine number of specimens required, but number of specimens shall not be less than three.

   c. Specimens shall be tested in accordance with ASTM C39. Age-at-test of specimens shall be selected by Contractor.

3. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength test, and whenever consistency of concrete appears to vary. Slump shall be measured in accordance with ASTM C143. In the event that a batch fails to comply with specified requirements, the slump shall be measured on each successive batch until three batches meet the specified requirements.

4. Air content shall be determined for first batch of each concrete class delivered in morning and afternoon, for each strength test, and as required by field representative. Air content shall be measured in accordance with ASTM C231, ASTM C173, or ASTM C138. When concrete is placed by pumping, air content and slump shall be measured before pump and also at pump discharge. In the event that a batch fails to comply with specified requirements, the air content shall be measured on each successive batch until three batches meet the specified requirements.

5. Temperature of concrete sample shall be measured for each strength test.

6. If the measured slump or air content falls outside the specified limits, make additional tests immediately. Test all succeeding trucks for both slump and air until three in succession pass the slump and air tests.

3.11 EVALUATION OF STRENGTH

A. Contractor shall perform concrete mix work and produce concrete structures in full compliance with Specifications.

B. Concrete strength will be considered satisfactory if the average of three consecutive strength test results equals or exceeds the specified strength, and no individual strength test result falls below specified strength by more than 500 psi.

3.12 CONCRETE SCHEDULE

A. Unless indicated otherwise on the Drawings or specified, concrete shall be furnished as follows:

Class A-1: For all structures not defined under Class A-2 or Class B concrete.

Class A-2: For structures that cover, convey or store wastewater such as channels and tanks, and their attached auxiliary structures, and all other concrete that will be submerged or exposed to wastewater.

Class B: For pipe saddle supports, pipe pier supports, buried electrical duck banks, equipment pads, housekeeping pads and mudmats, unless noted otherwise. The above items shall not be exposed to weather and shall not be submerged in liquids; otherwise, they shall be of Class A concrete as specified above.

3.13 CONCRETE FINISHING SCHEDULE

A. Concrete shall be finished as follows unless indicated otherwise:

1. Building Interior:

Floors intended as walking surfaces or to receive a floor covering, bases, and curbs:	Troweled finish*.
Other slabs intended to receive roofing, water-proofing membrane or sand bed terrazzo:	Float finish*.
Exposed formed surfaces:	Smooth-rubbed finish*.
Other formed surfaces:	Smooth-rubbed finish*.

2. Building Exterior:

Slabs, drives, and walks:	Broom finish*.
Exposed formed surfaces:	Grout-cleaned finish to 6-in below grade*.
Other formed surfaces:	Smooth form finish*.

3. Pedestrian Ramps and Exterior Stairs: Non-slip finish*.

4. Tanks and Other Liquid Retaining Structures:

Slabs:	Float finish*.
Interior formed surfaces to 6-inches below low water level:	Grout-cleaned finish*.
Interior formed surfaces lower than 6-inches below low water level:	Smooth form finish *.
Exterior formed surfaces:	Grout-cleaned finish to 6-in below grade*.

Other formed surfaces:	Rough form finish*.

* Concrete surface finish shall be coordinated and acceptable surface finishes to be applied to concrete.

3.14 ELECTRICAL CONDUITS AND LIQUID PIPE EMBEDMENTS

A. Prior to placing concrete with embedded conduits and pipes the contractor shall submit a layout plan drawing that includes the locations, quantity and size of these items. The layout plan shall be submitted to the Engineer at least 14 days prior to placement for approval.

B. Conduits, pipes and sleeves passing through slabs, walls or beams shall not impair significantly the strength of construction. Conduits and pipes shall not be embedded in columns or beams without the approval of the engineer.

C. Conduits and pipes embedded within slabs and walls shall not be larger in outside dimension than one-third the overall thickness of the slab or wall that they are embedded in.

D. Conduits and pipes embedded within slabs and walls shall not be spaced closer than 3 diameters on center.

E. Concrete cover over conduits, pipes and fittings shall not be less than 2 inches.

3.15 HOUSEKEEPING PADS

A. Unreinforced concrete pads shall be installed under all floor-mounted items such as motor control centers, electrical panels, control panels, transformers, and HVAC equipment that do not produce vibration. The pads shall be4 inches high with chamfered edges and a troweled finish, unless noted otherwise on the drawings.

3.16 EQUIPMENT PADS

A. Reinforced concrete pads shall be installed under all generators, pumps, motors, blowers, drives or other pieces of equipment with internal moving parts that may produce vibration. The pads shall be a minimum of 4 inches high. Refer to standard pad details given on the drawings.

PART 4 SPECIAL PROVISIONS

4.01 CRYSTALLINE WATERPROOFING ADDITIVE

A. Contractor to provide crystalline waterproofing additive to cast-in-place concrete where indicated on the drawings or as specified. The crystalline waterproofing material shall be Xypex Admix C-500 NF or Penetron Admix. Dosage rate shall be 1.0% (minimum) of weight of cementitious material.

B. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.

C. Admix must be added to concrete mix at time of batching. The actual dosage in the mix design shall be certified at the time of application.

D. Manufacturer shall coordinate with the concrete batch facility and other admixture suppliers to ensure compatibility with the concrete mix design, other admixtures and concrete properties. The addition of the crystalline water proofing shall not reduce the concrete strength or compromise the ASTM specifications or other quality standards governing the concrete mix.

E. Concrete containing crystalline waterproofing admixture shall be moist cured in accordance with ACI Reference 308, “Standard Practice for Curing Concrete”.

F. Crystalline waterproofing shall be proved in all Aerobic Digester tank walls.

4.02 ADDITIONAL TESTING

A. Preparation and testing of field cured specimens required for cold weather concreting and for form removal requirements shall be furnished by Contractor at no additional cost to Owner.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.

10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.
    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.06 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
3. Core Construction: Manufacturer’s thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum thermal rating of 0.41 BTU/hr-ft2-F.
4. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2. Curries Company (CU) - QMax Core - 707 Series.

2.04 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where

indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.

3. Manufacturers Basis of Design:

a. Curries Company (CU) - M Series.

b. Curries Company (CU) - Mercury 3 Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.

2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

3. Manufacturers Basis of Design:

a. Curries Company (CU) - CM Series.

b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.

2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where

required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

9. Jamb Anchors: Provide number and spacing of anchors as follows:

   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:

      1) Two anchors per jamb up to 60 inches high.

      2) Three anchors per jamb from 60 to 90 inches high.

      3) Four anchors per jamb from 90 to 120 inches high.

4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.09 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.05 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 11104
AIR DIFFUSION EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing air diffusion equipment in Aerobic Digester Tanks and the Pressate Holding Tank.

B. The Equipment Manufacturer shall furnish the items listed below:

1. Drop Pipes,
2. Manifolds,
3. Distribution Headers,
4. Coarse Bubble Diffusers (for Aerobic Digester and Pressate Holding Tank)
5. Floor Support Brackets,
6. Air Purge Diffuser Assemblies.

C. All Work performed under this Section shall be in accordance with all approved trade practices and manufacturers' recommendations.

D. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
   a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
   b. Scaled dimensional drawings.
   c. Materials of construction.
   d. Manufacturer's catalog data.
2. Information for the Record:
   a. Test data showing compliance with the Specifications.
   b. Manufacturer's certification.
3. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 GENERAL

A. The design and layout shown on the Drawings are based on the manufacturer shown in Section 2.02. If equipment other than that of the manufacturer shown is submitted to the

Engineer for consideration as an equal, it shall be the responsibility of the Bidder wishing to make the substitution to submit with the request a revised drawing of the mechanical equipment and tank layouts acceptable to the Engineer. This revised drawing shall show the proposed location of the substitute 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.

B. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240.

C. Fabricate non-welded parts and flanges from sheets, plates, or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.

D. Provide droplegs, manifolds, and headers of the diameter shown on the drawings with dimensional tolerances conforming to ASTM A554 and fabrication procedures in accordance to ASTM A774 & A778.

E. Furnish 304L stainless steel diffusers with a cast 304L Schedule 80 threaded inlet nozzle. Furnish diffuser connector from cast 316L Stainless Steel.

2.02 MANUFACTURERS

A. Aerobic Digester Tank Coarse Bubble Diffuser System shall be manufactured ~~Fixed Header with D-24 Wide Band Diffuser~~ by Sanitaire Division of Xylem, Milwaukee, Wisconsin, EDI, SSI or equal. Basis of Design: Sanitaire D-24 Wide Band Diffuser.
(Addendum 1, Issued December 16, 2024)

B. Pressate Holding Tank Coarse Bubble Diffuser System shall be manufactured ~~Fixed Header with D-12 Wide Band Diffuser~~ by Sanitaire Division of Xylem, Milwaukee, Wisconsin, EDI, SSI, or equal. Basis of Design: Sanitaire D-12 Wide Band Diffuser.
(Addendum 1, Issued December 16, 2024)

2.03 COARSE BUBBLE DIFFUSER SYSTEM AERATION EQUIPMENT (AEROBIC DIGESTER TANK)

A. Piping (Fixed Aeration Headers, Manifolds and Drop Legs):

1. For each digester tank, provide three valved droplegs from the main air header to the digester tank aeration system as shown on the drawings.

2. Provide a stainless steel Van Stone style flange design with an 150 pound drill pattern flange ring for the top connection.

3. Provide a stainless-steel band clamp coupling with gasket for the lower dropleg to header connection.

4. Drop Pipe: A4-inch SCH10, 304 L stainless steel drop pipe shall be provided for each aeration header. The drop pipe shall start at the top of the tank with a flanged connection as shown on the contract drawings. Upper drop pipe shall have a minimum wall thickness of .109 inch and shall conform to ASTM A554, ASTM A774, ASTM A778, ASTM A-312 & A-409.

5. Manifold: A 6-inch SCH 10, 304 L stainless steel manifold shall be provided perpendicular to the distribution headers and as shown on the contract drawings.

Manifold shall have a minimum wall thickness of .109 inch and shall conform to to ASTM A554, ASTM A774, ASTM A778, ASTM A-312 & A-409.

6. Distribution Headers: A 4-inch SCH 10, 304 L stainless steel distribution header shall be provided for each drop pipe. The distribution header shall start at the manifold. Header pipe shall have a minimum wall thickness of .109 inch and shall conform to ASTM A-774 & A-778. Header piping shall be drilled and tapped with a 3/4-inch half coupling shall be welded to at the crown of the distribution headers for attachment of the diffusers.

B. Coarse Bubble Diffusers:

1. Design:

a. Air diffusers shall be furnished and installed as shown on the Drawings. The arrangement and spacing of the diffusers may differ slightly depending upon the diffuser performance characteristics.

b. Diffusers to meet the design requirements noted in Section 4.

c. The diffusers shall provide uniform wide band diffusion for a full 2-feet beyond each side of the fixed air header. Diffusers to provide full-wide band aeration with a minimum air release perimeter of 48 inches per diffuser.

d. The diffuser assemblies shall include an orifice designed to provide the proper headloss to assure uniform air distribution to each diffuser along the length of the fixed air header. Air shall be supplied to the diffusers through fittings factory welded along the bottom centerline of the fixed air header. The diffusers shall be connected to these fittings in a manner which allows for rotational adjustment of each diffuser. The system shall be designed so that upon supplying air to the header, water and solids will be blown out of the header through the diffusers.

e. The design and installation of the diffusion system shall be such that all diffusers can be leveled to within 3/8-inch of a common horizontal plane. The diffuser connectors shall be designed to withstand a moment of 500 inches per pounds without permanent deformation.

f. The diffusers shall be a non-clog design and contain no flexible or moving parts. The diffusers shall be constructed of 304 stainless steel.

g. Provide deflector below each diffuser for its full length and width.

h. Design deflector to direct the liquid being aerated along the diffuser reservoir walls so that the air exits through the ports and is sheared into small bubbles and distributed into the liquid.

C. Supports:

1. Manifold & Drop Pipe Supports:

a. Manifold and drop pipe supports to be fabricated from 304 stainless steel. All mounting hardware shall be 316 SS. Each support shall have a

support cradle with a minimum 2-inch-wide bearing surface and shall be secured to the concrete bottom with two 304 stainless steel threaded rods with a minimum diameter of ½ inch. Maximum spacing between supports shall not exceed 17 feet-6 inches. Limit header or manifold cantilever to no more than 4 feet.

2. Distribution Header Supports:

a. Distribution header supports (flat bottom tank only) to be fabricated from 304 stainless steel. All mounting hardware shall be 316 SS. Each support shall have a support cradle with a minimum 2-inch-wide bearing surface and shall be attached to one 304 stainless steel threaded rod with a minimum diameter of 3/8 inch. Rod will be attached to the concrete floor with one stainless-steel drop-in wedge anchor. Maximum spacing between supports shall not exceed 17 feet-6 inches. Limit header or manifold cantilever to no more than 4 feet.

b. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on a stainless-steel supporting structure.

c. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on anchor bolts cast into 4,000 PSI reinforced concrete pedestals.

d. Design support hold down locking mechanisms using a "U" bolt smaller diameter and larger.

D. Design:

1. The system shall be designed for contraction/expansion over a temperature range of 125 degrees F without deforming any component. Fixed supports will anchor the header against movement and intermediate supports will allow for longitudinal movement. One fixed support shall be provided for each straight pipe run.

2. Fixed or expansion joints shall be provided as required.

3. Flanged joints shall Van Stone with through bolts. The flanged joints shall transmit the longitudinal forces caused by expansion and contraction of the air distribution header. All flanged joints shall have 45 to 55 durometer, Shore A, neoprene gaskets.

2.04 COARSE BUBBLE DIFFUSER SYSTEM AERATION EQUIPMENT (PRESSATE HOLDING TANK)

A. Piping (Fixed Aeration Headers, Manifolds and Drop Legs):

1. For pressate holding tank, provide one drop leg from the main air header to the tank manifold and headers as shown on the drawings.

2. Provide a stainless steel Van Stone style flange design with a 150-pound drill pattern flange ring for the top connection.

3. Provide a stainless-steel band clamp coupling with gasket for the lower dropleg to header connection.

4. Drop Pipe: A 4-inch SCH10, 304 L stainless steel drop pipe shall be provided for aeration header. The drop pipe shall start at the top of the basin with a flanged connection as shown on the contract drawings. Upper drop pipe shall have a minimum wall thickness of .109 inch and shall conform to ASTM A554, ASTM A774, ASTM A778, ASTM A-312 & A-409.

5. Manifold: A 4-inch SCH 10, 304 L stainless steel manifold shall be provided perpendicular to the distribution headers and as shown on the contract drawings. Manifold shall have a minimum wall thickness of .109 inch and shall conform to to ASTM A554, ASTM A774, ASTM A778, ASTM A-312 & A-409.

6. Distribution Headers: Two 4-inch SCH 10, 304 L stainless steel distribution header shall be provided. The distribution header shall start at the manifold. Header pipe shall have a minimum wall thickness of .109 inch and shall conform to ASTM A-774 & A-778. Header piping shall be drilled and tapped with a 3/4-inch half coupling shall be welded to at the crown of the distribution headers for attachment of the diffusers.

B. Coarse Bubble Diffusers:

1. Design:

a. Air diffusers shall be furnished and installed as shown on the Drawings. The arrangement and spacing of the diffusers may differ slightly depending upon the diffuser performance characteristics.

b. Diffusers to meet the design requirements noted in Section 4.

c. The diffusers shall provide uniform wide band diffusion for a full 2-feet beyond each side of the fixed air header. Diffusers to provide full-wide band aeration with a minimum air release perimeter of 48 inches per diffuser.

d. The diffuser assemblies shall include an orifice designed to provide the proper headloss to assure uniform air distribution to each diffuser along the length of the fixed air header. Air shall be supplied to the diffusers through fittings factory welded along the bottom centerline of the fixed air header. The diffusers shall be connected to these fittings in a manner which allows for rotational adjustment of each diffuser. The system shall be designed so that upon supplying air to the header, water and solids will be blown out of the header through the diffusers.

e. The design and installation of the diffusion system shall be such that all diffusers can be leveled to within 3/8-inch of a common horizontal plane. The diffuser connectors shall be designed to withstand a moment of 500 inches per pounds without permanent deformation.

f. The diffusers shall be a non-clog design and contain no flexible or moving parts. The diffusers shall be constructed of 304 stainless steel.

g. Provide deflector below each diffuser for its full length and width.

h. Design deflector to direct the liquid being aerated along the diffuser reservoir walls so that the air exits through the ports and is sheared into small bubbles and distributed into the liquid.

2. Corrosion Protection and Finishing

a. Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:

1) Pre-clean all outside weld areas to remove weld splatter with the use of stainless steel brushes and/or deburring and finish grinding wheels.

2) Finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits, oxide film and contaminants to regenerate a uniform corrosion resistant chromium oxide film.

3) Completely immerse all stainless steel assemblies and components in an acid solution as described in Section 6.2.11 of ASTM A380-88. The acid shall be a nitric-hydrofluoric solution as defined in Table A.2.1 of Annex A2 of ASTM A380.

4) Provide a final thorough rinse using ordinary industrial or potable water and dry in conformance per Section 8.3 of ASTM A380.

b. Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.

c. Engineer/Owner at their option may choose to observe the equipment cleaning procedure by notifying the manufacturer of their intent to visit thirty (30) days prior to the date. Cost of the travel and expenses are by the owner.

C. Supports:

1. Manifold & Drop Pipe Supports:

a. Manifold and drop pipe supports to be fabricated from 304 stainless steel. All mounting hardware shall be 316 SS. Each support shall have a support cradle with a minimum 2-inch-wide bearing surface and shall be secured to the concrete bottom with two 304 stainless steel threaded rods with a minimum diameter of 1/2 inch. Maximum spacing between supports shall not exceed 17 feet-6 inches. Limit header or manifold cantilever to no more than 4 feet.

2. Distribution Header Supports:

a. Distribution header supports (flat bottom tank only) to be fabricated from 304 stainless steel. All mounting hardware shall be 316 SS. Each support shall have a support cradle with a minimum 2-inch-wide bearing surface and shall be attached to one 304 stainless steel threaded rod with

a minimum diameter of 3/8 inch. Rod will be attached to the concrete floor with one stainless-steel drop-in wedge anchor. Maximum spacing between supports shall not exceed 17 feet-6 inches. Limit header or manifold cantilever to no more than 4 feet.

b. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on a stainless-steel supporting structure.

c. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on anchor bolts cast into 4,000 PSI reinforced concrete pedestals.

d. Design support hold down locking mechanisms using a "U" bolt smaller diameter and larger.

D. Design:

1. The system shall be designed for contraction/expansion over a temperature range of 125 degrees F without deforming any component. Fixed supports will anchor the header against movement and intermediate supports will allow for longitudinal movement. One fixed support shall be provided for each straight pipe run.

2. Fixed or expansion joints shall be provided as required.

3. Flanged joints shall Van Stone with through bolts. The flanged joints shall transmit the longitudinal forces caused by expansion and contraction of the air distribution header. All flanged joints shall have 45 to 55 durometer, Shore A, neoprene gaskets.

2.05 WELDING

A. All welding on this equipment shall be completed in the factory. Field welding shall not be permitted. All welding shall be by the shielded arc, inert gas, MIG, or TIG method. Filler wire shall be added to all welds to provide for a cross section of weld metal equal to or greater than the parent metal. Butt welds shall have full penetration to the interior and exterior of the joint.

B. Interior weld beads shall be smooth, evenly distributed with an interior projection not exceeding 1/16-inch.

C. The outside weld area shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel. All discoloration and deposits left by welding shall be removed by pickling.

D. After fabrication, all stainless-steel assemblies and parts shall be passivated by immersion in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material. A complete neutralizing operation shall be required by immersion in a tri-sodium phosphate rinse.

E. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Prior to connecting the diffuser to the headers, the Contractor shall carefully clean all piping, headers, and accessories through which air is delivered, so that all dust, dirt, oil, grease, or other foreign material will be effectively removed from contact with the air being blown through the diffusers. This cleaning shall be done with clean water at velocity of 2 to 3 feet per second. All diffusers shall be leveled to within 3/8 inch of a common horizontal plane.

3.02 FIELD TESTING

A. After the piping, headers, and diffusers for any tank have been installed, clear water shall be introduced into the tank until the diffusers have been covered about 2 inches. Compressed air shall then be released through the piping and any leaks through joints, piping, and the like shall be repaired. This test shall be repeated until the entire system is tight, to the satisfaction of the Engineer. Testing will be done by the Contractor.

B. By visual inspection, air release shall be shown to be uniform for each diffuser and header section.

C. The Contractor shall make all modifications and repairs until the system passes all tests at no cost to the Owner.

3.03 FIELD SERVICE

A. The manufacturer shall furnish the services of a competent representative experienced in the operation of the equipment to inspect the installation of his equipment and instruct the plant operating personnel in the proper operation and maintenance of the diffused air equipment. A total of one 8-hour day in one trip shall be provided. The Contractor to coordinate field service with equipment manufacturer and Engineer and shall provide at least two weeks' notice for scheduling purposes.

4.02 WARRANTY

A. Warrant all parts to be free from defects in materials and workmanship for a period of one year after installation or 18 months after delivery, whichever occurs first.

B. Furnish replacement parts to the Owner for any items found to be defective within the one year warranty period.

PART 4 SPECIAL PROVISIONS

4.01 AEROBIC DIGESTER TANK DIFFUSER SYSTEM

A. Aerobic Digester Tank Summary:

Aerobic Digester Tank Summary		
Description	**Units**	
No of Tanks:		3
Tank Size (Square)	Feet	50 Feet x 50 Feet

Tank Depth:	Feet	16
Storage Depth:	Feet	14
Design Oxygen Requirement/Tank:	SCFM	1,100
Standard Oxygen Transfer Rate:	lbs/day	2,698
Volumetric Rate:	SCFM	1,100
Operating Pressure at Top of Drop Leg:	PSI	5.85
Diffuser Submergence:	Feet	13
Diffuser Placement i.e., side roll, etc:		Midwidth

B. Aerobic Digester Tank Diffuser Summary:

Aerobic Digester Tank Diffuser Summary (Per Tank)		
Description	**Units**	**Operating Point**
No of Trains in Operation	Per Tank	3
No of Grids in Operation		3
No of Operating Diffusers /Grid		24
SOR	lbs/day	2,698
SOTE	%	9.8
Total Air Rate	scfm	1,100
Min/Max Diffuser Rate	scfm/diffuser	15.28
Diffuser Operating Range	scfm	8 to 40

4.02 PRESSATE HOLDING TANK DIFFUSER SYSTEM

A. Pressate Holding Tank Summary:

Pressate Digester Tank Summary		
Description	**Units**	
No of Tanks:		3
Tank Size (Square)	Feet	44.5 Feet x 20 Feet
Tank Depth:	Feet	7
Storage Depth:	Feet	6
Design Oxygen Requirement/Tank:	SCFM	200
Standard Oxygen Transfer Rate:	lbs/day	150
Volumetric Rate:	SCFM	200
Operating Pressure at Top of Drop Leg:	PSI	2.71
Diffuser Submergence:	Feet	5
Diffuser Placement i.e., side roll, etc:		Midwidth

B. Pressate Holding Tank Diffuser Summary:

Pressate Tank Diffuser Summary (Per Tank)		
Description	**Units**	**Operating Point**
No of Trains in Operation	Per Tank	1
No of Grids in Operation		2
No of Operating Diffusers /Grid		22
SOR	lbs/day	150.3

SOTE	%	3.0
Total Air Rate	scfm	200
Min/Max Diffuser Rate	scfm/diffuser	9.09
Diffuser Operating Range	scfm	4 to 20

END OF SECTION

SECTION 11222
BIOSOLIDS STORAGE DAY TANK

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing all material, equipment, labor, and supervision required for chemical tanks as specified and shown on the Drawings.

B. All Work under this Section shall be in accordance with all approved trade practices and manufacturers' recommendations.

C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Scaled dimensional drawings.

c. Materials of construction.

d. Manufacturer's catalog data.

e. General Arrangement Drawings.

f. Corrosion resistance charts verifying that the selected materials of construction are suitable for the chemicals to be handled.

2. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 POLYETHYLENE TANKS

A. Polyethylene tanks shall be of one-piece seamless molded construction of either high density polyethylene or high density cross linked polyethylene as specified in Part 4. The wall thickness for a given hoop stress is to be calculated in accordance with and no less than design requirements per ASTM D 1998. The wall shall be no less than 0.187" thick.

B. Tanks shall be of the size and configuration specified in Part 4 and as shown on the Drawings. Tank design shall incorporate a factor of safety of two.

C. Location of tank fittings and modifications shall be as required in Part 4 and as shown on the Drawings. The nozzles shall be the following types as specified:

1. Two flange fitting (2FF) consisting of two flanges, one inside and outside the tank, gasketed and bolted together through the tank wall. Bolt heads inside the tanks shall be encapsulated. The outside flange shall have NPT threads to accept the connecting piping.
2. Bulkhead fittings (BF) consisting of a flange and nozzle installed inside the tank with the nozzle penetrating the tank wall. A nut shall be threaded on to the nozzle and tightened against the tanks outside wall to secure the fitting. A gasket shall be used to make the fitting liquid tight. The nozzle shall contain NPT thread to accept the connecting piping. Bulkhead fittings used in domed tops shall be the self-aligning type.
3. Half couplings (HC) or full couplings (FC) welded to the tank shell having NPT threads to accept the connecting piping.
4. Fittings on the lower one-third of the tank sidewall for tank capacities of 1,000 gallons or greater shall be included with expansion joints to meet manufacturer warranties.
5. On closed top tanks the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.
6. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

Tank Diameter, ft	Min Knuckle Radius, in
less than or equal to 6	1
greater than 6	1-1/2

7. Tanks with 3000 gal capacity or larger shall have at least 3 lifting lugs. Lugs shall be designed for lifting the tank when empty.
    a. Unless otherwise indicated by Contract drawings, for indoor pneumatic fill, manways shall be 24-in diameter or greater and equipped with an emergency pressure relief device or manway with pressure relief at 6-inch water column to prevent over-pressurization. The manway shall be chemically compatible with the chemical being stored. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

D. Tank colors shall be natural (un-pigmented), or black (COMPOUNDED), or as specified by the ENGINEER with written agreement by the tank manufacturer.

E. Manways shall be furnished and installed completely where designated in Part 4 of this Section and as shown on the Drawings. Manways shall have handles, be flanged, bolted and gasketed, and made of fiberglass. Bolts, nuts, and washers shall be stainless steel.

F. Ladders shall be furnished and installed completely where designated in Part 4 and as shown on the Drawings. Ladders shall meet the following:

1. Ladders and appurtenances shall meet OSHA requirements.
2. Ladders shall be of ASTM A276, AISI Type 304L stainless steel.
3. All components of ladder shall be designed for a minimum concentrated live load of 300 pounds.
4. Ladders shall be welded assemblies.

G. When specified in Part 4 a heavy duty braced steel tank stand shall be provided. The height of the stand shall be as specified in Part 4. The stand shall be provided with an agitator support for mounting mixing equipment. Stands shall be shop primed for field painting. Stands shall be furnished by the tank supplier.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. AVOID sharp objects on trailers.

B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.

C. Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, the tank manufacturer shall be notified immediately.

3.02 INSTALLATION

A. Installation shall be complete and in accordance with the manufacturer's recommendations, Engineer's instructions, and the Contract Documents.

B. Contractor shall provide, in the field, any additional holes required in hinged covers for fill lines, suction lines, or instrumentation.

C. Flat bottom tanks which are to be installed on concrete bases shall have a cushioning pad provided between the tank and the base. The pad shall consist of several layers of 30-pound roofing felt, 1/2-inch thick sheet of 2 pound density polyurethane foam board, or other Engineer approved material to meet manufacturer's warranty. The pad's diameter shall be equal to the tank diameter plus 2 inches. Any additional padding under the center of the tank shall be in accordance with the manufacturer's recommendations.

3.03 MATERIAL TESTING

A. Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.

B. Degree of Cross-linking. Use Method C of ASTM D 1998- Section11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

3.04 LEAKAGE TESTS

A. In addition to leakage tests performed at the manufacturer's facility the tank and connected piping and appurtenances shall be filled with water and tested for leaks prior to filling with chemical for a minimum period of 24 hours.

B. Tanks shall be filled with water to the highest point of the invert overflow.

C. Leaks shall be repaired as necessary by the manufacturer or contractor.

D. Leakage tests shall be repeated until satisfactory results are obtained. Water for initial leakage test will be furnished by Owner. Water for subsequent tests shall be furnished by Contractor.

E. The tank shall have no visible signs of leakage to complete a successful leakage test.

F. Following successful testing, the tank shall be drained and cleaned prior to filling with chemical. Test water shall be drained and discharged at an acceptable location.

PART 4 SPECIAL PROVISIONS

4.01 BIOSOLIDS STORAGE DAY TANK

A. One high-density cross-linked polyethylene tank.

B. The tank shall be suitable for storing 3% thickened biosolids.

C. The tank shall be vertical with a closed dome top, flat bottom type.

D. The outlets must be an integral part of the tank, molded from the same material as the tank and provide drainage of liquid through the sidewall of the tank.

E. The tank shall have a minimum capacity of 10,000 gallons. Tank shall be approximately 14 feet high and have a 12 feet nominal diameter.

F. The tank shall be fitted as follows:

Fitting	Location	Purpose
6 in. BF	Dome	Flanged Fill
8 in. BF	Dome	Vent
2 in. BF	Dome	Level Sensor Cables
2 in. BF	Dome	Multipurpose/Future
4 in. BF	Dome	Recirculation
6 in BF	Side Wall	Overflow
4 in BF	Side Wall	Pump Suction
6 in. BF	Side Wall	Drain

G. Horizontal fitting locations shall be as shown in the Drawings.

H. Bolted one piece seal double flange fittings constructed of virgin polyethylene shall be supplied. Bolts will be welded to a common backing ring and encapsulated with polyethylene preventing fluid contact with the metal material. Flange will have one full face gasket to provide a sealing surface against inside tank wall.

I. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at 6-ft max intervals. Down pipes and fill pipes shall be PVC or material compatible with the chemical stored.

J. Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F) (iii)(2)(IV)(9).

K. All fittings on the 1/3 lower sidewall of tanks with capacities > 1000 gallons shall have 100% virgin PTFE Flexi-joint expansion joint.

L. Tank shall be furnished with the following accessories:

1. Ladder attachment: Metal components to be stainless steel, edge softeners, and tension ring with stainless steel cables and clamps. Ladders must be secured to the tank and secured to the concrete to allow for tank expansion/contraction due to temperature and loading changes. Safety cages shall be added to ladders.

2. Tank restraint system: Tank restraint system shall be supplied and the design of same certified by a Structural Engineer registered in the State of tank installation. Design shall conform to the most recent edition of the IBC code for seismic and wind load. Anchor bolts as required by the calculations shall be supplied by the tank manufacturer.

M. Tank stand to elevate the tank bottom 6 inches off the floor.

N. Level Indication:

1. Float Indication: The level indicator shall be assembled to the tank and shall consist of PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, clear UV resistant PVC sight tube, and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time. Indicator shall be neon orange color for visual ease for onsite operators.

2. Ultrasonic Level Indicator: The ultrasonic level indicator with one 4-20 mA or 0-10 VDC continuous level input and NEMA 4X box to be supplied by tank manufacturer.

O. The tank shall be manufactured by Poly Processing Co., Assman or equal. Basis of Design: Polyprocessing IMFO-F-10150. ***(Addendum 1, Issued December 16, 2024)***

END OF SECTION

This page was intentionally left blank.

SECTION 11239
ROTARY LOBE BLOWERS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing, installing, factory test, and placing in operation blowers and related accessories complete and in place ready for service, as shown in the Drawings and described herein.

B. The blowers shall include all drives, drive shafts, couplings, guards, common bases, anchor bolts, silencers, and other accessories specified or required for a complete installation.

C. Each blower package shall be furnished complete with positive displacement tri-lobe blower, electric motor, transmission belting and guards, expansion joints, inlet and discharge silencers, pressure relief valve, check valve, auto tensioner, gauges, soundproof enclosure, and all other accessories required for satisfactory operation.

D. All work performed under this Section shall be in accordance with approved trade practices and the manufacturer's recommendations.

E. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. General Arrangement Drawings.

a. Scaled dimensional Drawings.

b. Sectional assembly Drawings.

c. Installation instructions and Drawings.

d. Wiring schematics with termination point identification.

e. Materials of construction.

f. Manufacturer's literature and catalog data.

g. Motor information per Section 11050.

h. Manufacturer's certificates and test curves.

i. Complete blower performance data including RPM, capacity, discharge pressure, dB(A) noise pressure level, maximum gear tip speed and rotor

tip speed (fpm), HP required at rated capacity and pressure, and rated maximum pressure rise of blowers

j. Test curves (computer model printouts are not acceptable).

k. Valves

l. Anchoring requirements and installation instructions.

m. Special maintenance tools.

2. Information for the Record:

a. The Contractor shall submit blower supplier's installation and operation certificate.

b. Results of factory tests.

3. Operation and maintenance manual.

1.03 WARRANTY

A. The blower(s) shall be covered by a warranty for 24 months from date of commissioning, or a maximum of 30 months from date of shipment.

PART 2 PRODUCTS

2.01 GENERAL

A. The blower performance shall be as indicated in Part 4 of this Section.

B. The blower shall be of rotary positive displacement design.

C. The blower manufacturer shall be Aerzen, or equal.

D. All equipment shall be designed and proportioned to have liberal strength, stability, and stiffness and shall be especially adapted for the intended service. Ample room and facilities shall be provided for inspection, repairs, and adjustments.

E. The blowers shall be designed to operate continuously without overheating or overloading the motor at any discharge pressure up to and including design pressure, as specified.

F. Blower bases shall be rigidly and accurately anchored into position. All necessary anchor bolts, nuts, and washers shall be furnished by the blower manufacturer and installed by the Contractor.

G. Blower base to have machined sole plate for placement of the blower and have jacking lugs on the blower flange.

H. Nameplates stating the manufacturer, serial number and design operating characteristics shall be rigidly attached to each item of equipment.

I. Each blower shall be given a factory mechanical and one point flow test to assure mechanical integrity and verify performance. If the tests indicate that adjustments are

necessary to meet the manufacturer's standard design capacities of these specifications, such adjustments shall be made prior to shipment.

J. The blower shall be shipped with openings sealed after injection of rust inhibiting powder or with desiccant bags.

K. The Contractor shall furnish and install all interconnecting piping and wiring, gaskets, bolts, nuts, washers, and anchor bolts for auxiliary equipment to complete the system as shown on the Drawings and specified herein.

2.02 BLOWERS

A. The air blower shall be of the rotary positive displacement type as described in Paragraph 2.01 and be constructed with suction and discharge connections oriented as shown on the Drawings.

B. The blower casing shall be of one-piece construction, with separate side plates that are bolted and pinned to the housing. Materials shall be close-grained cast iron ASTM A48.

C. Inlet and outlet shall be flanged connections.

D. The rotors shall be of the straight, three-lobe type and shall be one single piece.

E. Each rotor/shaft shall be supported by anti-friction bearings and fixed to control the axial location of the rotor/shaft in the unit.

F. Bearings shall be sized for a minimum expected life of 5 years between overhauls.

G. The rotors shall be timed by a pair of single helical AGMA 12 quality gears with hardened and ground teeth; minimum AGMA service factor of 1.70.

H. A double sealing arrangement shall be provided to prevent lubricant from contaminating the airstream. Four rotary piston ring shaft seals, an oil slinger and an O-ring seal shall be provided.

I. The timing gears and the bearings shall be splash lubricated.

J. A recessed oil sight glass must be provided on each oil sump.

K. Each bearing shall be provided with positive lip-type oil seal designed to prevent lubricant from entering the airstream, and a labyrinth seal on each shaft designed to reduce air leakage at the point where the shaft extends through the headplate of the blower casing. Further provisions shall be made to vent the area between the two sealing systems to atmosphere to relieve any excessive pressure on the seals.

L. The bearings and gears shall be lubricated by a positive pressure lubrication system completely mounted and piped on the blower unit. The lube system shall consist of an integral direct-driven oil pump, distribution piping, oil sump in the bottom of the gear housing, suction strainer, pressure relief valve, pressure gauge, temperature gauge, provision for Contractor supplied, low oil pressure and temperature transmitters for alarm and shutdown, and oil cooler.

2.03 BLOWER ACCESSORY EQUIPMENT

A. Each blower shall be provided with a suction silencer, suction and discharge expansion joints, discharge silencer, and other accessories as shown on the Drawings.

B. The inlet filter silencer shall be mounted directly to the inlet flange of the blower.

C. The silencer portion shall be located upstream of the inlet filter.

D. The base frame shall be constructed from welded carbon steel or cast iron.

E. Suction silencer shall be on the chamber-absorptive type with inlet and outlet connections as shown on the Drawings. The silencer shall be sized for 100% of the blower flow with a pressure drop not to exceed 5.5 inches of WC. The silencer shall be all-welded steel construction.

F. Discharge silencers shall be of the chamber-absorptive type with inlet and discharge connections and flange sizes as shown on the Drawings. The silencer shall be sized such that a pressure drop of 5.5 inches WC will not be exceeded at the specified blower operating conditions.

G. The silencer shall be subject to a pressure test for tightness and strength at a minimum of 1.65 times the maximum blower operating pressure.

H. The silencer shall be provided with supporting legs as shown on the Drawings, shall be all-welded steel construction.

I. Each package shall be connected to the plant piping via flexible connector(s) located downstream of the discharge silencer.

J. Flexible discharge connectors shall be Proco Style 240, Type EE, EPDM, with a standard ANSI flange discharge connection, rated for 300 degrees F at 20 psig.

K. The blower shall have temperature gauge and air pressure gauges located in the discharge piping and mechanical counter mounted on a lobe shaft extension.

2.04 ELECTRIC MOTOR

A. Each package shall be supplied with a WEG manufactured TEFC motor that shall operate on 460 Volts, 3 Phase, 60 Hertz current.

1. Torque NEMA B.
2. Temperature Rise Class B.
3. Dust tight enclosures (Severe Duty).
4. Class F inverter rated insulation with Class H applied varnish.
5. 3:1 Constant torque.
6. All cast iron construction, including frame, end bells, conduit box and fan cover.
7. NPT threaded and gasketed F3 top mounted conduit box.
8. Copper windings.

9. Regreasable bearings, positive pressure lubrication system with automatic drawn plugs – pressure compensated (Frame sizes 254T and larger).

B. All frame sizes shall be NEMA standard, suitable for overhung belt drive and with the conduit box location on top of the motor.

C. The motor shall be mounted on a pivoting base to provide automatic tensioning of the belts.

D. The motor nominal rating after any corrections for ambient conditions shall be 10% above the maximum operating bHp.

E. The motor shall have a 1.15 service factor.

F. Motor windings shall be supplied with a normally closed thermostat, one per phase, wired in series to form a fail-safe motor protection circuit for the external fault circuit of the motor controller.

G. Motors shall be equipped with an Aegis ring and insulated NDE bearing to mitigate the effects of stray motor currents.

H. The blower manufacturer shall be responsible for coordinating the starting torque requirement of the blower and the motor.

2.05 V BELT DRIVE

A. Each package shall be supplied with a V-belt drive that shall be of the high-capacity type, oil and heat resistant. The drive shall be designed for a minimum service factor of 1.4 times operating power (bHp), or 1.1 times the motor nameplate Hp, whichever is larger to allow a minimum of 1.4-service factor based on the maximum blower bHp.

B. Belt tensioning shall be automatic without the use of any devices or interaction on the part of the operator. Neither slide rails nor load-adjusting springs shall be used.

C. Sheaves shall be dynamically balanced regardless of the operating speed.

D. The belt drive shall be guarded in compliance with OSHA regulations.

E. Portions of the guard shall be easily removable allowing for belt inspection and replacement.

F. Guard material shall be perforated carbon steel.

2.06 VIBRATION ISOLATORS

A. Each package shall be supplied with vibration isolating feet with a minimum efficiency of 80%.

B. The blower manufacturer shall be responsible for attenuating noise and vibration in the blower package such that no special installation base shall be required, nor shall any additional measures be required to reduce vibrations from the blower package being transmitted to the base or the piping.

2.07 PRESSURE SAFETY VALVE

A. Each package shall be supplied with a single pressure safety valve on the discharge side of the blower mounted downstream of the discharge silencer and upstream of the check valve.

B. The safety valve shall be set to protect the blower from exceeding its maximum pressure rating and shall be sized to pass 100% of the design flow.

C. The safety valve shall be field adjustable, spring loaded, and have a certificate of conformity to PED.

D. If the blower package is supplied with a sound enclosure. The pressure relief valve shall be housed by the sound enclosure and shall relieve into a segmented section of the sound enclosure. Weighted relief valves inside the enclosure are not permitted.

E. The valve shall be manufactured by the blower manufacturer.

2.08 CHECK VALVE

A. Each package shall be supplied with one check valve that shall be installed on the discharge line.

B. The check valve shall be of the full-bore low pressure-drop, flapper type design with a steel body, and steel flap embedded in EPDM with full-contact seal.

C. The valve shall be removable without disturbing the piping. Pressure losses produced by the check valve shall be included in the blower performance calculation. Check valves requiring installation in the discharge piping shall not be considered unless installation cost of the external valve is included in supplier's proposal.

D. The valve shall be manufactured by blower manufacturer.

2.09 INSTRUMENTATION

A. Each package shall be supplied with the following instrumentation:

1. Inlet Vacuum Gauge (4-Inch Gauges):
    a. Standard gauge with 4-inch dial and scale from 0 to –40 inches of water column.
    b. Gauge to function as a filter maintenance indicator.
2. Discharge Pressure Gauge (4-Inch Gauges):
    a. 4-Inch dial and scale from 0 to 20 psig.
    b. The pressure gauge shall have a stainless-steel case.
    c. Gauge shall be dry (no fill) with no pulsation snubber required.
3. Discharge Pressure Switch:
    a. Ashcroft Model B4-24-V-XRN-XJK-15 PSI.

b. Type 400 pressure Switch in NEMA 4X enclosure.

c. Single general purpose 15A, 110-480V switches (2) SPDT snap-acting, NOT independently adjustable.

d. Viton Actuator Seal.

e. Internal range scale and operating range of 0 to 15 PSIG.

4. Discharge Temperature Gauge / Switch (4-Inch Gauges):

a. Standard gauge with 4-inch dial and scale from 32 to 397-degree F.

b. NEMA 4 enclosure, 5A at 250 volt, SA 28 SPDT microswitch.

c. UL & CSA approved.

5. E-Stop Switch:

a. Siemens model 52PX2V2.

b. Mounted on the face of the blower enclosure.

c. NEMA 4X rating.

d. Two normally closed contacts.

6. Terminal Strip:

a. The switches and motor thermostat shall be prewired to a labeled terminal junction box inside the blower enclosure.

2.10 ACCOUSTICAL SOUND ENCLOSURE

A. Each package shall be supplied with a sound enclosure covering the entire blower package.

B. Each blower system shall be equipped with an acoustical enclosure. The acoustical enclosure shall need to meet below:

Sound Limit Req. @ 1 Meter In Free Field:	80 dB

C. The Enclosures shall be designed, assembled, and inspected at the manufacturing site with documentation provided to verify the noise reduction demanded in these documents. Noise attenuation shall be provided as necessary to reach the specified sound limit requirement at a distance of 1 meter from the operating equipment in a free field environment. All readings shall be taken by personnel experienced in the field of sound attenuation. The enclosure herein specified shall be designed and manufactured by the blower system manufacturer specifically for the equipment supplied.

D. The enclosure shall be designed so as to be able to install them side-by-side with all maintenance done from the front or back of the package.

E. Details shall be as follows:

1. Panels shall be made of galvanized steel sheet, powder coated in a light reflecting, blue color per RAL 5001. The skid shall be of the same color.

2. The enclosure and the blower package shall both be mounted on a skid / oil-drip pan designed for meeting environment protection standards and for easy transportation and installation.

3. A grounding strap shall be installed between the blower base and the package skid to bypass any vibration isolating mounts.

4. Quick release panels, each less than 50 lb (as mandated by OSHA) must provide easy and quick access for routine maintenance of the blower and the package components.

5. Enclosure Cooling Fan:

a. A high efficiency blower shaft driven ventilation fan shall provide ventilation and cooling integral to the sound enclosure.

b. Cooling fan shall be sized for sufficient heat removal from the sound enclosure, even when the blower is operated with a VFD.

F. Electrical components, instrumentation and instrument connections shall not be mounted or interface with moving panels of the sound enclosure.

G. Both blower oil sumps shall be piped to a common fill and drain, located at the front of the package for easy maintenance. An oil level indicator shall be mounted on the outside of the enclosure, which gives an accurate oil level indication while the blower is in operation. All oil lines to be hydraulic hose with fittings. No plastic tubing with compression fittings is allowed.

2.11 SHOP PAINTING

A. Shop painting shall be in accordance with Section 01350.

2.12 SPECIAL TOOLS AND SPARE PARTS

A. Any special tools required to perform routine maintenance functions, such as replacement of gears and bearings, shall be furnished with the blowers.

B. The following spare parts, as applicable, shall be furnished with each blower equipment:

1. One complete set of gaskets, seals, O-rings, and bearings for each blower.

2. One integral inlet silencer filter elements (Total 2).

3. Lubrication for first year of operation (Total 2).

4. One belt set (Total 2).

2.13 FACTORY TESTING

A. All critical dimensions of the blower components actually provided by the manufacturer shall be verified and documented prior to assembly.

B. The rotating parts of each blower actually provided by the manufacturer shall be statically and dynamically balanced before final assembly. The blower line shall operate without excessive vibration. Removal of material from the face of the rotors for balancing purposes is not allowed.

C. Each blower actually provided by the manufacturer shall be slip tested. The Slip RPM shall be documented. Each bare blower provided by the manufacturer shall be operated as its maximum rated speed and differential pressure for 30 minutes. A document certifying that the supplied blowers conform to the design specifications shall be provided.

D. On completion of final assembly of the packaged blower and prior to shipment, each packaged blower shall be mechanically run to a minimum of 15 minutes.

2.14 QUALITY ASSURANCE

A. The blowers and equipment covered by this specification are intended to be standard blower equipment, of proven ability, as manufactured by a reputable CE certified manufacturer having at least two years' experience in the production of such blowers. The blowers furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

PART 3 EXECUTION

3.01 INSTALLATION

A. The blowers and accessories shall be installed in accordance with the approved Shop Drawings and the manufacturer's instructions.

B. All base pads and bearing pedestal shall be flat and parallel to the centerline of the existing drive within 0.001-inch. The new bearing and blower shall be installed in line with the centerline of the existing drive within 0.001-inch. A vibration test by an independent Contractor shall be provided. Corrections in alignment, fabrication, and installation shall be made as necessary to bring the installation within the requirements of the blower vendor. Vibration readings shall be equal to or less than one mil at each bearing location.

C. Installation shall include the furnishing and installation of all supports and bracing as required to support the blowers, silencers, and piping and to prevent any excessive vibration or movement which may be harmful to the equipment.

D. Precompression or extension of the expansion joints is not allowed.

E. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendation.

F. After a satisfactory start-up and field test are completed, the initial gear oil will be replaced with clean oil meeting manufacturer's recommendation.

3.02 INSPECTION, STARTUP, AND TESTING

A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, startup, and training services. The manufacturer's representative shall be experienced in the installation, start-up, and operation and maintenance of the equipment.

B. The representative shall check the installation and supervise final adjustments and initial startup of the equipment. He shall certify that the installation is correct, and that the equipment is operating satisfactorily.

C. The manufacturer's representative shall submit to the Engineer four copies of a written certification to verify that the installation, inspection, and startup is correct, and that the equipment is operating satisfactorily.

D. After the installation, inspection, and startup are satisfactorily complete, the manufacturer's representative shall train the Owner's personnel for a minimum of four hours in the proper operation and maintenance of the equipment.

PART 4 SPECIAL PROVISIONS

4.01 OSHA GUARDS

A. Provide OSHA Guards for all couplings, pillow blocks, and shafts.

4.02 BLOWER ROTATION

A. The Contractor shall verify existing driver engine rotation requirements and coordinate with the blower manufacturer.

B. Provide OSHA Guards for all couplings, pillow blocks, and shafts.

4.03 AEROBIC DIGESTER TANK BLOWERS

A. The Aerobic Digester Tank Blower shall be manufactured by Aerzen, Kaeser, Atlas Copco, Universal or Equal***. (Addendum 1, Issued December 16, 2024)***

B. Service:

1. The blowers will be used to supply atmospheric air to the aerobic digester tanks. The normal liquid level in the digester tank above the aeration diffuser will be 13 feet. The inlet temperature to the blower will be between 0 degrees F and 100 degrees F.

a.	Quantity:	4
b.	Basis of Design:	Aerzen Model GM 35 S DN 150
c.	Design Inlet Temperature:	100 Degree Fahrenheit
d.	Site Elevation:	1012 Feet above sea level

e. Design Inlet Pressure (abs): 14.17 psia

f. Design Humidity: 80%

g. Design Flow Inlet Volume: 1,100 SCFM per Blower

h. Design Discharge Pressure: 6.16 psi

i. Main Rotor Speed: 3,545 rpm

j. Brake Horsepower (Max): 59 BHP

k. Motor Size (Max): 75 HP

l. Power: 3 phase, 460 volts

1) Panel:75 HP VFD in MCC (see specification 16421 – Motor Control Center)

m. Free Field Noise Guarantee Sound pressure level without enclosure: 101 dB(A) at 3.3 feet (at design point)

n. Free Field Noise Guarantee Sound pressure level with enclosure: 77 dB(A) at 3.3 feet (at design point)

o. Package BHP to include pressure loss through a clean inlet filter/ silencer, pressure loss of the exhaust silencer and check valve.

p. Package Performance shall be guaranteed to ISO 1217 with a tolerance is +/- 5% on volume flow and +/- 5% on package horsepower. Manufacturer of blower must provide data for purchased machine.

q. Sound data shall be from an ISO 2151 method of measurement, in an ISO 3745 qualified test facility. Sound data shall be compliant with a Declaration of Conformity assessment standard.

4.04 PRESSATE TANK BLOWER

A. The Pressate Tank Blower shall be manufactured by Aerzen, Kaeser, Atlas Copco, Universal or Equal. **(*Addendum 1, Issued December 16, 2024)***

B. Service:

1. The blowers will be used to supply atmospheric air to the pressate tank. The normal liquid level in the pressate tank above the aeration diffuser will be 7 feet. The inlet temperature to the blower will be between 0 degrees F and 100 degrees F.

a. Quantity: 1

b. Basis of Design: Aerzen Model GM 7 L DN 80

c. Design Inlet Temperature: 100 Degree Fahrenheit

d. Site Elevation: 1012 Feet above sea level

e.	Design Inlet Pressure (abs):	14.17 psia
f.	Design Humidity:	80%
g.	Design Flow Inlet Volume:	200 SCFM
h.	Design Discharge Pressure (abs):	2.81 psia
i.	Main Rotor Speed:	3740 rpm
j.	Brake Horsepower (Max):	4.4 BHP
k.	Motor Size (Max):	5 HP
l.	Power:	3 phase, 460 volts
m.	Panel:	5 HP VFD NEMA 4X Package Mounted

n. Free Field Noise Guarantee Sound pressure level without enclosure: 86 dB(A) at 3.3 feet (at design point)

o. Free Field Noise Guarantee Sound pressure level with enclosure: 70 dB(A) at 3.3 feet (at design point)

p. Package BHP to include pressure loss through a clean inlet filter/ silencer, pressure loss of the exhaust silencer and check valve.

q. Package Performance shall be guaranteed to ISO 1217 with a tolerance is +/- 5% on volume flow and +/- 5% on package horsepower. Manufacturer of blower must provide data for purchased machine.

r. Sound data shall be from an ISO 2151 method of measurement, in an ISO 3745 qualified test facility. Sound data shall be compliant with a Declaration of Conformity assessment standard.

END OF SECTION

SECTION 11441
SLUDGE MACERATOR

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing one in-line sludge macerator complete with required appurtenances. The macerator will be located in the Biosolids Handling Building.

B. All work performed under this Section shall comply and be in accordance with approved trade practices and manufacturer's recommendations.

C. The macerator equipment manufacturer shall have substantial experience and expertise in similar process applications and shall guarantee that the units provided will effectively grind the material described in Part 4.

D. Additional product requirements are specified in Section 01350.

1.02 MANUFACTURER

A. It is the specific intent of this Section to limit the equipment furnished to a product of a major process equipment manufacturer that has substantial experience and expertise in similar size sludge macerators and that will assume responsibility with respect to the overall functional capability of the equipment provided.

B. Macerator components shall be furnished by a single manufacturer who has adequate experience and experimental data, in the judgment of the Engineer, concerning aerators of the type to be furnished for this Section. The manufacturer shall assume the responsibility for integrating the various components, regardless of manufacturer, to produce a complete sludge macerators.

C. The drawings and specifications are based upon JWC Environmental Inc., Model 10000-0806. The other named acceptable manufacturers, Seepex and Volgelsang may have slight differences.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Manufacturer's warranty.

c. Manufacturer certification/affidavit.

d. Manufacturer's literature.

e. Information and data concerning the materials of construction, salient components and details of construction of equipment and components.

f. Motor data in accordance with Section 11050.

2. Information for the Record:

a. Performance data.

b. Equipment supplier’s written report that equipment:

1) Has been properly installed.

2) Has been operated satisfactorily.

c. Operation and Maintenance information.

1.04 WARRANTY

A. The manufacturer shall warrant, in writing, that all equipment supplied by them shall be free from defects in material and workmanship, for a period of one year from the date of substantial completion.

1.05 ELECTRICAL AND CONTROL COORDINATION

A. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items under the Section the equipment is specified. The increased wiring, conduit, and starter costs shall be included in the motor or equipment cost under the Section the equipment is specified and no additional compensation will be allowed.

B. Equipment and panels shall be NEMA 4X unless designated otherwise on the Drawings, or in the electrical or equipment specifications.

C. Certain equipment furnished under this Section shall be connected to the plant control system as shown on the P&ID Drawings. Mechanical and electrical components for these connections shall be furnished, under this Section, as required to provide control functions compatible with the plant control system. These connections and any remote-control connections shall be furnished and wired to clearly labeled terminal strips within the equipment control panel.

D. If the electrical control requirements change from that specified or shown on the Electrical or P&ID Drawings due to the requirements of the actual equipment furnished, the Contractor shall perform all necessary modifications under this Section and no

additional compensation will be allowed. The final installation shall meet the operational intent of that specified and shown on the Drawings.

PART 2 PRODUCTS

2.01 SLUDGE MACERATOR

A. Macerator shall be ~~JWC Model 10000-0806~~ JWC Environmental, Seepex, Moyno EZ Strip, Vogolsang or Equal. Basis of Design: JWC Model 10000-0806.
(Addendum 1, December 16, 2024)

B. A vertical mount in-line sludge macerator shall be installed with cast iron or steel housing as indicated on the Drawings. The macerator shall be suitable for continuous operation on digested sludge containing solids content between 2 to 6 percent by weight. The system shall be capable of passing 500 gpm of sludge. Pressure drop through macerator shall be maximum 1.53 psi at design flow.

C. The macerator shall consist of a single shaft design mounted vertically. The shaft shall be made of stainless steel and supported by two bearings mounted between the input drive coupling and cutter mechanism. The bearings shall be grease lubricated and isolated from the pumpage by a single mechanical seal with silicon carbide faces.

D. The arrangement shall include a single rotating headstock containing four tungsten carbide tipped cutting edges running against a hardened, ground, and precision lapped tool steel shearplate. The headstock shall be mounted on a mechanism which maintains the contact between the headstock cutter tips and the shearplate throughout the life of the cutters, thereby providing maximum efficiency and performance while eliminating the need for a reversing control package. The cutter head assembly shall be designed such that the headstock and shearplate can be replaced in less than 60 minutes without removal of piping. The surface of the cutting elements shall have a hardness of Rockwell C of 60 or greater.

E. Housings and covers shall be made of carbon steel. Both inlet and outlet flanges mate to 6 inch, ANSI 125 lbs., flat face.

F. All wettable O-rings within the macerator shall be fluoroelastomer.

G. The bearings shall be grease lubricated, ball and roller type, designed for minimum B-10 life of 30,000 hours under maximum load conditions.

H. The macerator shall be equipped with two inspection ports, located 180 degree apart, in order for the cutter assembly to be inspected.

I. The macerator shall be designed to minimize the chances of jamming, thereby eliminating the need for sophisticated reversing controls. No reversing controls are required.

J. The unit shall be driven by a direct coupled gear reducer capable of operating reliably in high shock 24 hours a day service. The unit motor shall be a 3 phase, 460 volt motor

with a TEFC enclosure. A flexible coupling shall be used to isolate the reducer from the main machine.

K. A three-position "Hand-Off-Auto" switch shall control the mode of operation. The controller shall sense overload currents indicating a jam condition. An "Alarm" light shall be illuminated.

1. Indicator lights shall be provided as follows:

   a. A Green "Run Light" shall indicate the macerator is running.

   b. A Red "Trip Light" shall indicate an alarm condition.

2. Two sets of contacts shall be provided as follows:

   a. One for FAIL signal output.

3. In auto mode, the macerator shall accept an input to run whenever the sludge pump is running.

2.02 MOTOR AND EQUIPMENT REQUIREMENTS - WIRING, CONDUIT, AND STARTER

A. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, and/or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items. The increased wiring, conduit, and/or starter cost shall be provided at no additional cost to the Owner.

B. All electrical, instrumentation, and control equipment and panels furnished under this Section shall conform to appropriate Sections of Division 16 of these Specifications. Equipment and panels shall be NEMA 4X, or explosion proof as designated on the Electrical Drawings in the Electrical Specifications, or in this Section, unless designated otherwise.

C. Certain equipment furnished under this Section shall be connected to the plant control system as shown on the P&ID Drawings. Mechanical and/or electrical components for these connections shall be furnished as required to provide control functions compatible with the plant control system. Those connections and any remote control connections shall be wired to clearly labeled terminal strips within the equipment control panel.

D. All electrical motors shall conform to the requirements of Section 11050.

2.03 SHOP PAINTING

A. Shop painting shall be in accordance with the requirements of Section 01350.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be complete and in accordance with the manufacturer's recommendations, engineers' instructions, and Contract Documents.

B. All lubrication required for initial operation shall be furnished with the equipment applied in accordance with the manufacturer's recommendations.

C. The Contractor shall furnish the services of a manufacturer's factory serviced person for final inspection, startup and training of all equipment furnished by the manufacturer and to instruct Owner and Contractor personnel in proper operation and maintenance procedures. A minimum of one trip and one day for final inspection and one trip and one day for training shall be required.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

This page was intentionally left blank.

SECTION 11735
PUMPING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installing of pumping equipment as shown on the Drawings, as scheduled in Part 4, and as specified herein.

B. The pumping equipment shall be furnished with all drives, drive shafts, couplings, steady bearings, belts, drive shaft and belt guards, drive bases, pump bases, anchor bolts, anchor bolt sleeves, and other appurtenances as specified or required for a complete installation and satisfactory operation.

C. All Work performed under this Section shall be in accordance with all approved trade practices and manufacturers' recommendations.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
    a. Manufacturer's warranty.
    b. Manufacturer certification/affidavit.
    c. Manufacturer's literature.
    d. Manufacturer's certified test curves (computer model printouts are not acceptable).
    e. Information and data concerning the materials of construction, salient components and details of construction of equipment and components.
    f. Motor data in accordance with Section 11050.
2. Information for the record.
    a. Manufacturer's installation instructions.
    b. Operation and maintenance manuals.
    c. Manufacturer's certification of installation.

1.03 QUALITY ASSURANCE

A. Manufacturer Warranty and Service Packages:

1. Warranty Submittals - At the time of shop drawing submittal, the Contractor shall submit a written warranty from the manufacturer(s) covering workmanship and materials on those pumps with drive motors of 7-1/2 hp or larger when used as intended for this installation. Warranty period shall be one-year, unless specified otherwise. The warranty period shall commence on the date of Substantial Completion. Under terms of this warranty, the manufacturer shall furnish and install all replacement parts for any defective component at no cost to the Owner. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

2. Owner shall have the option to purchase additional manufacturer warranty options and service package plans, for a cost. Contractor shall provide, upon request, the warranty and service plan information and their respective cost.

3. Warranty options should include, but not be limited to:

a. Prorated warranties, terms and conditions, and length of time.

b. A full replacement (non-prorated) warranty, terms and conditions, for time frames up to 5 years.

c. Service package plans.

B. Manufacturer Certification/Affidavit:

1. Manufacturer shall provide affidavit certifying that:

a. Manufacturer has examined the Contract Documents, including but not limited to the Drawings and specifications.

b. Understand the installation and parameters specified herein and shown on the Drawings.

c. The equipment specified is suitable for this application.

d. Notified Owner and Engineer of any modifications required to the system or the equipment in this application.

PART 2 PRODUCTS

2.01 PUMPS

A. General:

1. Each pump shall be designed and furnished to meet the operating conditions specified in Part 4 of this Section. The type of pump for each service is given in the Schedule in Part 4.

2. Each pump shall be of the manufacturer and model listed in Part 4 or equal. All pumps used for one type of service shall be of the same manufacturer.

3. Each pump shall be shop tested in accordance with standards of the Hydraulic Institute. Certified test curves indicating capacity, head, efficiency, brake horsepower, and speed shall be submitted to the Engineer for approval. No pump shall be shipped to the job site until the test curves have been approved by the Engineer.

4. No point on the centrifugal pump performance curve shall require more than the nameplate horsepower of the drive motor.

B. Centrifugal Pumps:

1. Centrifugal pumps shall be in accordance with the requirements described in the following paragraphs and in Part 4 of this Section. Pumps shall be either horizontal or vertical as indicated in Part 4.

2. The pump casing shall be of the one-piece volute type with integral ANSI 125-pound discharge flange and arranged as shown on the Drawings. It shall be made of ductile iron, unless specified otherwise in Part 4, of sufficient strength, weight, and thickness to provide accurate alignment and prevent excessive deflection. The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction or discharge connections and provided with a large handhole to permit inspection and cleaning of the pump interior. The handhole cover shall be bolted and its inner contour shall match the contour of the casing. Lifting eyes shall be furnished to facilitate handling. The discharge nozzle shall be tapped for gauge connection and shall have 125pound flanges. The casing shall have vent and drain connections.

3. Each pump shall have a suction head of ductile iron unless specified otherwise in Part 4 and designed to provide equal flow distribution to the impeller eye. It shall be provided with an ANSI 125-pound suction flange, a hand hole with removable cover and tapped gauge connection. The suction head on vertical pumps shall be either an elbow integrally cast with a pump support base or a straight nozzle integrally cast with a pump base as specified in Part 4.

4. The impeller shall be single-stage end suction mixed flow enclosed type with a minimum number of vanes and shall be designed to prevent clogging and to pass 3-inch diameter solids, unless specified otherwise in Part 4; trash; and stringy materials contained in sewage. The impellers shall be made of ductile iron, unless specified otherwise in Part 4, accurately machined and polished to remove hollows or projections which might encourage cavitation. Each impeller shall be statically and dynamically balanced prior to assembly. The impeller shall be secured to the shaft with a key and contoured lock nut, which in turn is secured by a locking screw. The arrangement shall be such that the impeller cannot be loosened by torque from either forward or reverse rotation.

5. Wear rings of dissimilar material and a means of maintaining pump efficiency shall be provided.

6. Pump shafts shall be of heat treated alloy steel of sufficient size to transmit the full driver horsepower with a liberal safety factor and shall be accurately machined over the entire length. Sleeve material shall be hardened stainless steel for packing or 316SS for mechanical seals. The shafts shall be protected from wear in the stuffing box by a removable hardened 13% chrome steel shaft sleeve sealed to prevent leakage between the sleeve and the shaft.

7. The stuffing box shall be cast integrally with the stuffing box head, designed to accommodate commercially available sealing designs (single, double, tandem, & cartridge mechanical seals, or standard packing). An integral seal housing/bearing frame design where failure of the secondary mechanical seal will allow contamination of the bearing housing is not acceptable. Any leakage will be retained by a drainable reservoir, integral with the bearing housing. A 0.75-inch NPT hole will be provided to connect seal water drainage piping. The packing gland shall be of the material specified in Part 4.

8. Bearings shall be of the cylindrical roller or tapered roller type as required, mounted in a removable cast iron frame. The bearings shall be arranged to eliminate all radial play and designed for a minimum B-10 life of 100,000 hours in accordance with AFBMA. The bearings shall be oil or grease lubricated as indicated in Part 4. Grease lubricated bearings shall have Alemite fittings. Suitable seals shall be provided in the bearing covers to prevent the entrance of contaminants.

9. Each horizontal pump shall have a flexible type coupling and shall be mounted on a common cast iron or steel base with its drive unit.

10. Vertical pumps shall be direct coupled or shall have intermediate shaft as indicated on the Drawings.

    a. Each direct coupled pump shall have a driver pedestal. The driver pedestal shall be of sufficient size, strength, and rigidity to support the driver and prevent excessive vibration. It shall be made of fabricated steel and provide for easy access to stuffing box, bearing frame, and coupling for maintenance. An expanded metal coupling guard shall be provided. This guard shall be positioned to protect against contact with coupling end to shaft and coupling, but still allow easy access to bearing lubrication fittings and stuffing box connections. Pedestal shall be designed to allow the complete pump rotor consisting of bearing frame shaft, stuffing box, and impeller to be removed as a unit without disturbing suction and discharge piping, driver, or pedestal.

    b. Shafting and steady bearings as necessary shall be provided between pumps and drivers on pumps with intermediate shafts. The pump manufacturer shall provide with each pump, a pump mounted safety

cage around pump drive shafting. The safety cage shall meet OSHA requirements and extend a minimum of 8-feet above the operating floor. The cage shall be so designed that it will not interfere with servicing of the pump. The pump manufacture shall also provide with each pump a safety cage meeting the same requirements for each floor through which the shafting passes.

C. Booster Pumps

1. Contractor shall test and document the water system pressure at Biosolids Handling Building and document in Booster pump shop drawing. Contractor to document flow and pressure needs of press, polymer and seal water systems in booster pump submittal. Booster pump system should be able to supply flow and pressure needed for dewatering press system, polymer system and seal water systems for the Dewatering Press Feed Pumps and Day Tank Recirculation Pump.

2. Pumps shall be ANSI NSF 61/NSF372.

3. The pumps shall be of the in-line vertical multi-stage design.

4. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at best efficiency point.

5. Vertical in-line multi-stage pumps shall have the following features:

   a. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.

   b. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as determined by the pump manufacturer.

   c. Suction/discharge base, pump head, motor stool: Cast iron (Class 30)

   d. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel

   e. Shaft 316 or 431 Stainless Steel

   f. Impeller wear rings: 304 Stainless Steel

   g. Shaft journals and chamber bearings: Silicon Carbide imbedded with graphite

   h. O-rings: EPDM

6. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling, and motor. The entire cartridge shaft seal shall be removable as one piece component.

7. Each motor shall have an integrated variable frequency drive consisting of a permanent magnet synchronous motor and variable frequency dive built and

tested as one by the manufacturer. An integral RFI filter shall be standard in the VFD.

8. A 10 gallon bladder type diaphragm tank shall be piped to the discharge manifold or system piping downstream of the pump system.

D. Vertical Dry Pit Chopper Pump

1. Casing and back pull out plate shall be volute design, spiraling outward to Class 125 flanged centerline discharge.

2. The impeller shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings with a set clearance between them of 0.015 to 0.025 inches cold.

3. The cutter bar plate shall be recessed into the pump bowl and shall contain at least 2 shear bars extending diametrically across the intake opening and within 0.010 to 0.030 inches. Cuter bar shall be cast alloy steel or alloy steel heat-treated to minimum Rockwell C 60.

4. The impeller shall be secured using a cutter nut. The cutter nut shall be cast alloy steel heat treated to minimum Rockwell C 60.

5. The pump shaft shall be heat treated alloy steel.

6. The bearings shall be oil-bath lubricated with ISO grade 46 oil. L-10 bearing life shall be minimum 100,000 hours.

7. The bearing housing shall be ductile cast iron.

8. The studding box shall be ductile cast iron and shall accommodate the mechanical seal.

9. The pump shall have a mechanical seal with throttle busing and water fitting for seal water flush. The mechanical seal shall be 316 stainless steel. The seal shall be positively driven by set-screws. Elastomers of Buna N shall be of the cup-mounted type.

10. The inlet manifold shall be mounted vertically on a 90 degree carbon steel elbow with a Class 150 inlet flange., cleanout, ¼" NPT suction pressure tap, drain connection, and pedestal base.

E. Progressing Cavity Pumps:

1. Progressing cavity pumps shall be in accordance with the requirements described in the following paragraphs and Part 4 of this Section.

2. Each pump casing shall be cast stainless steel. Suction and discharge ports shall be tapped for gauge connections and shall have ANSI 125 pound flanges. Casing shall be tapped for drain and shall have a large inspection port.

3. Unless specified otherwise in Part 4, internal parts including the rotor shall be tool steel. The rotor shall be chromium plated.

4. Unless specified otherwise in Part 4, the stator shall be Hycar Buna-N synthetic rubber or equal.

5. The pump drive shaft shall be machined steel of sufficient size to transmit the full driver horsepower without transmitting radial loads to the stuffing box area.

6. Seals shall be Teflon fiber impregnated with graphite stuffing. Packing shall be for water flush. The packing gland shall be of the split type.

7. Bearings shall be grease lubricated ball type. The bearings shall be designed for a minimum AFBMA B-10 life of 30,000 hours.

8. Universal joint shall be gear type, completely sealed from process fluids.

9. Each pump and drive shall be mounted on a common steel base. Bases shall be fabricated steel provided with sump located under stuffing boxes and furnished with 1-inch tapped drain opening.

F. Submersible Pump:

1. Submersible centrifugal pumps shall be in accordance with the requirements described in the following paragraphs and in Part 4 of this Section.

2. Unless specified otherwise in Part 4, the motor shall be explosion proof and conform with Section 11050.

3. The pump shall be easily removed from its chamber to ground level for inspection or service without requiring dewatering of the chamber. This shall be accomplished by utilizing a sliding guide bracket attached to the pump, two guide bars adequately braced, a cadmium pull chain reaching ground level, and a specially formed discharge flange that will automatically and firmly connect and disconnect with the discharge pipe without bolts, nuts, fasteners, or extreme force.

4. Major pump components shall be of ASTM A-48, Class 35B cast iron with smooth surfaces. Where watertight sealing is required, O-rings made of nitrile rubber shall be fitted into machined surfaces so that metal to metal contact is maintained. All exposed nuts and bolts shall be 304 stainless steel.

5. The impeller shall be coated with PVC epoxy and dynamically balanced. The fit between the impeller and the shaft shall be a sliding fit with one key. The volute shall be of single piece design.

6. A wearing ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrite rubber molded with a steel ring insert which is drive fitted to the volute inlet and a rotating 304 stainless steel ring which is drive fitted to the impeller eye.

7. Each pump shall be provided with a tandem mechanical rotating shaft seal arrangement running in an oil reservoir. The lower seal unit between the pump and oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper seal unit shall have one positively driven carbon ring and one tungsten-carbide stationary ring. The seals shall require neither maintenance nor adjustment, but shall be readily inspected and replaced. The oil chamber shall be designed to assure that air is left in the oil chamber to absorb the expansion of the oil due to temperature variations.

8. Each unit shall be provided with an adequately designed cooling system consisting of a water jacket which encircles the stator housing. The water jacket shall be provided with a separate circulation of the pumped liquid. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall also be provided.

9. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel.

10. Unless otherwise noted in Part 4, the pumping units shall be furnished complete with sliding brackets, guide bars, cadmium plated pull chain, aluminum access doors, power cables, permanently installed discharge connection elbows, and all other necessary appurtenances.

    a. Sliding bracket shall be integral with the pump and shall be of cast iron.

    b. A minimum of two guide bars shall be provided with each installation for guiding the pump unit to and from its operational position. The bars shall be of stainless steel pipe of the size recommended by the manufacturer. Bars at no time shall carry any of the pumps' weight. Bracing for guide bars shall be spaced at a maximum of 8-feet.

    c. Cadmium plated pull chain shall be of adequate length and size to lift pump to ground level from operating position.

    d. Aluminum access doors shall meet OSHA requirements, be skid proof, and provide guide bar holders and cable holders.

    e. Power cable shall be hypalon jacketed SPC cable.

    f. The discharge elbow shall be of cast iron and shall support the pump when the pump is in its operational position.

2.02 VARIABLE SPEED DRIVES AND CONTROLS

A. Variable Frequency Drive:

1. Variable frequency drives shall conform to the requirements of Section 16230.

2.03 MOTORS

A. Motors shall conform to the requirements of Section 11050.

2.04 ACCESSORIES

A. Each pump shall be provided with easily identifiable terminal points to facilitate the exchange of the central control functions between the pumps and the process control system as indicated on the Contract Drawings.

B. Pressure Gauges and Connections:

1. Pump suction and discharge flanges shall be tapped for gauge connections as indicated in Part 4 of the Specifications.

2. Gauge connections shall be 1/2-inch in diameter.

3. Each connection shall include a shutoff needle valve and necessary lengths of pipe to allow the mounting of a pressure gauge. The open end on the gauge connection shall be plugged to prevent the accumulation of debris.

4. Each pump or set of pumps used for one application shall be supplied with two pressure gauges. One gauge shall be adequately sized to indicate discharge pressure while the other shall be adequately sized to indicate the suction conditions. The gauges shall be properly installed on the pump suction and discharge lines. Gauges shall be a product of H. O. Trerice, Ashcroft, or equal as specified in Section 15400.

5. Submersible pumps shall be supplied with a discharge gauge only. Gauge shall be located in the discharge piping at a location easy to access.

C. Each set of pumps shall be provided with one set of special tools required for complete service and maintenance.

2.05 SHOP PAINTING

A. Shop painting shall be in accordance with the requirements of Section 01350.

PART 3 EXECUTION

3.01 ERECTION

A. The equipment shall be erected in accordance with the manufacturer's recommendations. Required grout and leveling shims shall be provided by the Contractor.

B. All stuffing boxes, seals, packing glands shall be piped to the nearest drain with 1/2-inch Schedule 40 PVC pipe.

3.02 INITIAL LUBRICATION

A. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

3.03 INSPECTION, START-UP, AND TESTING

A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, start-up, and training services. The manufacturer's representative shall be experienced in the installation, start-up, operation, and maintenance of the equipment.

B. The representative shall check the installation and supervise final adjustments and initial start-up of the equipment. The representative shall certify that the installation is correct and that the equipment is operating satisfactorily.

C. Within two weeks of start-up, the manufacturer shall submit to the Engineer a written report (minimum 4 copies) covering the representative's inspection and start-up of the equipment. This report shall include the manufacturer's certification that the installation is correct and that the equipment is operating satisfactorily.

D. After the installation and operation of the equipment has been certified, the manufacturer's representative shall train the Owner's personnel for one, eight-hour day in the proper operation and maintenance of the equipment. The Owner may videotape the training.

PART 4 SPECIAL PROVISIONS

4.01 PUMP SCHEDULE

A. The following tables provide the operating conditions, type of pump, manufacturer name and model number, along with salient features specific to each manufacturer. The pumps listed are selected for the specified service and acceptable to the owner.

B. The listed pumps, for the specified service, are intended to provide equal operation in the application, therefore there may be variations from one manufacturer to another.

4.02 BOOSTER PUMP SKID

The equipment shall be manufactured by Grundfos (Model: Hydro Multi-E 2CRE), Metropolitan Industries or Equal. ***(Addendum 1, December 16, 2024)***

Description	Basis of Design: Grundfos
Quantity	2
Type	Vertical Multistage Centrifugal
Model No.	Hydro Multi-E 2CRE
Solids Content	0% (NPW)
Temperature	Ambient
pH	6-7
Suction Condition	Negative
Stator or Impeller Type	Splined Shaft Arrangement
Casing & Impeller Coating	304 Stainless Steel
Seal Type	O-ring, EPDM

Description	Basis of Design: Grundfos
Bearings	Leadless Tin Bronze
Motor HP	1.5
Motor RPM	3232
Pump RPM	3599
Inverter Duty (VFD)	Integrated VFD/motor
Voltage	460 V
Phase	3
Minimum Pump Efficiency (at design point)	66.95%
Design Points (gpm/ft TDH)	35/57.81 45/65.46
Certified Test Curve (Yes/No)	Yes

4.03 DIGESTER PUMPS

The equipment shall be manufactured by FLYGT (Model: NP-3085.930), Sulzer, KSB, Ebara-Hayward Gordon or Equal. ***(Addendum 1, December 16, 2024)***

Description	Basis of Design: Flygt
Quantity	3
Type	Submersible
Model No.	NP-3085.930
Solids Content	2-5%
Temperature	Max 104°F
pH	6-7
Suction Condition	Flooded
Impeller	Hard Iron
Casing & Impeller Coating	Grey cast iron
Impeller Trim	452
Seal Type	Double mechanical seal
Lubrication	Seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate
Bearings	Upper: single deep groove ball bearing Lower: two row angular contact bearing to compensate for axial thrust and radial forces
Motor HP	3.5
Motor RPM	1800
Pump RPM	975
Inverter Duty (VFD)	Yes
Voltage	460
Phase	3
Minimum Pump Efficiency (at design point)	61.1%
Design Point (gpm/ft TDH)	310/24
Approximate Points (gpm/ft TDH) (on pump curve)	Truck fill (tank min fill): 230 gpm, 27.5 ft Truck fill (tank max fill): 320 gpm, 24 ft Digester 2 to Digester 1 (tank min fill): 385 gpm, 20.5 ft

Description	Basis of Design: Flygt
	Digester 1 to Digester 2 (tank min fill): 385 gpm, 15.5 ft (pump operating at 55 Hz) Digester 2 to Digester 1 (tank max fill): 440 gpm, 13.5 ft (pump operating at 55 Hz) Digester 1 to Digester 2 (tank max fill): 470 gpm, 8.5 ft (pump operating at 50 Hz)
Certified Test Curve (Yes/No)	Yes

4.04 PRESSATE PUMP

The equipment shall be manufactured by FLYGT (Model: NP-3085.MT 3), Sulzer, KSB, Ebara-Hayward Gordon, or Equal. ***(Addendum 1, December 16, 2024)***

Description	Basis of Design: FLYGT
Quantity	1
Type	Submersible
Model No.	NP 3085 MT 3
Solids Content	<1%
Temperature	Ambient
pH	6-7
Suction Condition	Flooded
Impeller	Hard Iron
Stator Housing Material	Grey Cast Iron
Seal Type	Double mechanical seal
Motor HP	3
Motor RPM	1750
Pump RPM	1705
Inverter Duty (VFD)	Yes
Voltage	460
Phase	3
Minimum Pump Efficiency (at design point)	61.7%
Design Point (gpm/ft TDH)	318/17.8
Approximate Points (gpm/ft TDH) (on pump curve)	275/19.8
Certified Test Curve (Yes/No)	Yes

4.05 VOLUTE DEWATERING PRESS PUMP

The equipment shall be manufactured by Moyno (Model: 1E036G1CDQ3AWA), Seepex, or Equal. ***(Addendum 1, December 16, 2024)***

Description	Basis of Design: Moyno
Quantity	2
Type	Progressive Cavity
Model No.	1E036G1CDQ3AWA
Solids Content	2-5%
Temperature	32°F - 113°F

Description	Basis of Design: Moyno
pH	5-9
Suction Condition	Flooded
Stator or Impeller Type	Nitrile Stator
Casing & Impeller Coating	Cast Iron
Impeller Trim	Sensor sleeve 1.4404
Seal Type	Double Mechanical Seal
Motor HP	3.45
Motor RPM	1750
Pump RPM	278
Inverter Duty (VFD)	Yes
Voltage	230/460
Phase	3
Design Point (gpm/ft TDH)	105/17.1
Certified Test Curve (Yes/No)	Yes

4.06 RECIRCULATION PUMP

The equipment shall be manufactured by Vaughan (Model: PE3F6CS-055), Ebara – Hayward Gordon or Equal. ***(Addendum 1, December 16, 2024)***

Description	Basis of Design: Vaughan
Quantity	1
Type	Vertical Dry Pit Chopper Pump
Model No.	PE3F6CS-055
Solids Content	2-5%
Temperature	32°F - 113°F
pH	5-9
Suction Condition	Flooded
Impeller	5.5”, cast steel
Casing	Ductile cast iron
Impeller Trim	5.5” C
Seal Type	Mechanical
Bearings	Oil bath lubricated with minimum 100,000 hour L-10 bearing life
Motor HP	5
Motor RPM	1170
Pump RPM	1170
Inverter Duty (VFD)	No
Voltage	230/460
Phase	3
Minimum Pump Efficiency (at design point)	25%
Design Point (gpm/ft TDH)	200 gpm @ 3.54 ft
Certified Test Curve (Yes/No)	Yes

END OF SECTION

SECTION 11835
VOLUTE DEWATERING PRESS

PART 1 GENERAL

1.01 SCOPE

A. This Section shall include furnishing one Volute Dewatering Press' as specified and indicated on the drawings and as required to meet the specified performance requirements.

B. The Volute Dewatering Press shall be a complete prefabricated system consisting of:

1. Sludge conditioning system consisting of two-stage flocculation tanks with mixing tanks with gear motor and mixing impeller to allow efficient mixing of polymer in the sludge and a flocculation tank including gear motor and large cross-sectional area agitator.
2. Three x 300 series "Dewatering drums" including spray wash down system and gear drives.
3. Support structure for the Dewatering Drum including filtrate collection pan and outlet plumbing.
4. A self-contained electrical and control panel including control for ancillary equipment such as sludge, polymer, and booster feed pumps and conveyors.
5. Each Dewatering Drum shall be equipped with an isolation valve located on the discharge line from the flocculation tank.

C. Appurtenances supplied by others and required to be coordinated and controlled by volute dewatering equipment.

1. Two sludge feed pumps per Section 11735,
2. One polymer feed systems per Section 11233,
3. One magnetic flow meter per Section 16902,
4. One shaftless screw conveyor per Section 14551,
5. One pressate holding tank pump per Section 11735

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
   a. Complete description in sufficient detail to permit an item comparison with the specification.

b. Dimensions and installation requirements.

c. Descriptive information including catalogue cuts and manufacturers' specifications for major components.

d. Electrical schematics and layouts.

e. Hydraulic calculations demonstrating compliance with the required hydraulic characteristics.

2. Information for the Record:

a. Manufacturer’s certification of installation.

b. Provide operation and maintenance manuals.

c. Provide an electronic copy of the PLC program to the owner for restoration of the system program.

1.03 WARRANTY

A. The manufacturer shall warrant, in writing, that all equipment supplied by them shall be free from defects in material and workmanship, for a period of two years from the date of substantial completion. Five-year standard warranty shall apply to mechanical parts.

1.04 CONDITIONS OF SERVICE

A. The sludge dewatering equipment shall be designed to adequately condition and dewater the sludge such that a dewatered sludge cake is produced that easily discharges from the dewatering unit, without blinding or plugging, and that may be handled by the existing solids conveying equipment.

B. Each unit shall be designed to operate in the environment for which it is intended, continuously or intermittently on demand, and shall perform the required dewatering operations without spillage of water or sludge beyond the nominal machine envelope. In addition, the unit will operate with no requirement for operator attention other than periodic inspection and chemical replenishment.

1.05 QUALITY ASSURANCE

A. All components of the sludge dewatering equipment shall be engineered for long, continuous, and uninterrupted service with minimal operator intervention. Provisions shall be made for easy maintenance, adjustment, or replacement of all parts.

B. To ensure unity of responsibility, the screw press, supporting frames, isolation valves, flocculation tank, mixer and control system shall be coordinated by a single supplier. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire screw press dewatering system package.

C. Prior to shipment, the Volute Dewatering Press and control panel shall be factory tested at the place of assembly. Factory test each pre-assembled, pre-wired, Volute

Dewatering Press and its associated control panel to be supplied to the job site. Prior to shipment, verify through a one-hour continuous operating test that the Volute Dewatering Press and associated equipment operate smoothly, noiselessly, vibration free, and without overheating of any bearing or motor.

D. The owner/engineer shall, at their option, be permitted to witness the factory quality control test at the manufacturer's facility. The manufacturer shall give the owner/engineer a minimum of one weeks' notice prior to testing.

E. The Supplier shall have at least ten full-scale systems utilizing the exact technology proposed for this project operating successfully for at least three years in North America at municipal wastewater treatment plants that were furnished under the manufacturer's own name.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturer:

1. Volute Dewatering Press Model ES-303 as supplied by Process Wastewater Technologies LLC, Rosedale, MD.

2.02 MATERIALS AND COATINGS SCHEDULE

A. All materials utilized in the construction of the sludge dewatering equipment shall be entirely suitable in every respect for the service required. All metals in contact with polyelectrolyte or sludge, and all other metal components other than those specified below in Table 1 shall be stainless steel, type 304 or 316.

B. No carbon steel will be used for any part of the press.

C. The following table indicates the materials and coatings that shall be provided for the Volute Dewatering Press and related components unless specified otherwise herein:

Item of Equipment	Material
Tanks and support frame	Type 304 Stainless steel
Plumbing and Spray bars	Type 304 Stainless steel
Dewatering Drums	Type 304 Stainless steel
Dewatering Drum screw	Type 304 Stainless steel with flame coating 10Co-4Cr
Gear Motors	Die cast Aluminum and Type 304 Stainless steel
Gear Motor coating	Acrylic paint
Spray nozzles	Polypropylene
Electrical enclosure	Type 304 Stainless steel
Electrical wiring housing	Non-metallic flexible liquid-tight conduit and fittings
Valves – wetted sections	Stainless Steel, EPDM Seating

2.03 STRUCTURAL COMPONENTS

A. The structural support frame shall be fabricated of type 304 stainless steel members conforming to the latest ASTM Standard Specifications for Structural Steel, Designation A36. It will be a rigid structure, adequately braced to withstand intended loads without excessive vibration or deflection.

B. The framework shall be of welded and/or bolted construction. All welding shall conform with the American Welding Society Structural Welding Code.

C. The structure shall be designed for installation on a prepared concrete foundation, suitable flat concrete slab, or fabricated platform and secured with anchor bolts.

D. The construction shall allow easy access and visual inspection of all internal components.

2.04 DEWATERING DRUMS

A. The dewatering drums will be constructed of ATSM type 304 SS. All circular components will be laser cut to ensure maximum evenness of wear and therefore operating life.

B. Assembly will be undertaken in such a way that all fixed rings are concentric and parallel. All fixed rings will be equally spaced apart for each section of the dewatering drum. When mounted on the retaining rods and installed, all moving rings will move freely between the fixed rings.

C. Each Dewatering Drum shall be equipped with individual spray bars. Each spray bar shall consist of a spray pipe fitted with spray nozzles, located above the dewatering drum. The spray pipe and spray nozzle assembly shall be readily removable. Nozzle spacing, and spray pattern shall be such that the sprays from adjacent nozzles overlap one another on the dewatering drum surface. The sprays will operate periodically and will remove solids built up externally on the drum such that over time no significant buildup of solids occurs on the drum.

D. The filtrate drain shall be a 6-inch flanged connection and shall be mounted under the dewatering drums housing for easy access to the drainage sump.

E. Each Dewatering Drum will have a drive motor:

1. The Dewatering Drum drive motor will be a one-piece gearmotor. Gearmotors will be hollow shaft design designed to drive the dewatering drum screws with no additional couplings or joints. Motors will be filled with grease on assembly and sealed for life. Screw rotational speed shall be obtained through a hypoid reduction gear. Input power to the dewatering drum drive shall be supplied through an A.C. variable frequency drive unit.

2. Drive Motor Data:

   a. Maximum Horsepower: 1.0

   b. Power Requirements: 480 VAC, 3 phase, 60 hertz

c.	No load motor speed:	1750 RPM
d.	Gear Reduction:	750:1
e.	Output shaft speed:	2.6 RPM @ 60Hz
f.	Insulation Class:	IP65
g.	Enclosure:	TEFC
h.	Enclosure material:	Die Cast Aluminum

2.05 MIXING AND FLOCCULATION TANKS

A. Each Volute Dewatering Press shall have an integrated two-stage mixing system comprising of a flash/rapid mix tank and flocculation tank, each with mixers and drive motors. Tank sizing and design will ensure adequate residence times and mixing conditions to ensure complete flocculation and satisfactory dewatering performance. Tank design will minimize the possibility of any short circuiting of flow. The discharges from the flocculation tank shall include a valve to isolate each dewatering drum.

B. Design and manufacture of tanks and spill trays must ensure no leakage or spillage of fluids under normal working conditions.

C. Mixing and flocculation tanks will be manufactured in type 304 stainless steel and will be a minimum of 11 gauge (0.12-inch). Tanks and spill containment trays will be fully welded internally and externally.

D. The Mixing and Flocculation tanks shall be equipped with a two-inch drain mounted on the side of the tanks for easy access by the operator given the tanks mounting location as indicated on the drawings. The drain lines shall be directed to the sump. All drain lines shall be equipped with a 2-inch Stainless Steel ball valve.

E. Each Mixer will have a drive motor:

1. The mixer and flocculation tank drive motors will be a one-piece gearmotor. Gearmotors will be hollow shaft design designed to drive the mixing impeller shafts with no additional couplings or joints. Motors will be filled with grease on assembly and sealed for life. Mixer rotational speed shall be obtained through a hypoid reduction gear. Input power to the dewatering drum drive shall be supplied through an A.C. variable frequency drive unit allowing variable mixing energy to be input to the system.

2. Flash Mixing tank drive motor data:

a.	Maximum Horsepower:	1
b.	Power Requirements:	480 VAC, 3 phase, 60 hertz
c.	No load motor speed:	1720 RPM
d.	Gear Reduction:	15:1

	e.	Output shaft speed:	180 RPM @ 60Hz
	f.	Insulation Class:	IP65
	g.	Enclosure:	TENV
	h.	Enclosure material:	Die Cast Aluminum
	i.	Service Factor:	1.15
3.	Flocculation Tank Drive Motor Data:		
	a.	Maximum Horsepower:	2.0
	b.	Power Requirements:	480 VAC, 3 phase, 60 hertz
	c.	No load motor speed:	1760 RPM
	d.	Gear Reduction:	60:1
	e.	Output shaft speed:	30 RPM @ 60Hz
	f.	Insulation Class:	IP65
	g.	Enclosure:	TENV
	h.	Enclosure material:	Die Cast Aluminum
	i.	Service Factor:	1.15

2.06 CONTROL PANEL

A. Each Volute Dewatering Press shall have an integrated electrical and control system that will allow for safe, simple, and automated operation of the unit. All electrical work, motors and drives will comply with any relevant NEMA standards.

B. The electrical control system will be able to accept remote start and stop signals, and will have outputs for unit in operation, and unit alarms to an external PC.

C. Control Panel Features:

1. Enclosures: Control panel enclosures shall be wall mounted or free-standing, fabricated of type 304 stainless steel and shall be suitable for NEMA 4X service.

2. The control panel shall accept a 480 VAC, 60 hertz, 3 phase ac power input. A main disconnect circuit breaker and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system.

3. NEMA rated motor starters shall be provided for all non-VFD and DC motors.

4. Variable frequency drives (VFD) shall be provided for each dewatering drum drive, mixing and flocculation tank agitators, two volute dewatering press feed pumps, one shaftless screw conveyor, two booster pumps, one polymer system, and one pressate pump. The VFD's must support Ethernet IP with the ability to

natively be controlled over ethernet from an Allen-Bradley CompactLogix PLC. ***(Addendum 1, Issued December 16, 2024)***

5. Short circuit protection for system components shall be accomplished utilizing fuses. Individual thermal overload protection shall be provided.
6. A transformer shall be included that will provide 120 volts, ac for the polymer dilution and dosing system and control system
7. A Programmable Logic Controller (PLC) will control all timing and switching functions.
8. The Volute Dewatering Press PLC will communicate with the main PLC using Ethernet. At a minimum, the control panel is to feature a local DIN Rail 4 port network switch.

D. External Enclosure Features:

1. The external door of the panel will have the following switches and indicators:
   a. Main Isolating Switch (Circuit Breaker).
   b. Transient Surge Protection.
   c. LED Door activated panel light.
   d. An emergency stop button which shall be a mushroom head style pushbutton that when depressed shall immediately de-energize all moving equipment in the system.
2. Within a windowed enclosure mounted on the panel door:
   a. Allen-Bradley PanelView Plus 7 Color Touch Screen.
   b. An H-O-A system switch to switch the Volute Dewatering System from Auto to off to manual modes.
   c. Power on Light (white).
   d. An Operating Light -for when the unit is actually in operation - (green).
3. In addition to items located on the main enclosure door:
   a. An Alarm Light - a flashing light located on the top of the panel (red).
4. UPS.
5. Door mounted Grace Port with 120VAC GFI ckt. P/N Grace Engineering P-R2-K2RF0_2D1.
6. 20% or 25% spare I/O and Panel Space for future needs.

2.07 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Each Volute Dewatering Press will be provided with an Allen Bradley CompactLogix PLC, installed, wired and programmed to perform the following functions:

1. Operational Control:
    a. Control of all components of the Volute Dewatering System including the ability to place any component in Auto or in the Off position, set wait/run times and operating speeds for any feed pump, installed solids conveyor, dewatering drums, mixers, polymer dosing system and wash-down sprays.
2. System Tuning:
    a. PLC will allow operators to adjust operating parameters such as delay timers for fault alarms and system calibration constants.
3. Monitoring Operation:
    a. PLC will allow the operator to inspect the operation of all the components including indicators such as output frequency, current draw, thermal condition, elapsed operating times, and any faults present. Operator will be able to view approximated readouts of all operational speeds and flowrates relevant to the operation of the system.
4. Manual Operation of Components:
    a. Operator will be able to manually operate each item of equipment from the PLC interface for inspection and maintenance reasons.
5. Time Clocks:
    a. Operator will be able to set the unit to operate at specific time or on specific days with no operators present.

2.08 ELECTRICAL HARDWARE

A. Power wiring shall be 600 volt, type MTW insulation stranded copper and shall be sized for the required load, 14 AWG minimum.

B. Control wiring shall be 120 volt, type MTW insulation stranded copper and shall be sized for the required load, 18 AWG minimum.

C. Circuit breakers for the main disconnect shall be thermal magnetic molded case units. Circuit breakers shall conform to the requirements of Specification 16431 – Circuit Breakers.

D. Motor starters shall be full voltage, non-reversing or reversing depending on application, NEMA style across-the-line units. Coils shall be 120 volts ac. Motor starters shall conform to the requirements of Specification 16422 – Motor Starters and Contactors.

E. Selector switches shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10 ampere continuous service. Selector switches shall be Idec Series TWTD.

F. Pilot lights shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Units shall be 120 VAC full voltage incandescent type. Pilot lights shall be Idec Series TWTD, or equal.

G. Terminal blocks shall be high density, solderless box lug style, with 600-volt rating. Terminal blocks shall be Allen Bradley type 1492, or equal.

H. Control relays shall be general purpose type with a 10 amp contact rating, miniature square base and internal on status pilot light. Relays shall be Allen Bradley Type 700-HF Series, or equal.

I. Discrete outputs to utilize 1769-OW8I relay output cards to ensure electrical isolation from channel to channel.

J. Variable Frequency Drives (VFD) shall be UL listed and shall conform to the requirements of Specification 16230 – Variable Frequency Drive (VFD) with the following exceptions:

1. VFDs shall be mounted inside the Volute Dewatering Press Control Panel. Separate VFD enclosures are not required.

2. VFDs inside the Volute Dewatering Press Control Panel do not require separate pushbutton or potentiometer controls.

3. Any exceptions to Specification 16230 – Variable Frequency Drive (VFD) shall need to be clearly documented during shop drawing review and may only be approved with the Owners consent.

2.09 FUNCTIONAL SPECIFICATION

A. The control panel will undertake the following operations:

B. Auto-Manual Operation:

1. The Volute Dewatering Press system may be set to either Auto/Manual/Off on the control panel via a 3-position switch. This will be the “main switch” for the system.

2. When set to manual, all items may be switched on and off at the control panel by the switches on the HMI unit.

3. When set to off, no items will work whether switched on or off either at the control panel or anywhere else.

4. When set to Auto, all items of equipment will work as per the following descriptions.

C. Clock Operation:

1. The clock function will be controlled by the PLC in the control panel. Two clock functions will be allowed for in the program. The clock may be set to either “On” or “Auto/timer” via at the PLC. If the clock is set to “On” the plant will run for as

long as the main switch is set to “Auto”. When the clock is set to “Auto/Timer” the plant will operate in accordance with the clock settings.

2. Clock function settings will allow the operator to set the dewatering press and all associated equipment to switch on and off, at pre-designated times on pre-designated days with no operators being present. A minimum of two different “clock programs” will be allowed for in the PLC program.

D. Sludge Feed to Dewatering Press:

1. Sludge is fed to the dewatering press by a sludge feed pump connected to and controlled by the dewatering press control panel. A VFD will control the speed of the pump. Outputs from the control panel to the sludge feed pump will include power, start, and stop signals, and variable speed control for the sludge feed pump. In the event of a sludge feed pump shut down caused by an overload or a VFD fault, the control system will shut down the polymer feed system and an alarm will occur.

2. A flow meter will monitor the sludge flow. The operator will be able to set the flow and the feed pump will operate to maintain that flow via a PID loop. Any variations from the preset flow will cause the system to shut down and an alarm to occur.

E. Polymer Feed:

1. Polymer feed to the dewatering press is achieved by the integral polymer preparation system connected to and controlled by the dewatering press control panel.

2. Outputs from the control panel to the polymer preparation system will include power, start, and stop signals, and variable speed control for the polymer feed pump. In the event of a polymer system shut down, the control system will shut down the sludge feed pump and an alarm will occur.

3. Manual adjustment of the speed control for the polymer dilution mixing chamber will be made from the control panel. The control panel will also monitor the polymer system for faults due to low water pressure, or no polymer flow and shut the system down with an alarm should this occur.

F. Flocculation Tank Agitation:

1. Whenever the dewatering press is operating 2 motorized agitators will operate continuously, stirring the contents of the flocculation tank. These are geared motors and will be controlled by a VFD in the control panel. The operator can select the speed of these two units at the HMI.

2. A high-level sensor will detect any high fluid level in the flocculation tank and will shut down the sludge and polymer feed pumps and cause an alarm should this occur.

G. Dewatering Drums:

1. The Dewatering Drums will operate whenever the dewatering press is operating. The operator, through the HMI may select which dewatering drum to place in Auto mode. Note each dewatering drum has a manual isolation valve that will need to be opened or closed depending on which drums are placed in Auto. Each drum motor is controlled by a VFD. The operator can select the speed of the drums at the HMI.

2. Whenever the sludge or polymer feed pump shuts down, for any reason, the dewatering drums will continue to operate for a pre-set amount of time to allow sludge to be purged from the system and for the dewatering drums to be washed down before they shut down. Sprays will periodically switch on while the dewatering drum is operating. The frequency and duration of the spray are adjustable in the PLC.

H. Conveyor:

1. Conveyor will operate whenever the dewatering press is in operation and will shut down following a pre-set delay following the shutdown of the dewatering drums. Any conveyor shut down alarm will trigger a Volute Dewatering Press System alarm that will shut down the Volute Dewatering Press System.

~~2.~~ ***(Addendum 1, Issued December 16, 2024)***

2. The PWT control panel should verify the conveyors are running prior to starting other devices.

3. There is an adjustable conveyor extended run timer that causes conveyors run time to be extended after the drum run timer stops. This allows sludge cake to be cleared from the conveyors prior to shutting them down. This delay timer will apply to any conveyor controlled from the PWT panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Contactor will undertake installation of equipment in this section as per the manufacturer’s submitted instructions and in accordance with these specifications and associated plans.

B. Manufacturer will provide phone/email consultation as necessary to ensure correct installation and resolve any issues that arise during installation.

C. No on-site supervision should be required for installation; however, should the contractor deem it necessary, onsite services may be provided and charged to the Contractor at the manufacturer's standard service rates plus travel.

3.02 START-UP AND COMMISSIONING

A. Prior to start up and commissioning the manufacturer shall provide bench scale testing of the sludge to be dewatered along with polymer, including the polymer currently used

by the Owner. The Manufactures technician shall test at least two other different polymer manufactures and will make their recommendation for the most cost-effective polymer to be used. Dry polymers will not be allowed.

1. Owner to package sludge samples for delivery to the manufacturer for testing in accordance with the manufacturer's directions. The Owner will purchase the recommended polymer for startup purposes.

B. Prior to start up and commissioning the Contractor and manufacturer shall perform installation inspection to ensure all equipment is installed properly and is ready to be started up and operated.

C. The Contractor shall provide manufacturer a minimum of two weeks' notice prior to onsite start up, functional testing, and manufacturer training services.

D. Upon completion of the installation, and at a time that is deemed to be most appropriate by the Owner, the services of the manufacturer's factory trained startup technician shall be provided at the project site for equipment start-up. The following tasks will be undertaken during this time:

1. Functional Startup of equipment, calibration and setting of equipment parameters.
2. Operational startup, optimization, and data collection.
3. Operator Training.

E. Start-up or commissioning service shall be provided by the manufacturer, or their authorized representative.

F. Contractor shall ensure that start up is not performed until there is a minimum volume of sludge to allow four days of operation at dewatering system design capacity plus sludge production rates sufficient to allow plant operators to operate the press on a regular schedule following start-up and training of plant staff.

3.03 OPERATOR TRAINING

A. Upon satisfactory completion of the start-up and calibration, a representative of the manufacturer shall be provided to instruct Owner's personnel in the proper operation and maintenance of the equipment.

B. Manufacturer will provide training during the four day start-up period.

C. Training will occur during one training session for all relevant plant staff.

D. Total time for equipment training session will not exceed eight hours.

3.04 ON SITE SERVICES

A. Manufacturer will allow for one trip of four consecutive days on site for installation inspection, startup, and operator training.

3.05 DOCUMENTATION

A. Upon completion of commissioning, the manufacturer will provide the owner with operation and maintenance manuals according to Section 1300, Submittals.

B. Upon completion of commissioning, the manufacturer will provide an electronic copy of the PLC program, drawings as AutoCAD file to the owner with a copy of the HMI configuration file.

3.06 OTHER SERVICES

A. Additional services, other than those provided for by warranties or as specified herein, may be charged to the Owner/Contractor at the manufacturer's standard service rates.

PART 4 SPECIAL PROVISIONS

4.01 NEGOTIATED COST

A. The Owner has negotiated the cost of ~~$538,100.00~~ $487,500.00 change for the equipment supplied under this Section. The Contractor shall include the cost in Item 1 of the Bid. ***(Addendum 1, Issued December 16, 2024)***

B. Priced Items:

1. Price Includes one PW Tech Dewatering Press Model ES-303 and appurtenances, noted in this specification.
2. Price includes Compactlogix 5069 series PLC.
3. Price does not include the Polymer System.
4. Price does not include the flow meters in the sludge feed line. ***(Addendum 1, Issued December 16, 2024)***

4.02 PERFORMANCE REQUIREMENTS

A. The new PWT Volute Dewatering Press shall meet the following performance requirements:

1.	Maximum Solids Loading Rate:	1050 lbs/hr (@ 4% solids or above)
2.	Dewatering Capacity @ 2% WAS	750 dry lbs/hour
3.	Dewatering Capacity @ 3% WAS	900 dry lbs/hour
4.	Sludge Flow Rate:	Max. 105 gpm (@ sludges below 1%)
5.	Feed solids:	4% (Range: 2% - 8%)
6.	Expected dry solids to dispose:	18.9% (Range: 16% – 24%)
7.	Polymer Consumption:	22 lbs./dry ton of solids; (15 – 26 lbs./ dry ton of solids)

END OF SECTION

This page was intentionally left blank.

SECTION 12310
CABINETS AND FURNISHINGS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing shelving, cabinets, tables, chairs, desks, and other items as specified in this Section.

B. All items specified herein shall be installed after all remodeling is completed.

C. The locations of these items are shown on the Drawings.

D. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with GC-6.25.3. of the General Conditions.

   b. Descriptive literature.

2. Information for the Record:

   a. Schedules of cabinets and furnishings.

3. Operation and maintenance manual.

4. Quantities to be confirmed with owner during shop drawing review. ***(Addendum 1, December 16, 2024)***

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise shown or specified, all storage cabinets and shelving shall be of unitized steel construction and be the product of one manufacturer. It shall be of a similar design to that shown on the Drawings or as indicated by the catalog numbers. Colors shall be selected by the Owner prior to purchase.

B. Closed sections of shelving shall include backs, ends, and partitions as required. Assemblies of adjacent sections shall be made with male and female clips

C. Open type shelving shall be cross-braced on the ends and backs of each section to control sway. The legs of both types shall consist of 1-1/2-inch by 1-1/2-inch by 1/8-inch T-sections with 13/32-inch diameter holes punched at 1-inch centers.

D. Shelving shall be designed for heavy loading by the addition of 1-inch by 1/8-inch bar reinforcing placed in the front and rear flanges of each shelf. Punched holes in reinforcing bars and T-sections shall correspond to the shelf holes.

E. The cabinets and furnishings in the Maintenance Building shall be a product of one of the following manufacturers:

Storage cabinets and locker-room equipment	Penco Products Inc., Lyon Metal Products Inc., or equal
Office furniture	Lyon Metal Products Inc., Steelcase Inc., or equal
Coat rack	Vogel-Peterson Co., EMCO, Inc., or equal
Folding tables	Fort Smith, National Business Furniture, or equal
Folding chairs	Samsonite, Cosco, or equal

F. The manufacturers' names and catalog numbers shown in the following schedules have been used as a guide to the type, style, size, quality, and materials of construction.

2.02 SCHEDULE OF CABINETS AND FURNISHINGS

A. Record Storage Room:

Quantity	Catalog No.	Description
31	Penco 49019	Open type adjustable shelving units. 3-feet-0-inch wide, 2-feet-0-inch deep, 7-feet-0-inch high complete with label holders, base strips, end kits, and 8 shelves per unit. Units are to be bolted back to back to form three assemblies 4-feet-0-inch deep, 18-feet-0-inch long, 7-feet-3-inch high as shown on the Drawings. Design for Class 2 heavy loading.
6	Penco 49002	End racks for ends of each assembly.
6	Penco 38255	Shelf Box sets of 6 per 36-inch shelf width 5-5/8-inch wide, 23-3/16-inch deep, 4-5/8-inch high.
12	Penco 38260	Shelf Box sets of 4 per 36-inch shelf width 8-7/16-inch wide, 23-3/16-inch deep, 4-5/8-inch high.
7	Penco 49800	Ledge type adjustable shelf units, each consisting of four lower shelves 24-inch deep by 36-inch wide and four upper shelves 12-inch deep by 36-inch wide bolted to end and back panels to form closed type adjustable sections 87-inch high, complete with label holders and base strips.
		Design for Class 2 heavy loading. Five units to be bolted together and two units to be bolted together to form one assembly 15-feet-0-inch long and one assembly 6-feet-0-inch long.
2	Penco 49005	End racks for ends of each assembly.
48	Penco 38511	Drawer Dividers 8-1/4-inch by 2-5/8-inch for 12-drawer unit.
72	Penco 38541	Drawer Dividers 5-3/8-inch by 2-5/8-inch for 18-drawer unit.
144	Penco 38566	Drawer Dividers 5-3/8-inch by 1-13/16-inch for 24-drawer unit.

Quantity	Catalog No.	Description
2	Penco 38530	Drawer Insert Unit 12-inch deep by 10-3/4-inch high with 18 drawers.
2	Penco 38500	Drawer Insert Unit 12-inch deep by 10-3/4-inch high with 12 drawers.
3	Penco 38560	Drawer Insert Unit 12-inch deep by 10-3/4-inch high with 24 drawers.
50	Penco 45640H	Shelf Dividers 12-inch deep by 12-inch high.
50	Penco 45940H	Shelf Dividers 24-inch deep by 12-inch high.
50	Penco 45620H	Shelf Dividers 12-inch deep by 9-inch high.
50	Penco 45920H	Shelf Dividers 24-inch deep by 9-inch high.
1	Penco 49107	Bin Unit 36-inch wide by 12-inch deep by 75-inch high overall w/72 Bins - 6-inch by 12-inch by 6-inch
1	Penco 49109	Bin Unit 36-inch wide by 12-inch deep by 75-inch high overall w/40 Bins - 9-inch by 12-inch by 9-inch
2	Penco 49110	Bin Unit 36-inch wide by 12-inch deep by 87-inch high overall w/84 Boxes - 5-1/2-inch by 11-1/2-inch by 4-5/8-inch
1	Penco 49114	Bin Unit 36-inch wide by 12-inch deep by 87-inch high w/6 Bins 6-inch by 12-inch by 9-inch, 54 Bins 6-inch by 12-inch by 6-inch, Four Bins 9-inch by 12-inch by 9-inch, One Bin 36-inch by 12-inch by 12-inch
8	Penco 49017	Open type adjustable shelving units. 3-feet-0-inch wide, 1-feet-6-inch deep, 7-feet-0-inch high complete with label holders, base strips, end kits and eight shelves per unit. Units are to be bolted together to form one assembly 24-feet-0-inch long. Design for Class 2 heavy loading.
1	Penco 49001	End rack for end of assembly.
2	Penco 49122	Steel counter units 36-inch long by 24-inch deep by 39-inch high, complete w/four shelves, back, ends, and heavy counter top bolted together to form one assembly 6-feet-0-inch long.
1	Penco 49123	End rack for end of assembly.
2	Penco 30960	Bench drawers and mounting kits.
1	Penco 33000	Service cart 30-inch long, 16-inch deep, and 32-inch high heavy-duty construction with two shelves.
1	Lyon 120245	Desk 60-inch long by 30-inch wide by 29-inch high with center drawer, pedestal right w/lock combined with typing height return #12-2511.
		For 60-inch desk include top, pedestal, back panel, legs, and connector - size 38-1/2-inch wide by 18-inch deep by 26-inch high.
		Plastic laminate top on both.
1	Lyon 306	Secretarial posture chair w/perforated contoured seat and formed back, foam cushioned 18-inch by 16-inch seat, adjustable from 16-1/2-inch to 21-inch above floor. 15-inch by 11-3/4-inch back, adjustable from 13-inch to 16-inch above seat.

B. ~~Operator Office:~~

~~Quantity~~	~~Catalog No.~~	~~Description~~
~~1~~	~~Lyon 12-0175~~	~~Desk 6-feet-0-inch wide, 36-inch deep, 29-inch high w/center drawer and lock - three box drawers on left; one box drawer over file drawer on right; plastic laminate top.~~
~~1~~	~~Lyon 301~~	~~Chair posture type 19-3/4-inch wide by 19-1/2-inch deep seat independent back adjustment; vinyl back, fabric seat polished chrome frame; blade type base; black upholstery.~~
~~2~~	~~Lyon 303~~	~~Chair "C" to match Chair "A" seat 20-inch wide by 19-1/2-inch deep all vinyl upholstery.~~
~~6~~	~~Lyon 3-3401~~	~~Four-drawer letter size file cabinets 15-inch wide by 29-inch deep by 51-inch high w/lock.~~
~~2~~	~~Lyon 90-2842~~	~~Bookcases 36-inch wide by 12-inch deep by 84-inch high w/six adjustable shelves incl. two end finish panels.~~
~~1~~	~~Lyon 38-3124~~	~~Wardrobe Cabinets 36-inch wide by 24-inch deep by 78-inch high.~~
~~1~~	~~Lyon 306~~	~~Secretarial posture chair identical to that in the Storage Room.~~
~~1~~	~~Lyon 12-1741~~	~~Table with center drawer, plastic laminate top.~~
~~1~~	~~Stacked unit consisting of:~~	
~~2~~	~~Lyon 1210~~	~~Five-drawer plan file units 40-inch wide by 27-1/2-inch deep by 17-1/8-inch high.~~
~~1~~	~~Lyon 1213~~	~~Base.~~
~~1~~		~~Top panel.~~
~~2~~	~~Lyon 1214~~	~~Two Compartment dividers.~~
~~1~~	~~Lyon 1216~~	~~Eight Compartment dividers.~~

(Addendum 1, December 16, 2024)

C. Locker Room Equipment:

Quantity	Catalog No.	Description
150	Lyon 5062	Single tier steel lockers without legs 15-inch wide by 18-inch deep by 72-inch high w/coat rods, shelf 9-inch from top.
150	Lyon 5829	Number plates 2-3/4-inch by 1-inch.
150	Lyon 7020	Built-in Flat Key Locks.
		Locker Benches 18-1/2-inch high by 9-inch wide hardwood tops, steel pedestals w/flange for floor mounting.
3		3-feet-0-inch long - See detail on Drawings.
4		4-feet-0-inch long - See detail on Drawings.
5		4-feet-6-inch long - See detail on Drawings.

D. ~~Lunch Room Equipment:~~

~~Quantity~~	~~Catalog No.~~	~~Description~~
~~1~~		~~Vogel-Wall type Coat Rack 28-feet long w/single shelf.~~
		~~Peterson Includes 100 Y-17X "T" top hangers with AA-200E receptacles.~~

~~6~~	~~Fort Smith MF-7218-01-37~~	~~Folding tables 30-inch by 72-inch with 3/4-inch solid core top covered with high pressure laminate. Legs to be 16-gauge steel.~~
~~50~~	~~Samsonite SC-2705-04~~	~~All steel folding chairs with bronze enamel finish.~~

(Addendum 1, December 16, 2024)

E. Garage:

Quantity	Catalog No.	Description
3	Penco 49019	Open type adjustable shelving units identical to those in the Storage Room.
6	Penco 38515	Drawer insert units 18-inch deep by 10-3/4-inch high with 12 drawers.
144	Penco 38511	Drawer dividers for 12-drawer unit.
6	Penco 38545	Drawer insert units 18-inch deep by 10-3/4-inch high with 18 drawers.
216	Penco 38541	Drawer dividers for 18-drawer unit.
1	Penco 30530	Steel top work bench 72-inch by 28-inch by 34-inch high.
1	Penco 30978	Back and end stops for work bench.
1	Penco 30967	Riser shelf for work bench.
2	Penco 49122	Closed type steel counters with four shelves and a top.
1	Penco 49123	Rack ending kit for steel counters.
12	Penco 38255	Shelf boxes 5-5/8-inch wide, 23-3/16-inch deep, and 4-5/8-inch high.
24	Penco 38306	Dividers for shelf boxes.
5	Lyon 3700	Single face bar and pipe racks.
1	Lyon 3701	Rack end for bar and pipe rack.
1	Lyon 3950	Seven-shelf revolving storage bin 34-inch diameter by 65-3/4-inch high.
4	Lyon 1874	Steel shop stools 14-inch square, 26-inch to 29-inch adjustable height

PART 3 EXECUTION

3.01 INSTALLATION

A. Cabinets and shelving shall be delivered to the job site in their original unopened shipping cartons. They shall be stored in a dry and protected area of the building until time for assembly.

B. The units shall be assembled by the Contractor, and carefully installed where shown.

C. Any damaged parts or misfits will be rejected.

D. Office furniture consisting of desks, chairs, wardrobe lockers, etc., shall be delivered fully assembled.

3.02 INSPECTION

A. All equipment shall be checked before acceptance. All dents, scratches, abrasions, or other defects shall be repaired or corrected.

3.03 ACCEPTANCE

A. The Work will be approved when all corrections have been satisfactorily performed and in the opinion of the Engineer meets the quality of materials and workmanship of the products specified.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 12601
LUNCHROOM EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installation of the lunchroom furniture and equipment.

B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturers' recommendations.

C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with GC-6.25.3. of the General Conditions.

   b. Descriptive literature.

2. Information for the Record:

   a. Schedule of all equipment proposed for this project.

3. Operation and maintenance manual for all equipment.

4. Quantities to be confirmed with owner during shop drawing review. ***(Addendum 1, Issued December 16, 2024)***

PART 2 PRODUCTS

2.01 GENERAL

A. The lunchroom furniture and equipment mentioned in this Specification shall be of high quality materials and workmanship.

2.02 EQUIPMENT

A. Tables shall be 72-inch by 30-inch Royalco, Inc. Catalog No. MF-7213-01- 37, Ft. Smith Co., Barricks Fine Quality Co., or equal.

B. Chairs shall be Royalco, Inc. Catalog No. SC-2805-04-05, Samsonite Co., folding steel chairs, Heywood-Wakefield Co., or equal.

C. Bulletin boards and chalkboards shall be 36-inch by 48-inch, 1/2 cork and 1/2 chalkboard, Royalco, Inc. Catalog No. T5-504, Quartet, Carolina Chalkboard Co., or equal.

D. Waste baskets shall be 14-inch square by 31-1/5-inch high, Rubbermaid, Inc., Heywood-Wakefield Co., Hamilton Cosco, Inc., or equal.

E. Under this item there shall be furnished and installed one complete kitchen unit, Dwyer E72EC, or equal, include Thermador Microwave Oven with cabinets modified to receive microwave; also include a garbage disposal in the unit. The unit shall be connected to the concealed electrical outlet and connected to the hot and cold water, and drain lines using flexible tubing to permit pulling the unit from the wall.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be complete and in accordance with the manufacturer's recommendations, the Engineer's instructions, and the Contract Documents.

B. The Contractor shall provide any miscellaneous appurtenances necessary for initial operations.

PART 4 SPECIAL PROVISIONS

4.01 CASEWORK

A. For case work, refer to Specification Section 11600, 2.01.

4.02 COUNTERTOP

A. For countertop work, refer to Specification Section 11600, 2.02.

END OF SECTION

SECTION 12602
OFFICE EQUIPMENT AND FURNITURE

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installation of the office furniture and equipment.

B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturers' recommendations.

C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
    a. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with GC-6.25.3. of the General Conditions.
    b. Descriptive literature.
2. Information for the Record:
    a. Schedule of all equipment proposed for this project.
3. Operation and maintenance manual.
4. Quantities to be confirmed with owner during shop drawing review. ***(Addendum 1, December 16, 2024)***

PART 2 PRODUCTS

2.01 GENERAL

A. Office furniture and equipment mentioned herein shall be of high quality materials and workmanship.

2.02 EQUIPMENT

A. The Contractor shall provide the office furniture specified below and install it where shown on the Drawings.

B. Metal four-drawer letter size file cabinets equal to HON Series 230, Lyon Metal Products Co., or equal, letter file with automatic lock, color selected by the Owner, shall be provided and installed.

C. Metal office desk shall be 60-inch by 30-inch as manufactured by HON Budget Series, Lyon Metal Products Co., or equal, and desk shall be of a color selected by the Owner.

D. Blueprint files shall be equal to Plan Hold Corporation, Teledyne Post Catalog No. 34CF-02D, or equal. Blueprint file shall have capacity to hold 24-inch by 36-inch prints in a vertical fashion. Twelve or more binders shall be able to slide out of the steel cabinets.

E. Desk chairs shall be HON No. HN-C17, Lyon Metal Products Co., or equal, arm chair with adjustable set height.

F. Drafting tables shall be Royalco, Inc. Catalog No. ST-TH3862, Stacor Co., with auxiliary unit ST-A1019, Hamilton Industries, or equal. Tables shall have tool and reference drawers and sturdy one-piece formed steel legs and footrest. Drafting stools shall be equal to Royalco, Inc. Catalog No. RM-C-1290-MC, InterRoyal Co., Teledyne Post Catalog No. 34BD-04G, Cramer Co., or equal. The stool should be furnished with 2-inch ball bearing casters.

G. Bookcases shall be Royalco, Inc. Catalog No. MF-1448-BC, Tiffany Co., HON, Lyon Metal Products Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be complete and in accordance with the manufacturer's recommendations, the Engineer's instructions, and the Contract Documents.

B. The Contractor shall provide any miscellaneous appurtenances necessary for initial operations.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 14551
SHAFTLESS SCREW CONVEYORS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish, install, and place in satisfactory operation one horizontalshaftless screw conveyors complete with all supports, spare parts, accessories, and appurtenances as specified herein, shown on the Drawings, and as required for a complete and operable system. The conveyors shall be reversing to allow distribution to evenly fill containers or discharge to the sludge storage area as selected by the operator or for maintenance activities.

B. Each screw conveyor unit shall consist essentially of shaftless spiral, trough, trough ends, seals, inlet and discharge chutes, motor operated gate, drive units, safety devices and supporting steel together with any other items required for a complete conveying system.

C. All necessary provisions required to comply with OSHA safety requirements shall be included.

D. The Contractor shall be responsible for coordinating the placement of all supports necessary to secure the equipment and shall have the undivided responsibility for the system's structural integrity.

E. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings:
    a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    b. Plan and Elevation Drawings.
    c. List of accessories and appurtenances.
    d. Motor data in accordance with Section 11050.
    e. Fabrication drawings.
2. Information for the Record:
    a. Installation certification.
3. Operation and Maintenance Manual information.

1.03 QUALITY ASSURANCE

A. Manufacturer:

1. It is the intention of the specifications to cover minimum acceptable quality equipment for a complete installation.

2. The conveyor shall be as manufactured by Spirac, Keystone, Custom Conveyors JDV or equal. Basis of Design: SPIRAC U250-SPX/SS. ***(Addendum 1, December 16, 2024)***

B. Warranty:

1. The shaftless screw liner and spiral shall be warranted for a period of three years from start-up against wear.

a. Liner:

1) For a wear indicator (bi-color) liner, excessive wear shall be indicated by appearance of the bottom indicator layer (second color) along more than 30 percent of the conveyor length during the first three years of service. If these wear indications occur the conveyor supplier shall provide new formed liner in full length racks to replace all the liner in the conveyor that has excessive wear.

b. Screw:

1) Excessive wear on the screw shall be indicated by loss of more than 50 percent of the height of the main outer screw section over 30 percent of the total length of the screw. If excessive screw wear is found the conveyor supplier shall provide new screw to replace the screw in the conveyor that has excessive wear.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. The conveyors shall be designed to handle dewatered municipal sludge with solids content between 15 and 25 percent.

B. AC motor(s) shall conform to the latest applicable NEMA, IEEE, and ANSI standards. Reversing as required. Motor safety factor to be a minimum of 2 times.

C. The conveyor shall be capable of conveying sludge in a clean and efficient manner.

Conveyor Identification	All
Operating Schedule	Continuous Duty
Product to Convey	Dewatered Sludge
Dry Solids Load	1,050 dry pounds/hour
Wet Solids Load (18% Solids)	5,833 wet pounds/hour

Conveyor Identification	All
Design Material Density	65.0 lb/cf
Design Percent Solids	15%-25%
Degrees of Incline, Maximum Fill %	5%
Length of Trough/Screw	Coordinate per manufacturer
Minimum Screw Diameter	8-inches to 12 inches
Maximum Screw Speed	20 rpm, except vertical-30rpm
Minimum Drive Hp	5Hp
Trough Bottom Drain Size	3 inches
Special Requirements	Inclined – 3-inch drain (minimum)
Approximate Length	Volute conveyor 80 ft

2.02 DESCRIPTION OF EQUIPMENT

A. Shaftless Flighting:

1. Spiral flight shall be 1-inch thick by 3-inch wide and manufactured from chromium nickel alloy steel with a brinnel hardness of 250, and maximum yield strength of 80,000 psi.

2. The spiral flights shall be designed with the stability to prevent distortion and jumping in the trough. The torsional rating of the spiral shall be such that, at 150 percent of the motor nameplate horsepower, the drive unit cannot produce more torque than the torsional rating of the flighting.

3. Packing gland material consisting of two Teflon fiber packing rings shall seal the drive shaft at its penetration through the end plate, along with a greased labyrinth sealing system.

4. The flighting shall be capable of conveying the product capacity and all horsepower and torque loadings without deflection or compression exceeding 0.08-inch per foot.

5. If flighting sections require field welding, this work shall be performed by the Contractor, with full penetration welds or bolted as recommended by the conveyor manufacturer.

6. The flighting shall include a bolted connection to the drive shaft.

B. Drive:

1. Drive assembly shall consist of an integral gearmotor, mounted directly to the screw shaft. Gearmotor housing shall be cast iron, furnishing complete protection under all conditions of service. Gears shall be manufactured and rated for continuous duty in accordance with AGMA Standards, of heat-treated alloy steel. The drive shall have a minimum AGMA service factor of 1.4. Provide splash type gear lubrication. Gear reducer shall be Class II speed reducer as manufactured by Eurodrive or approved equal.

2. The conveyor shall be driven by a 460 volt, 3 phase, 60 Hz, 1800 RPM, TEFC severe duty motor with 1.15 SF and class F insulation.

3. The drive shall be connected to the spiral with a bolted connection to a C-1045 drive shaft. A flanged gland seal with Teflon coated packing rings shall be provided at the trough end of the shaft penetration.

4. The drive system shall be provided with an instantaneous trip current relay for torque overload protection. The relay shall be provided with a time delay (adjustable) to short the relay on start-up and initial motor amp draw.

5. Gearboxes and motors shall be factory-assembled on the conveyor, factory-tested and shipped fully assembled with the conveyors.

6. The gear reducer and drive shall be designed to provide an applied torque adequate to start a fully loaded conveyor.

7. The drive package is to operate the conveyor at speeds determined by the system manufacturer to meet the specified Design Handling Capacity.

8. Bearings shall have on AFBMA B-10 life of 30,000 hours.

C. Trough:

1. Trough shall conform to CEMA Standards. The conveyor flighting shall be housed in a 3/16-inch-thick minimum type 304 stainless steel U-trough with double rolled down top flanges and integral end flanges. A neoprene or rubber gasket shall be provided at each trough flange.

2. Trough ends shall be inch 1/2-inch (gear end) and 3/16-inch (non-gear end) minimum thickness stainless steel and shall include top flange and CEMA standard drilling for end flanges, bearings, and seals.

3. Provide removable trough stiffeners, secured to the trough by screws to a tapped block welded to the top inside of the trough. Drilling holes in the trough for stiffeners is not acceptable.

4. A 12-inch by 12-inch flanged inlet port shall be provided at locations along the conveyor as shown on the Drawings. A motorized gate, discharge or manual gate discharge supplied as part of the conveyor package shall be installed on the conveyors as shown on the P&ID drawings. Where shown on the Drawings, conveyor discharge shall include an 18 ounce per yard rubber impregnated canvas flex chute extension.

5. A 3-inch drain shall be mounted into the end of the inclined conveyor trough.

D. Trough Liner:

1. The inside trough surfaces of the conveyors shall be lined with a layer of ultra-high molecular weight polyethylene (UHMW-PE). The liner shall be a single piece, formed and bonded with two layers of the same material, each of a

different color, to provide a visible indication when the liner is nearing the end of its useful life. Liners using layers of different material shall not be accepted.

2. The liner shall be supplied in maximum 4-foot-long sections to provide ease of replacement. The liner shall be held in place with stainless steel cleats; no fasteners will be allowed.

3. Liner thickness shall be at a minimum 1/2-inch thick. Liners less than the specified minimum thickness, molecular weight, wear strips and steel or hardened steel shall not be acceptable.

4. The liner material shall have the following physical properties, as a minimum:

Property	Value/Unit	Testing Method
Density	61.2 lbs/ft^3	DIN53479
Molecular Weight	9.2 x 10^6 g/mol	Margolies
Ball Indentation Hardness	5,946 lbs/in^2	DIN53456
Shore Hardness D	64	DIN53505
Crystalline Melting Range	278 degrees F	
Dynamic Coefficient of Friction	0.1 – 0.12 ratio of tension / load	Plastic to steel

E. Covers:

1. The screw conveyor troughs shall include 12 gauge minimum 304 stainless steel covers with neoprene or rubber gasketing. Covers shall be held in place with stainless steel bolts on 24-inch maximum centers. Covers shall be manufactured in maximum four-foot length sections.

F. Supports:

1. Provide supports suitable for mounting at the approximate elevations and locations shown on the Drawings and as required by supplier’s design. The supports shall be capable of supporting the equipment weight when fully loaded. The supports shall be fabricated from standard shapes and made of 304 stainless steel. Supports shall be marked and shipped to the job site for installation in the field.

2. At a minimum, each conveyor shall be provided with supports at the inlet and discharge end, with intermediate supports at no more than 12 feet-0 inches on center and including provisions for anchoring to the floor or hanging style to loadout area ceiling structure.

3. . Supports shall be designed to avoid interference with other equipment or equipment supports.

4. Conveyor Supports inside Biosolids Storage Building shall need to be coordinated with Pre-Engineered Building Manufacturer.

G. Guards:

1. All exposed, accessible rotating parts shall be covered with an OSHA complaint guard. These guards are to be constructed of minimum 14 gauge stainless steel, epoxy coated safety yellow.

H. Zero Speed Switch and Safety Stop Switch:

1. The conveyors shall be provided with a non-contacting probe and relay type zero speed indication switch. The probe shall be a Milltronics/Siemens WM 100 or approved equal with stainless steel mounting hardware. Switch shall operate from 120v AC supply.

2. Each conveyor is to be provided with a NEMA-4X, safety pull cord stop switch. A continuous orange vinyl coated galvanized cable shall fully surround the conveyor. The cable shall be supported from the conveyor frame on 10-foot maximum centers.

I. Slide Gates

1. Slide gates shown on the Drawings shall be supplied by the conveyor manufacturer under this Section. The slide gate shall be designed so that in the full, open position at least one rotation of the flight or spiral is exposed to the opening in the direction of transport, the slide gates shall have an opening at least the full width of the conveyor.

2. The slide gate blade shall be positioned by an electromechanical linear actuator. The actuator shall have a 480 volt, 3 ph. TENV permanent split capacitor, high starting torque motor with a rod travel velocity of approximately 2-inches per second. The actuator shall include all metal gearing, two, independently adjustable, gear driven position indication switches, anti-friction drive bearings, manual override, nickel-plated drive rod and cast aluminum weatherproof enclosure.

3. The slide gate body shall be 1/4-inch minimum thickness and include either a dust-proof, heavy-duty, bolted cover plate and expanded metal guard or a bolted bonnet, arranged to cover the gate when in the retracted position and to facilitate safety and maintenance. Greater thickness shall be provided based on actual actuator thrust forces.

4. Slide gate shall be designed to prevent wedging of sludge cake material between the gate edge and the valve body.

5. Slide gate body shall be designed to withstand the thrust of the actuator or handwheel.

6. The slide gates shall be fabricated with stainless steel frame, gate blade, stem, and all wetted parts.

The slide gates guides and seals shall be machined UHMW PE.

J. General Requirements:

1. All welding to be in accordance with the latest AWS standards.

2. All component items shall be provided with manufacturer's standard finish. Shafting and other exposed machined surfaces shall be coated with a rust inhibitive compound.

K. All nuts, bolts, and washers used for assembly to be furnished by the conveyor manufacturer and shall be stainless steel.

PART 3 EXECUTION

3.01 COORDINATION

A. The screw conveyor shall be installed in accordance with the manufacturer’s written recommendations.

3.02 LUBRICANTS AND LUBRICATING EQUIPMENT

A. Provide and install necessary grade quality oils, greases and anti-seize compounds for initial operation of all equipment provided that requires oil, grease or anti-seize.

B. Anti-seize shall be applied to the threads of all stainless steel bolts before assembly at the factory and field assembly.

3.03 INSPECTION, STARTUP, AND TRAINING

A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, start-up, and training services. The manufacturer's representative shall be experienced in the installation, start-up, operation, and maintenance of the equipment.

B. A factory trained manufacturer's representative shall be provided for a minimum of two trips with a minimum of two eight-hour days each to provide installation supervision, start-up and field-testing services. The installation services shall be coordinated between the Contractor and the manufacturer. The start-up and field-testing services shall be coordinated with the Engineer.

C. Within two weeks of start-up, the manufacturer shall submit to the Engineer a written report (minimum 4 copies) covering the representative's inspection and start-up of the equipment. This report shall include the manufacturer's certification that the installation is correct, and the equipment is operating satisfactorily.

D. After the installation, start up, field service testing and operation of the equipment has been certified, the manufacturer's representative shall train the Owner's personnel for one eight-hour day in the proper operation and maintenance of the equipment. The Owner may video tape the training.

END OF SECTION

This page was intentionally left blank.

SECTION 15150
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 SCOPE

A. Section Includes:

1. Sanitary drain, waste, and vent (DWV) piping buried within 5 feet of building.
2. Chemical resistant DWV piping.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Floor drains.
7. Trench Drains.
8. Cleanouts.
9. Universal p-traps.
10. Sleeves.
11. Sump pumps.
12. Backwater valves.
13. Bedding and cover materials.

B. This Section includes furnishing all materials, equipment, labor, and supervision related to air sanitary waste and vent piping necessary for the completion of the Work in accordance with the Contract Documents. Sleeves for penetrations for new Work shall be provided by this Section and installed by others.

C. This Section shall include but not limited to all appurtenances required for complete installation.

D. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

E. Additional equipment and installation requirements in Division 15 as included shall be provided by this Contract.

F. Additional product requirements are specified in Section 01350.

1.02 REFERENCES

A. American Standard of Mechanical Engineers:

1. ASME A112.14.1 – Backwater Valves.
2. ASME A112.14.3 – Grease Interceptors.
3. ASME A112.14.4 – Grease Removal Devices.
4. ASME A112.21.1 – Floor Drains.
5. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
6. ASME B16.3 – Malleable Iron Threaded Fittings.
7. ASME B16.4 – Gray Iron Threaded Fittings.
8. ASME B16.23 – Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
9. ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
10. ASME B31.9 – Building Services Piping.

B. ASTM International:

1. ASTM A47/47M – Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 – Standard Specification for Cast iron Soil Pipe and Fittings.
4. ASTM A234/A234M – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 – Standard Specification for Ductile Iron Castings.
7. ASTM B32 – Standard Specification for Solder Material.
8. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 – Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 – Standard Specification for Seamless Copper Tube.
11. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 – Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B302 – Standard Specification for Threadless Copper Pipe, Standard Sizes.
14. ASTM B306 – Standard Specification for Copper Drainage Tube (DWV).

15. ASTM C14 – Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
16. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
17. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
18. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
19. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
20. ASTM C1053 – Standard Specification for Borosilicate Glass Pipe and Fittingd for Drain, Waste, and Vent (DWV) Applications.
21. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
22. ASTM D2241 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
23. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
24. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
25. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
26. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
27. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
28. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
29. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
30. ASTM D 2996 – Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resign) Pipe.
31. ASTM D2997 – Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
32. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

33. ASTM D3262 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
34. ASTM D3517 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
35. ASTM D3574 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
36. ASTM D3840 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.
37. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
38. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
39. ASTM F891 – Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
40. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waster, and Vent Piping Applications.
2. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
2. MSS SP 69 – Pipe Hangers and Supports – Selection and Application.
3. MSS SP 70 – Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 – Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 – Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
7. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

E. Plumbing and Drainage Institute:

1. PDI G101 – Standard – Testing and Rating Procedure for Grease Interceptors.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

1. Product Data:

a. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

b. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

c. Hangers and Supports: Submit manufacturers catalog information including load capacity.

d. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

e. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

2. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

3. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

C. Information for the Record:

1. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include spare parts list, exploded assembly views for pumps and equipment.

1.04 DRAWINGS

A. All Drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Dimensions given on the Drawings shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

1.05 PROTECTION FROM DAMAGE

A. Delivery, Handling, and Storage:

1. Material delivery, handling, and storage shall meet the requirements of Section 01350.
2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.07 FIELD MEASUREMANTS

A. Verify field measurements prior to fabrication.

1.08 EXTRA MATERIALS

A. Furnish two sets of pumps seals for each pump.

PART 2 PRODUCTS

2.01 SANITARY DRAIN, WASTE, AND VENT (DWV) PIPING

A. Cast Iron Pipe: ASTM A74, service weight, bell and spigot ends.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2665, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. PVC Pipe: ASTM D1785 Schedule 40 or 80, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC, ASTM D2467, Schedule 80, PVC, ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.02 CHEMICAL RESISTANT SEWER PIPING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729 or ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: PVC, ASTM D2729 or ASTM D2665.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.03 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. PVC Piping: PVC flanges.

2. Gaskets: 1/16-inch-thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.04 BALL VALVES

A. Plastic Ball Valves for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward TBH Series, Spears Manufacturing, or equal.

2. True Union Ball Valves: All thermoplastic ball valves shall be true union standard type, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.05 CHECK VALVES

A. Plastic Check Valves for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward TC Series, Spears Manufacturing, or equal.

2. True Union Ball Check Valves: All thermoplastic check valves shall be true union ball type suitable for horizontal or vertical installation, schedule 80 full-port design, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. Valve stem shall have an

O-ring stem seal. All handles shall be of polypropylene construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.06 UNIONS

A. Plastic Unions for PVC Schedule 80 Pressure Pipe:

1. Manufacturers: Hayward, Spears Manufacturing Union 2000, or equal.

2. Unions: All thermoplastic unions shall be schedule 80, manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O-rings shall be EPDM or FKM construction. All union nuts shall have Buttress threads. All EPDM valves shall be certified by NSF International for use with potable water.

2.07 PIPE HANGERS AND SUPPORTS

A. Drain, Waste, and Vent: Conform to ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

B. Hangers for Pipe Sizes ½ to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

F. Wall Support for Pipe Sizes 3 inches and Larger: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

2.08 FLOOR DRAINS

A. Medium Duty:

1. Manufacturers: Zurn Industries, Inc., Model ZN550, J.R. Smith Mfg. Co., Model 2120-NB, Josam Manufacturing Co., or equal.

2. Construction: ASME A112.21.1; 9-inch diameter top drain, medium duty, latex coated, cast-iron two-piece body with double drainage flange and bottom outlet, seepage pan, weep holes, combination membrane flashing clamp and frame with integrated trap primer and plug, and round, adjustable slotted nickel-bronze medium-duty grate.

3. Deep Seal Trap with Floor Cleanout:

   a. Manufacturer: Zurn Industries, Inc., Model Z1012/ZN1406, J.R. Smith Mfg. Co., Josam Manufacturing Co., or equal.

   b. Construction: Deep seal trap, latex coated, cast-iron body for use with bottom outlet drain, with adjustable cast iron floor cleanout with spigot for caulking into Hub. Latex coated cast iron body with gas and watertight ABS plug and cast-iron housing with round, scoriated, secured cast iron heavy-duty cover adjustable to finished floor.

2.09 TRENCH DRAINS

A. Administration Area:

1. Manufacturers: Zurn Z886, or equal.

2. Construction: Channels made of High-Density Polyethylene (HDPE). Channels have a positive mechanical connection between channel sections that will not separate during installation and mechanically lock into the concrete surround a minimum of every 10”. Channels to be provided with ductile iron slotted grate with H-20 traffic rating.

B. Biosolids Storage Area:

1. Manufacturers: Aco Drain PowerDrain Type ~~SK3 903D~~ S300K, or equal. The contractor shall be responsible for any additional cost incurred do to subsequent changes required to the construction do to the selection of a substitute trench drain system. ***(Addendum 1, December 16, 2024)***

2. Construction: Trench system bodies made of polymer concrete. Channels to be provided with ductile iron slotted grate with PowerLok securing devise and load class F traffic rating, or equal. ***(Addendum 1, December 16, 2024)***

2.10 BARRIER-TYPE TRAP SEAL

A. Manufacturers: Everflow Supplies Green Drain, Sure Seal, or equal.

B. Construction: ASSE 1072 tested and certified, inline floor drain, barrier type trap seal with UV ABS plastic frame, silicone rubber sealing flapper, and four flexible sealing ribs. Trap seal shall open to allow drainage and close when there is no flow. Trap seals shall be in compliance with the Ohio Plumbing Code.

2.11 CLEANOUTS

A. Interior Finished Floor Areas:

1. Manufacturers: Zurn Model ZN1400, J.R. Smith Mfg. Co., Josam, or equal.

2. Construction: Adjustable floor cleanout, latex coated cast iron body, anchor flange, threaded top assembly, and round scored polished nickel bronze cover

with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

2.12 UNIVERSAL P-TRAPS

A. Manufacturers: United States Plastics Corporation/IPEX Industrial Systems, Item 33054 /Model No. 156511, or equal.

B. General: Dilution trap for installation at sink drain to provide immediate dilution.

C. Construction: Black polypropylene tops, translucent low density polyethylene jars, 1-1/2 inch tapered threaded outlet, with complete waste assembly for installation directly in a standard sink drain outlet.

D. Capacity: 1 gallon.

2.13 SLEEVES

A. Type B Sleeve:

1. Type B sleeves are for use in exterior walls.
2. Type B sleeves consist of casting in place a black wrought iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.
3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.

B. Type C Sleeve:

1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.
3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of 40-degree F to 250-degree F. The pressure plates shall be of Delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

C. Type D Floor Sleeve - Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

D. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.
2. Type E sleeves consist of casting in place mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.

3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting all requirements of AWWA C111 on both ends.

E. Type F Sleeve:

1. Type F sleeves shall be used for passing through masonry walls.

2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

2.14 SUBMERSIBLE SUMP PUMPS

A. Manufacturers: Zoeller Pump Company, Model 137, or equal.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body with 100 percent baked-on powder coated epoxy finish for corrosion resistance and longer casting durability and oil filled motor chamber. All fasteners and external metal parts shall be of stainless steel.

D. Impeller: Cast iron; open non-clog vortex, corrosion resistant alloy steel shaft.

E. Pump Discharge: 1-1/2-inch NPT.

F. Bearings: Sleeve bearings.

G. Accessories: UL listed, oil resistant 10-foot cord and plug with three-prong connector for connection to electric wiring system.

H. Controls: Integral float operated mechanical switch type level controls.

I. Performance:

1. Flow: 30 GPM, at 20 feet lift.

J. Electrical Characteristics and Components:

1. Power: 1/2 HP.

2. Electrical (V/PH/HZ): 120/1/60.

K. Motors: In accordance with Division 16.

2.15 BACKWATER VALVES

A. Manufacturers: Spears BWV-3-0410, or equal.

B. Description: Backwater valve for 6” diameter pipe with 20” Service Access extension kit.

C. Extension kit consists of:

1. Access plug.

2. Threaded adapter.

3. Riser pipe.
4. Riser coupling.
5. Threaded Tee Handle.
6. Lock Ring.
7. ¾" Threaded Coupling.
8. Internal Extension Pipe.

D. Riser pipe shall be 10” Class 125 PVC or 10” Sch 40 PVC .

2.16 BEDDING AND COVER MATERIALS

A. Bedding, Cover, and Backfill: In accordance and as specified in Section 02200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:

1. Provide inserts for placement in concrete forms.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches 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 flush with top of slab.

B. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, and MSS SP 89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
8. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
9. Install hangers adjacent to motor driven equipment with vibration isolation.

3.04 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than one ft of cover.

C. Establish minimum separation of from other services piping in accordance with applicable code.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 02200.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

1. Backfill trench in accordance with Section 02200.
2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

J. Install Work in accordance with applicable standards.

3.05 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations and maintain gradients.

B. Slopes for Horizontal Drainage Pipe:

1. 2-1/2 Inches or Less: 1/4 inch per foot.
2. 3 to 6 Inches: 1/8 per foot.
3. 8 Inches or Larger: 1/16 inch per foot.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

G. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

H. Install piping to maintain headroom. Do not spread piping, conserve space.

I. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment

K. Provide clearance in hangers and from structure and other equipment for installation of insulation.

L. Provide access where valves and fittings are not accessible.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

P. Install bell and spigot pipe with bell end upstream.

Q. Sleeve pipes passing through partitions, walls, and floors.

R. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Follow Section 07270.

S. Support cast iron drainage piping at every joint.

T. Install Work in accordance with applicable standards.

3.06 INSTALLATION – SUMP PUMPS

A. Provide check valve, union, and ball valves on sump pump discharge piping.

B. Provide shaft length allowing ejector pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

C. Check, align, and certify alignment of pumps prior to start-up.

D. Install Work in accordance with applicable standards.

3.07 FIELD QUALITY CONTROL

A. Test sanitary waste and vent piping system in accordance with applicable code or local authority having jurisdiction.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

This page was intentionally left blank.

SECTION 15210
PIPING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installing of all pipelines 4-inch diameter and larger shown on the Drawings or as required to complete the Work.

B. Piping less than 4-inch diameter, will be included under other Sections unless otherwise specified.

C. Material to be furnished and installed, but not limited to:

1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials.
2. Pipe supports other than those specified in Section 15010.
3. Granular material for bedding and encasement of pipelines.
4. Class B concrete as specified in Section 03300 for blocking and encasement of pipelines.
5. Make connections to all existing and/or new facilities and provide temporary services.
6. Install temporary plugs and/or stoppers and harnessing.
7. Test and clean pipelines.
8. Sterilize water mains.

D. The Contractor shall make adequate field measurements before new piping is fabricated.

E. All wall, floor, and roof penetrations and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

F. Instruments which are to be located in pipelines 4-inch in diameter and larger shall be furnished under Division 16 and installed under this Section.

1.02 QUALITY CONTROL

A. Laboratory Services - Laboratory testing services shall be provided as specified under Section 01410 of the Specifications.

B. Field Inspection:

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective

piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Resident Project Representative at the Contractor's expense.

2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

C. Field Testing:

1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.

2. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.

D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300 showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.

B. Shop drawings shall be drawn to not less than 1/4-inch scale and show the laying length and piece mark for each section of pipe and fitting.

C. Drawings shall show the position and elevation of valves, pumps, and/or other equipment served by the various pipe systems.

D. The concrete pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. The certificate shall be signed by an authorized agent of the manufacturer.

E. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

F. Before fabrication of any concrete pressure pipe, fittings, or specials, the Contractor shall furnish to the Engineer at least six copies of the design calculations for the pipe showing the calculations to arrive at the gross wrapping stress in wire; initial and

resultant stresses in concrete, cylinder, and wire; internal pressure when compression in concrete is zero; compression strength of concrete at time of wrapping; and calculations to show stress, conditions, and the core and steel when the pipe is simultaneously subjected to the design pressure and external loads. The Contractor shall also furnish the full details of all pipe, specials, and fittings, and a laying schedule showing dimensions, details, and specifications of all pieces.

G. Submit a schedule of all proposed pipe escutcheons.

H. Other submittals may appear in Part 4 of this Section.

I. Any proposed grooved joint couplings and fittings shall be shown on drawings and product ~~submittals, and~~ submittals and shall be specifically identified with the applicable style or series number. ***(Addendum 1, December 16, 2024)***

PART 2 PRODUCTS

2.01 SEWER PIPE AND JOINT MATERIALS

A. Sewer pipe shall be of the type specified as shown on the Drawings or as indicated in the Piping Schedule and of quality conforming to the following requirements.

B. Vitrified Clay Pipe (VCP):

1. Vitrified clay pipe and fittings shall meet requirements of ASTM C700 ES, except that pipe shall be furnished with full inside diameter.

2. Vitrified clay pipe joints shall be bell and spigot joints and shall meet the requirements of ASTM C425.

C. Nonreinforced Concrete Pipe (PCP):

1. Nonreinforced concrete pipe and specials shall conform to ASTM C14. Class 3 pipe shall be used unless specified otherwise or shown otherwise on the Drawings.

2. Joints shall be tongue and groove or O-ring as specified or shown on the Drawings.

a. Tongue and groove joints shall be sealed with flexible watertight gaskets meeting or exceeding all requirements of FS SS-S-06210 (GSA, FSS Washington, DC) “Sealing Compounds, Preformed Plastic for Pipe Joints,” Type 1 Ropeform. Such gaskets may be RAMNEK as manufactured by K. T. Snyder Co., Inc. of Houston, Texas; KENTSEAL No. 2 Joint Sealant as manufactured by Hamilton Kent Mfg. Co. of Kent, Ohio; or equal.

b. O-ring joints shall conform to ASTM C443. The gaskets shall conform to material requirements of ASTM C361.

D. Reinforced Concrete Pipe (RCP):

1. Reinforced concrete pipe shall meet the requirements of ASTM C76, for pipe to 108-inch and shall meet applicable ODOT Specifications for pipe larger than 108-inch. Pipe shall be manufactured and furnished in a class and wall thickness as indicated in Part 4 of this Section or on the Drawings, and in accordance with the design and strength requirement prescribed in Tables I to V with wall thickness B.

2. Joints shall be O-ring type unless indicated otherwise in Part 4 of Section or on the Drawings. O-ring joints shall conform to ASTM C443. The gaskets shall conform to the material requirements of ASTM C361.

E. Polyvinyl Chloride Pipe (PVC):

1. Polyvinyl chloride pipe shall be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B. PVC pipe and fittings shall meet the requirements of ASTM D2241, pressure rating 200 psi, and have a standard thermoplastic pipe dimension ratio (SDR) of 21.0.

2. Polyvinyl chloride pipe joints shall be integral bell push-on type meeting the requirements of ASTM D3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F477.

3. Mechanical joint cast iron fittings with iron pipe transition gaskets, meeting all requirements of ANSI A21.11 (AWWA C111) may be used in lieu of PVC pipe fittings.

F. Non-shrinking Mortar Material for Joints - Material for non-shrinking mortar used in pointing joints shall be Sauereisen F-100 Grout as manufactured by Sauereisen Cements Co., Pittsburgh, Pennsylvania; Five-Star Grout as manufactured by US Grout Corp., Old Greenwich, Connecticut; or equal.

G. Flexible Pipe Repair Couplings - Flexible repair coupling used to repair existing pipes shall be an 18-8 Type 304 stainless steel repair coupling. The coupling shall have a full length and diameter rubber gasket, type 304 stainless steel nuts and bolts and be manufactured by Rockwell, Romac, Ford or equal.

H. Flexible Connection Coupling - Flexible connection couplings shall be made of an elastomeric polyvinyl chloride boot with Series 300 stainless steel connecting clamps. Couplings shall be used as manufactured by Fernco Joint Sealer Co., Mission Day Products Corp. or equal.

I. Flexible Watertight Connector - Flexible watertight connector used to connect smaller sewers to larger sewers shall be an elastomeric polyvinyl “boot” type sealed to the larger pipe with a stainless steel internal expanding band and around the connecting pipe with a stainless steel external adjusting band. Connector shall be as manufactured by Fernco Joint Sealer Co., Mission Clay Products Corp or equal. Other types of applicable flexible connectors may be submitted for approval.

2.02 UNDERDRAIN PIPE AND JOINTS

A. Drain pipe shall be of the type specified or shown on the Drawings and of quality conforming to the following requirements.

B. Perforated Polyvinyl Chloride Pipe (PPVC):

1. Perforated polyvinyl chloride pipe shall be manufactured from polyvinyl chloride compounds conforming to ASTM D1784, Class 1254-B. Pipe and fittings shall conform to the requirements of ASTM F949, shall have a smooth interior and a corrugated profile. Pipe shall be manufactured to 46 psi stiffness when tested in accordance with ASTM D2412.

2. Joints shall be bell and spigot gasketed connections. Gaskets shall meet the requirements of ASTM F477.

3. Perforation dimensions shall conform to ASTM F949 Table 5.

4. Pipe shall be Contech A2000 or equal.

C. Corrugated Polyethylene Tubing (CPT):

1. Corrugated Polyethylene tubing shall conform to ASTM F405 Heavy-Duty Tubing Requirements for sizes 4-inch thru 8-inch and ASTM F667 for tubing sizes 10-inch, 12-inch, and 15-inch.

2. Tubing shall be a minimum 6-inch in size.

3. Tubing shall be perforated with two rows of holes nominally 1/4-inch to 3/4-inch in diameter at a maximum 5-inch centers.

2.03 PROCESS AND PRESSURE PIPE

A. Ductile Iron Pressure Pipe (DIP):

1. Ductile Iron Pressure Pipe (DIP) shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein. Mechanical joint fittings shall be ductile iron and conform to ANSI A21.10 or AWWA C110 and ANSI A21.53 or AWWA C153. Flanged fittings shall be ductile iron and conform to ANSI A21.15 or AWWA C115. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.

2. Ductile iron pipe buried underground, unless otherwise specified or shown, shall have rubber gasket (slip-on) type joints in straight runs and mechanical joints with retainer glands each way from bends as shown on the Drawings. The gasket shall be a single molded rubber ring fitted into a specially shaped recess in the bell forming a pressure tight seal. The spigot end of each pipe shall be marked to indicate when the pipe is “home.” Fittings shall have mechanical joints with retainer glands unless otherwise specified or shown. Retainer glands shall be ductile iron. The restraining mechanism shall impart multiple wedging

action against the pipe. Restraining devices shall be of heat treated ductile iron. Twist-off nuts shall be used to ensure proper actuation of the restraining device. The mechanical joint retainer gland shall be Ebaa Iron, Inc., Series 1100 Megalug, or equal.

3. Ductile Iron pipe inside buildings or structures shall be joined with flanged, or mechanical joints as shown on the Drawings, or as indicated in the pipe schedule. All mechanical joints shall have retainer glands. Flanges shall comply with ANSI 21.15 or AWWA C115 and shall be ANSI 125-pound drilling, unless otherwise specified. Flanged joints shall have full face 1/8-inch rubber gaskets or of thickness and type approved by the Engineer. The pipe shall not be threaded or flanged in the field. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number. Within buildings the bolts and nuts shall be of the best quality mild steel, with true threads, meeting the requirements of ANSI B16.1.

4. Flange adapters for plain end pipe (not fittings), where specified, shown on Drawings, or approved by Engineer shall be a restrained flange adapter. The restraining mechanism shall be multiple gripping wedges set against the pipe wall. Twist off nuts shall be used to ensure proper actuation of the restraining device. The restrained flange adapter shall be Series 2100 Megaflange by Ebaa Iron, Inc., or equal.

5. Wherever specified or shown, mechanical joints shall conform to ANSI A21.11 (AWWA C111), except as specified under Subsection Process and Pressure Pipe Nuts and Bolts.

6. Couplings, if required or permitted, shall be Dresser Style 38, Rockwell, or equal. Restrained coupling shall be Dresser Style 167 Lock Coupling, Rockwell, or equal.

B. Concrete Pressure Pipe (CPP):

1. Concrete pressure pipe shall be prestressed concrete, steel cylinder type or prestressed concrete embedded steel cylinder type conforming to AWWA C301. The pipe and fittings shall be designed for a minimum 150 psi internal working pressure with allowance for water hammer as specified in AWWA C301, and the most severe combination of H-20 truck loading and earth loading shown on the Drawings.

2. All fittings and specials shall be Type B as specified in AWWA C301.

3. Prestressed concrete pipe shall have a rubber O-ring gasket confined between two metal surfaces. The joint, materials, and its manufacture shall be in accordance with AWWA C301.

4. The pipe shall be installed in accordance with the manufacturer’s instructions. Any pipe that is damaged or has the surface coat abraded will be rejected. No pipe shall be used unless approved by the Engineer.

5. At each end, bend, tee, plug, or other fitting at which the water pressure tends to disjoint the pipe, the joint shall be connected with a Bell Bolt assembly by Interpace, Price Brothers, or equal, on both pipe and fittings, for the distance shown on the Drawings.

C. Steel Pipe:

1. Steel pipe shall be designed, fabricated, and installed in accordance with these Specifications, the applicable "Good Practice" outlined in AWWA Design and Installation of Steel Water Pipe, and applicable AWWA C200, C203, and C205, and ASTM A53 Grade B for pipe less than 24-inch in diameter and API-5L for pipe greater than 24-inch diameter.

2. Pipe shall be manufactured of materials conforming to ASTM A53 Grade B in accordance with the applicable AWWA Standards quoted above. It shall be supplied in nominal lengths approved by the Engineer. Not more than two circumferential welds per joint will be permitted.

3. Specials shall be fabricated of steel plate and designed for the same conditions as the pipe. Collars, stiffeners, and other reinforcement shall be used as required to obtain the necessary strength in all parts of the specials. A plate collar shall be welded around all outlet connections.

4. Minimum wall thickness shall be as follows:

Pipe Diameter	Min. Thickness
Less than 12-inch	Schedule 40
12-inch to 24-inch	1/4-inch
30-inch to 36-inch	5/16-inch
42-inch to 48-inch	3/8-inch
54-inch	1/2-inch

5. Wherever called for, a coupling, Dresser Style 38, Rockwell, or equal shall be used. Unless otherwise specified, the sleeve length shall be 5-inch and the sleeve thickness shall be 1/16-inch greater than the pipe wall thickness.

6. Welded joints shall be used wherever specified or shown on the Drawings. Welding shall comply with the specifications of AWWA covering such Work.

7. Unless otherwise specified, at each connection to an existing buried pipeline a pair of insulated flanges shall be used to completely insulate the new line from the old one. The system to be used shall be submitted to the Engineer for his approval. Flange gaskets shall be full face at least 1/8-inch thick molded phenolic with neoprene facings. Molded phenolic sleeves shall encase each bolt from outside face of flange to outside face. Sleeves shall be 1/16-inch thick. A 1/8-inch thick molded phenolic washer shall be installed under each nut and bolt head.

8. Joint harnesses, harness couplings, lock couplings, flange adapters with set screws, and other flexible restrained joints shall be provided as called for on the Drawings.

9. Where flanged joints are shown on the Drawings, flanges conforming to the requirements of AWWA C207, Table 1, Class D shall be used. All flanged joints shall have full faced gaskets.

D. Stainless Steel Pipe:

1. Stainless steel pipe 12-inch diameter and smaller shall be designed and fabricated in accordance with either ASTM A312 or ASTM A778. Stainless steel pipe larger than 12-inch diameter shall be designed and fabricated in accordance with either ASTM A409 or ASTM A778. The interior surface of the pipe shall be smooth with no protrusions, stiffeners, or bracing. The pipe and fittings shall be constructed of 304L stainless steel.

2. Stainless steel pipe shall have the following minimum wall thickness:

Pipe Diameter	Minimum Wall Thickness
4-inch to 14-inch	0.109-inch (12 gauge)
16-inch to 18-inch	0.140-inch (10 gauge)
20-inch to 24-inch	0.172-inch (8 gauge)

   a. Stainless steel requiring threading shall be minimum Schedule 40.

   b. Stainless steel requiring grooving shall be minimum Schedule 10.

3. Fittings shall conform to either ASTM A403 or ASTM A774 and shall have the same wall thickness and structural properties as the pipe. All bends shall be long radius smooth type. Mitered bends will not be acceptable.

4. Flanges where required shall be ASTM A182-F304L flanges with full facing gaskets and centering rings. Flange bolts shall be stainless steel.

5. Wherever possible, butt weld fittings shall be used for field welding. All welds shall be made by a certified welder and shall conform to procedures for which the welder has been certified. The Contractor shall submit certification statements for the welders and the methods employed. Belled end fittings may be used in lieu of butt weld fittings on air lines.

6. All welds shall have full penetration and be smooth and without protrusions on the interior of the pipe. Weld metal shall be equal to or greater than the parent metal. Any cracks or blow holes appearing on the surface of a welding bead shall be ground away before depositing the next bead.

7. All stainless-steel surfaces shall be passivated by the following procedures:

   a. All outside weld areas shall be wire brushed to remove weld splatter. Brushes shall be stainless steel and used only on stainless steel.

b. All stainless-steel assemblies and parts shall be completely immersed in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material after this procedure.

c. Previously pickled parts shall be neutralized by immersion in a tap water.

E. Polyvinyl Chloride Pipe (PVC):

1. Pipe shall meet the requirements of AWWA C900, and unless otherwise specified shall be Class 235, and have a standard thermoplastic pipe dimension ratio (D.R.) of 18.0.

2. All fittings and specials shall be as specified for ductile iron pressure pipe.

3. Polyvinyl chloride pipe joints shall be integral bell push-on type meeting the requirements of ASTM D3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F477. Where called for on the Drawings, flanged joints shall be used. Flanged joints shall be supplied with 1/16-inch thick full-faced gaskets of suitable material for the application. Flange bolts and nuts shall be stainless steel.

F. Chlorinated Polyvinyl Chloride Pipe (CPVC):

1. Chlorinated polyvinyl chloride pipe, Schedule 40 or 80 as shown on the Drawings shall conform to ASTM F441. CPVC fittings shall be Schedule 80 socket type and conform to ASTM F439.

2. The method of joining shall be as recommended by the piping manufacturer.

2.04 PROCESS AND PRESSURE PIPE NUTS AND BOLTS

A. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.

B. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.

C. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.

2.05 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall be as specified in Section 15010.

2.06 COATINGS AND LININGS OF PROCESS AND PRESSURE PIPE

A. Coatings and linings where required shall conform to the following requirements unless otherwise indicated in Part 4 of this Section or on the Drawings.

B. Ductile Iron Pipe:

1. Ductile iron pipe, and fittings unless otherwise specified, shall be lined on the interior with a standard thickness cement lining meeting ANSI A21.4 and AWWA C104. A seal coat of bituminous material shall be applied in conformance with the above Specifications. Piping used for compressed air shall not receive a cement lining.

2. All pipe buried underground shall be coated on the outside with a standard coating of coal tar or asphalt, 1 mil thick unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe. The coating materials, after drying 48 hours, shall impart no objectionable color, odor, or taste to water standing in contact with the coating for a minimum of 48 hours.

3. Where approved, the bituminous material used for an interior seal coat may be used for exterior coating of pipe buried underground.

4. All pipe used within buildings and structures and which are to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting specifications shall be followed for cleaning and painting.

C. Prestressed Concrete Pipe and Asbestos-Cement Pipe:

1. Prestressed concrete pipe and asbestos-cement pipe require no special interior or exterior lining or coating, unless otherwise specified.

D. Steel Pipe:

1. Steel pipe shall be shop lined on the inside with centrifugally spun cement mortar lining or field applied-in-place cement lining, in accordance with AWWA C205 and C602. If pipe is field lined, it shall be given an inside shop coat of bituminous primer after sandblasting before shipment to the Site.

2. The outside of all buried steel pipe shall receive a coat of an approved bituminous primer, followed by a coat of coal tar enamel into which shall be bonded a single layer of felt wrap, and finished with a single wrap of craft paper unless otherwise specified. All materials and application procedures to be in full accordance with the pertinent sections of AWWA C203. Protective coatings are to be shop applied.

3. The outside of steel pipe inside of buildings and structures, and exposed exterior shall be properly cleaned and shop painted with one coat of primer that is compatible with field coats.

2.07 BEDDING MATERIAL

A. Unless otherwise shown on the Drawings or specified herein, all pipe bedding material shall be in conformance with Section 02200.

B. Concrete bedding and encasement in lieu of standard bedding material shall be installed as shown on the Drawings or specified.

C. All underdrain pipe shall be bedded in AASHTO No. 67 aggregate in lieu of the standard bedding material to a depth shown on the Drawings.

2.08 PIPE ESCUTCHEONS

A. Split-type escutcheons shall be used for piping passing through finished wall, floors, or ceiling. Escutcheons shall be brass plated or chromium plated Model 3A by Ritter, Model 284 by Fee & Mason, or equal.

2.09 WALL PIPE AND SLEEVES

A. Type A Wall Pipe:

1. Cast iron wall pipe shall be used where noted on the Drawings.
2. Wall pipe shall be cast in place with joints as indicated on the Drawings.
3. Where wall pipe is flush with wall, bolt holes shall be tapped for studs.

B. Type B Sleeve:

1. Type B sleeves are for use in exterior walls.
2. Type B sleeves consist of casting in place a cast iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.
3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.

C. Type C Sleeve:

1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.
3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

D. Type D Floor Sleeve:

1. Type D sleeves are used for pipes passing through floors.

2. Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

E. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.

2. Type E sleeves consist of casting in place a mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.

3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting the requirements of AWWA C111 on both ends.

F. Type F Sleeve:

1. Type F sleeves shall be used for passing through existing masonry walls.

2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

G. Type G Sleeve:

1. Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrink grout as shown on the Drawings.

H. Type H Sleeve:

1. Type H sleeves shall be similar to Type G sleeves and used for passing through gastight walls.

2. Type H sleeves shall be as detailed on the Drawings.

I. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

2.10 EXPANSION JOINTS

A. Expansion joints as specified below shall be installed as per Section 15010.

B. Expansion joint construction shall include a neoprene inner tube extending through the bore to the outside edge of both flanges. The inner tube shall be covered with a flexible multiple layer fabric carcass of high strength rubber impregnated synthetic fibers with steel wire or reinforcement rings integral with the fabric to assure sufficient rigidity for vacuum service and high pressure. An outer cover coated with Hypalon paint shall cover the carcass and provide full protection against ozone and weathering.

C. Flange faces shall be neoprene covered and drilled to match drilling in mating flanges. Flange faces shall also be backed by split steel flange retaining rings.

D. All expansion joints shall be suitable for service temperatures of 225 degrees F.

E. All expansion joints used for vacuum service shall be capable of withstanding a 30-inch Hg vacuum.

F. Expansion joints shall have recommended working pressures compatible with the service for which they are installed.

G. All expansion joints shall be equipped with control units to restrict excess axial compression and elongation. Control units shall consist of plates bolted to pipe flanges on each end of the expansion joint and long control bolts extending between pipe flanges.

H. Expansion joints on pipes used for digester gas service shall be the open arch type.

I. Expansion joints on sludge piping shall be of filled arch construction to prevent solids accumulation at the joint.

J. Expansion joints on pipes used for fuel oil and digester gas service shall have Buna-N tubes.

K. For those locations where expansion joints are used to replace valves, spool pieces, or other short sections, standard single arch expansion joints may be of insufficient length. At these locations double, triple, and quad arch expansion joints shall be used as required.

L. Expansion joints shall be Mercer Rubber Company Style 500-700 or equal.

PART 3 EXECUTION

3.01 PRODUCT HANDLING

A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.

B. Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than 4-feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sun’s rays.

3.02 PREPARATION OF TRENCH

A. Trench excavation shall conform to requirements of Section 02200.

B. Unless otherwise specified or called for on the Drawings, the width of trench at the top of pipe 24-inch in diameter or less shall not exceed the outside diameter of the pipe or encasement, plus 9-inch on each side of the pipe measured to the face of the trench or to the back of the sheeting when used. For pipe having a diameter greater than 24-inch, the width of trenches at the top of the pipe shall not exceed the outside diameter of the pipe or encasement, plus 15-inch on each side of the pipe measured as specified above.

C. Unless otherwise directed or called for on the Drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

3.03 PIPE INSTALLATION

A. General:

1. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade as detailed on the Drawings. Bell holes shall be dug in the bedding where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6-inch layers to the height shown on the Drawings or as directed. A mechanical tamper shall be used when installing bedding material for pipe 24-inch diameter and larger. The remainder of the trench shall be backfilled as specified and called for on the Drawings.
2. All pipe shall be laid to lines and grades in conformance with Section 01800.
3. Wherever piping passes through walls or floors, a wall casting pipe or sleeve of the type indicated on the Drawings shall be installed. Escutcheons shall be provided for pipe passing through finished walls, floors, or ceilings.
4. Pipe Anchoring:
    a. Disjointing hydrostatic pressure at bends, valves, plugs, tees, and wyes shall be counteracted by restrained joints or reinforced concrete anchorage as directed on the Drawings or specified.
    b. Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.
    c. Approved joint restraints shall be installed for the distance from each side of each bend, valve, plug, tee, or wye in locations shown or scheduled on the Drawings.
    d. Reinforced concrete joint anchorage shall be installed in conformance with the Drawings.
5. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 5-feet. Pressure piping which carries gases shall be installed with a minimum cover of 4-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation, or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the

pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade and alignment shall be approved by the Engineer.

B. Sewer Pipe:

1. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings. Laser beams shall be used to maintain line and grade unless other methods are approved by the Engineer.

2. Where holes are cast in concrete pipe for handling, they shall be completely filled with non-shrinking mortar after the pipe is placed. A metal disc of proper size may be inserted near the bottom of the hole to retain the mortar until hardened. Wood plugs or rocks intended to plug the hole for retention of the mortar will not be permitted.

3. Joints:

a. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

b. Non-shrinking Mortar Joints - Where specified or shown on the Drawings, joints of concrete pipe sewers shall be thoroughly pointed full inside circumference with a non-shrinking mortar in conformance with the material manufacturer's instructions. The mortar shall be tightly packed and the interior face of the joint shall be left smooth and continuous with the interior face of the pipe. Pointing shall not be done until the backfill over the pipe is placed and compacted.

4. Connections to Existing Sewers:

a. Unless otherwise specified, shown on the Drawings, or directed, connections to existing sewers shall be made as follows:

1) Vitrified clay pipe, plain concrete pipe, and asbestos cement pipe, 15-inch diameter and smaller, and larger diameter at the option of the Contractor, shall be connected by removing a

section of the existing sewer and inserting connecting fittings using specified flexible connection couplings.

2) Reinforced concrete pipe and larger sizes of asbestos cement pipe and plain concrete pipe, unless otherwise shown on the Drawings, shall be connected by coring the existing sewer pipe wall and inserting a flexible watertight connector to receive the new pipe.

3) Polyvinyl chloride pipe, ABS pipe, and ABS truss pipe shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.

b. Connections shall be made in conformance with the jointing materials manufacturer's recommendations and as directed by the Resident Project Representative.

C. Underdrain Pipe:

1. Underdrain pipe shall be laid in a manner conforming to the laying of sewer pipe.

2. In addition, underdrain pipe shall be laid with perforations on the underside.

3. The ends of all pipelines shall be closed with stoppers to prevent entry of soil or other foreign materials.

D. Process and Pressure Pipe:

1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.

2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.

3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Resident Project Representative before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

4. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Resident Project Representative.

5. Joints:

a. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The

spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced "home" firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

b. Concrete Pressure Pipe Diapers - A band at least 5-1/2-inch wide shall be placed around the outside of concrete pressure pipe, over each joint as recommended by and available from the pipe manufacturer. This band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the spigot. If the air temperature is below 40 degrees the spigot, bell, and mortar shall be heated. If a reinforced paper joint band is used, it shall be drawn up tight around the pipe and backfill tamped against it up to the springline before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and the grout poured before backfilling.

c. Concrete Pressure Pipe Interior Joints - The interior joint recess of pipe 24-inch and larger shall be pointed using a non-shrinking mortar specified in Subsection 2.01. The inside surface shall be struck off smooth with the pipe interior. On pipe 20-inch and smaller a rope type mastic or trowellable mastic shall be affixed to the concrete face of the bell socket just prior to pushing the spigot into the bell, such that the mastic material squeezes to fill the internal joint recess. Mastics that are detrimental to rubber gaskets shall not be used. Similarly, primers to be used in conjunction with rope type mastics must be kept off gaskets and sealing surfaces of joint rings.

d. Bell and Spigot Lead Joints - If used, the spigot of each pipe shall be fully seated in the bell of the adjoining pipe, adjusted to form a uniform annular space which shall be caulked with sterilized pre-molded rubber, forming a solid packing against which molten lead shall be poured and caulked. Lead, after caulking, shall have a depth of at least 2-inch for pipes 14-inch or less in diameter, and 2-1/2-inch for larger pipe. The melting pot shall be kept near the joint which shall be made by one pouring. Dross shall not be allowed to accumulate in the pot. All Work shall be performed by skilled workmen.

e. Electrical Continuity - Where specified, electrical continuity shall be provided in concrete and steel pressure pipes by welding an insulated #4RR copper cable across joints. The cable shall be welded to the steel

of bell and spigot of concrete pressure pipe and across joints including each piece of coupling on jointed steel pipes.

f. Where new piping is to be connected into an existing joint, said joint shall be cleaned sufficiently to result in a liquid- or gastight seal. If applicable, a new gasket shall be supplied and installed.

3.04 SLEEVES AND WALL PIPE

A. Type A wall pipes shall be provided for all pipes passing through the exterior walls unless other sleeve types or wall pipes are designated on the Drawings. Type C sleeves shall be provided in interior walls unless designated otherwise on the Drawings.

B. At all points where piping passes through floors, Type D sleeves shall be provided, unless otherwise designated on the Drawings.

C. Other sleeve types and wall pipe shall be provided as indicated on the Drawings.

D. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

3.05 TESTS FOR INFILTRATION AND EXFILTRATION IN SEWER PIPE

A. Preparation:

1. Before sections of sewers may be tested for infiltration or exfiltration, all house leads from it must be constructed to limits called for and plugged or capped and all trenches backfilled and compacted.

2. Sewers to be tested shall be clean and free from construction debris. Sand, dirt, concrete, or other materials shall be completely removed in a manner that will not damage the sewer pipe.

3. Pipe joints shall be watertight. The Contractor shall repair manholes and pipe joints as required to stop all visible leaks. Seepage permitted through walls or patched joints shall be at the discretion of the Resident Project Representative but in no instance will the specified allowable infiltration be exceeded.

4. Where sewers are above the groundwater table, the Contractor may flood the trench or air test the sewer to find and repair leaks prior to exfiltration tests.

5. The materials and methods for repairing leaks shall be submitted to the Resident Project Representative for approval before beginning Work.

B. Observation:

1. After a sewer has been cleaned and all repairs made as specified, the sewer shall be observed and approved by the Resident Project Representative before conducting infiltration or exfiltration tests.

2. Sewers 36-inch diameter and larger shall be observed from the inside. Observation of sewers smaller than 36-inch diameter from the inside shall be at the discretion of the Resident Project Representative.

3. Unless otherwise specified, smaller sewers shall be observed by lamping between manholes.

4. The Resident Project Representative may require the Contractor to run close circuit television through smaller sewers that appear defective or do not pass infiltration tests.

5. The Contractor shall furnish all lights, carts, television, and other equipment and labor required to assist the Resident Project Representative in the observation.

C. Test Sections:

1. The maximum length of a sewer test section shall be 900 lineal feet. Every manhole shall be included in at least one test section.

2. The Contractor shall furnish and install bulkheads, sewer plugs, weirs, water level tubes, lighting, and other equipment required to conduct the tests in locations and as directed by the Resident Project Representative.

3. Infiltration:

a. Where the groundwater level is above the top of the pipe, the sewer shall be tested for infiltration.

b. The Contractor shall plug or bulkhead the sewer to isolate the test section and install a weir in the pipe at the outlet manhole. The weir shall be direct reading of an approved design calibrated to read gallons per day.

4. Exfiltration:

a. Where the groundwater level is below the top of the pipe and cannot be maintained above it, the sewer shall be tested for exfiltration.

b. The Contractor shall bulkhead or plug each end of the designated test section and fill the water to the elevation directed by the Resident Project Representative. Exfiltration will be computed from the loss of water as measured in the manholes.

5. Allowable Leakage:

a. The test in each section shall be continued for at least 24 hours and, if its measured leakage during that period exceeds 100 gallons per inch of diameter per mile of pipe, the Contractor shall locate the points of leakage and make necessary repairs, continuing the Work until leakage is reduced to the permissible maximum as specified.

b. The amount of infiltration allowed for storm sewers shall be limited to reasonable seepage, except that, if specified, the total in any section

shall not exceed the amounts allowed for sanitary sewers as herein specified.

3.06 LOW PRESSURE AIR ACCEPTANCE TESTS

A. Where approved by the Engineer, the Contractor may perform low pressure air acceptance tests in lieu of infiltration or exfiltration tests for pipes 24 inches in diameter or smaller. Test shall be made in accordance with ASTM F1417-Plastic Gravity Sewer Lines; ASTM C924-Concrete (Circular) Sewer Pipe with Gasket.

1. If the air pressure required for the test is greater than 5.0 psig, the low-pressure air acceptance test shall not be used.

B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Resident Project Representative.

C. Safety:

1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.

2. Pressurizing equipment shall include a regulator set at the maximum pressure.

D. Line Preparation:

1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.

2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.

3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.

E. Test Procedure:

1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the invert of the pipe.

2. When a constant pressure of 4.0 psig greater than the average back pressure of any groundwater above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.

3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any groundwater above the pipe, the air supply shall be shut off or disconnected.

4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any

groundwater above the pipe. When this pressure is reached, timing shall commence with a stop watch.

5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.

F. Test Method ASTM F1417-Plastic Gravity Sewer Line:

1. Low pressure air test method shall be the Time-Pressure Drop Method.

2. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.

3. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F1417, the section fails. The table below has been reprinted from ASTM F1417 for Contractor's information.

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown. For more information, see ASTM F1417, Table 1.

G. Test Method ASTM C924-Concrete (Circular) Sewer Pipe with Gasket:

1. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.

2. The time required for the pressure in the test to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM C924, the section fails. The table below has been reprinted from ASTM C924 for Contactor's information.

D Nominal Pipe Size, Inches	Minimum Time (minutes)/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6

H. Air Pressure Adjustment for Groundwater:

1. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10-inch long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.

2. The air pressure correction, for the average back pressure of the groundwater above the pipe, shall be calculated by subtracting the average invert elevation from the measured groundwater elevation and dividing the difference by 2.31 psi/feet. This correction must be added to the test pressures stated in the test procedure.

3.07 SPECIAL TESTING - DEFLECTION OF PVC SEWER PIPE

A. In addition to infiltration and exfiltration testing all PVC sewer pipe shall receive the following testing.

1. Vertical Ring Deflection - Before final acceptance of sewer lines constructed of these materials, all sections of sewer pipe 8-inch and larger specified diameter shall be measured for vertical ring deflection by the Contractor and witnessed by the Resident Project Representative. Maximum deflection under full load shall not exceed 5% of the average inside diameter as determined by the laboratory for the specified piping.

2. Failures - Should any pipe exceed the allowable deflection; the Contractor shall replace those pipes and retest the section as directed by the Resident Project Representative.

3. Equipment used in testing shall be go-no go pull through gauges of a type approved by the Engineer. Each gauge must be checked and approved by the laboratory before using. A metal or plastic gauging ring of diameter equal to 95% of the specified average pipe diameter shall be furnished with each gauge required.

4. Testing Equipment and Personnel to perform the required tests shall be provided by the Contractor. Tests must be witnessed by the Resident Project Representative.

5. Use of mechanical pulling devices will not be permitted.

3.08 PRESSURE AND LEAKAGE TESTS FOR PROCESS AND PRESSURE PIPE

A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines including the joint between existing and new pipes unless otherwise directed by the Engineer.

B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Resident Project Representative. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilling prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 9 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.

E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.

F. Testing of lines governed by other authorities, i.e. natural gas, shall be witnessed and approved by the authority.

3.09 DISINFECTION OF POTABLE WATER MAINS

A. After the pressure test and prior to disinfecting, the lines shall be thoroughly flushed through hydrants, fixtures or by other means as approved by the Engineer.

B. The Contractor shall furnish required materials and apparatus and perform the Work of disinfections. All temporary and permanent materials, apparatus and appurtenances shall have the same NSF 61 approval as the installed Work.

C. All water lines shall be cleaned and disinfected in accordance with federal, state, and local codes and AWWA C651 as follows:

1. Liquid sodium hypochlorite by means of a suitable solution feed machine or pump. Sodium hypochlorite storage conditions and durations shall be controlled to minimize deterioration.

2. Calcium hypochlorite as tablets, powder. Tablets or powder shall be placed in the water line during construction. The water line shall be filled, carefully, with potable water to produce a uniform solution.

3. Calcium hypochlorite as a water mixture. The calcium hypochlorite powder shall be mixed with water to form a paste and then thinned to a slurry, to be introduced into the pipe by pumping.

D. The dosage of chlorinating agent shall be of the amount to produce a minimum chlorine residual of 50 parts of chlorine per million. Tests with the DPD method shall be made at selected points to determine the residual.

E. Treated water shall be retained in the lines for sufficient time to accomplish the desired disinfection but not less than 24 hours. Valves in the line shall be operated during the retention period.

F. Following disinfection, all treated water shall be flushed from the lines at their extremities until the replacement water throughout the lines shall, upon test, be chemically and bacteriologically acceptable.

1. Two or more successive sets of samples taken at 24-hour intervals shall indicate microbiologically satisfactory water before the lines are placed into service.

2. Should the initial treatment prove ineffective, the disinfection shall be repeated until the test shows acceptable results.

G. All testing shall be done by a laboratory acceptable to the public authority having jurisdiction, and all costs shall be paid for by the Contractor.

H. The disposal of heavily chlorinated water shall be coordinated with the Owner and regulatory agencies. The heavily chlorinated water may require the addition of a dechlorinating chemical prior to release to a storm sewer or to the environment. The dechlorinating method shall be approved by the Owner and Engineer. The heavily chlorinated water shall not be released to sanitary sewers without permission from the Owner of the sanitary sewer system.

3.10 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.

D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

PART 4 SPECIAL PROVISIONS

4.01 PIPING SCHEDULE

A. The following letter designations are used in the Piping Schedule:

Location Designation

ADT - Aerobic Digester Tanks
BHB - Biosolids Handling Building
PT - Pressate Tank

Material Designation:

DIP - Ductile Iron Pipe
VCP - Vitrified Clay Pipe
PVC - Polyvinyl Chloride
PPVC - Perforated Polyvinyl Chloride
FRP - Fiberglass
SS - Stainless Steel
Steel - Steel
SWS - Spiral Welded Steel
CPP - Concrete Pressure Pipe
RCP - Reinforced Concrete Pipe
CPT - Corrugated Polyethylene Tubing

B. Schedule:

Location	Service	Size	Material	Remarks
ADT	Air Piping	4", 6"	Sch 10 304L SS	Exposed, within tank
ADT	Process Piping	4"	DIP	Exposed, within tank

Location	Service	Size	Material	Remarks
ADT	Process Piping	6"	DIP	Submerged, WAS piping inlet to tank
ADT	Process Piping	8"	DIP	Submerged/Buried, telescoping valve drain
ADT	Sanitary Drain	12"	DIP	Buried, Supernatant Drain
BHB	Air Piping	4", 6", 8", 10", 12"	Sch 10 304L SS	Exposed, inside building
BHB	Ferric Chloride Chemical Feed	3/4"	Sch 80 PVC	Exposed, inside building
BHB	NPW	½", 1 ¼", 1 ½", 1", 2"	Sch 80 PVC	Exposed, inside building
BHB	Polymer Chemical Feed	1 1/4"	Sch 80 PVC	Exposed, inside building
BHB	Process Piping	4", 6"	DIP	Exposed, inside building
BHB	Process Piping	6"	DIP	Buried, Truck Fill Line, WAS
BHB	Process Piping	8"	Sch 40 PVC	Biosolids Day Tank Vent
BHB	Sanitary Drain	2", 4"	Sch 40 PVC	Exposed/Buried, Sanitary Drain Vent
BHB	Sanitary Drain	3"	DIP	Exposed/Buried, Floc Tank Drain
BHB	Sanitary Drain	4", 6", 12"	DIP	Buried
BHB	Sanitary Drain	6"	DIP	Exposed/Buried, Biosolids Day Tank Drain
BSB	NPW	¾", 1.5"	Sch 80 PVC	Exposed, inside building
PT	Air Piping	4"	Sch 10 304L SS	Exposed, within tank
PT	Process Piping	4"	DIP	Exposed/Submerged, within tank
Yard	Air Piping	4", 8"	DIP	Buried, shall use viton gaskets in fittings
Yard	Water Line	2"	HDPE	Buried
Yard	Water Line	4", 6"	C900 DR18	Buried
Yard	Process Piping	6"	C900 DR18	Buried, WAS
Yard	Process Piping	4"	DIP	Buried, Scum
Yard	Process Piping	6"	DIP	Truck Fill Line, Buried

C. Schedules are not guaranteed to be complete. All piping shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

END OF SECTION

SECTION 15250
VALVES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installing valves, flap gates, and shear gates 4-inch and larger within structures.

B. Floor stands, floor boxes; valve boxes; gears, manual, hydraulic, and electric operators; extension stems; stem guides and supports; brackets; gaskets; bolts and nuts; and other accessories shall be provided as necessary to complete the Work.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. The Contractor shall indicate all variances from the requirements of the Contract Documents.

b. Scaled dimensional drawings.

c. Wiring schematics with termination point identification.

d. Piping schematics.

e. Materials of construction.

f. Manufacturer’s catalog data.

g. General Arrangement Drawings.

h. Motor information per Section 11050.

2. Information for the Record:

a. Valve hydrostatic testing certification

b. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves and appurtenances shall be of standard make approved by the Engineer and shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation shown on the Drawings, specified herein, or as directed by the Engineer.

B. Opening Direction - Unless otherwise specified in Part 4, valves with screw stems shall open by turning counterclockwise, the direction being indicated by an arrow cast where easily visible to operator.

C. Connections - Valves shall be provided with hubs, spigots, flanges, mechanical groove-type, screw, or other connections compatible with the pipe in which they are installed or scheduled in Part 4.

D. Unless otherwise specified, a stuffing box packed with O-ring seals shall be used to seal the stem of the valve. The seal system used shall be replaceable without removing bonnet or rotating element. Gaskets shall be of either Buna or a rubber composition.

E. All other nuts and bolts shall be low carbon steel conforming with the mechanical and chemical requirements of ASTM A307, Grade B.

2.02 RESERVED

2.03 CHECK VALVES

A. Check valves, unless otherwise noted, shall be standard swing type, quiet closing, and constructed for 150-pounds working pressure. They shall be iron body, bronze mounted, with outside lever and adjustable weights, flanged or grooved connections, and have hinge pins of hardened corrosion-resistant alloy. Discs on sizes smaller than 6-inch shall be solid bronze, and on larger sizes shall be cast iron with bronze facing.

B. Applicable specifications under gate valves, as to materials and character of construction, shall apply to check valves.

2.04 BUTTERFLY VALVES

A. All butterfly valves shall conform to AWWA C504, except as herein modified. The valves shall be suitable for throttling service through the entire operating head range and for the service listed in the Valve Schedule.

B. The butterfly valves shall be equipped with ANSI B16.1 Class 125 cast iron flanges, grooved ends or mechanical joints as indicated on the Drawings. Valve bodies shall be cast iron conforming to ASTM A48, Class 40, or ductile iron ASTM A536, Grade 65-45-12.

C. Valves shall be AWWA Class 150B short body, unless otherwise specified in Part 4.

D. Rubber seats shall be retained to the body of the valve. Method of retention shall conform to AWWA C504.

E. Valve shafts shall be a continuous, one-piece shaft type extending through the valve disc hubs for valves up through the 12-inch size. Valve shafts for valves larger than 12-inch shall be the stub shaft type into the disc hub. Shafts shall be of 18-8 stainless steel.

F. Valve disc shall be cast ductile iron with an 18-8 stainless steel seating edge.

G. The valve shall be equipped with a thrust bearing, other than the seat, to hold the disc in the center of the valve seat.

H. The stem seal shall be either multiple O-ring cartridge type or compression type Teflon impregnated packing. The stuffing box shall be designed so that it can be readily repacked and repaired without removing the valve operator.

I. Unless otherwise indicated, operators shall be sized in accordance with AWWA C504 for Class 150B valves. Traveling nut type operators are not acceptable for throttling service.

J. Butterfly valves for process air service shall be either cast or ductile iron body, aluminum-bronze disc, EPDM seats, stainless steel stem, with manufacturer's standard stem seal for dry air at 150 degrees F. Unless otherwise specified or shown on the Drawings, lever operators with positioning/locking handles with position pointer shall be supplied. Valves shall be rated for 150 psi service and 250 degrees F maximum.

2.05 PLUG VALVES

A. Unless otherwise shown on the Drawings or called for in the Valve Schedule, plug valves shall be the nonlubricated eccentric type valve providing dead tight shut-off.

B. Port area of valves 20-inch and smaller shall be not less than 80% of the nominal pipe area. Valves 24-inch and larger shall have port area of not less than 70% of the nominal pipe area.

C. The valve body bonnet and rotating element shall be semi-steel (ASTM A126, Class B). The bonnet shall be held in position with bolts and designed with a recessed tongue and groove or dowel pinned connection to the valve body to insure proper alignment of the body and bonnet bushings.

D. Pressure ratings shall be 175 psi on valve sizes through 12 inch and 150 psi for 14-inch and larger. Valve shall be certified hydrostatic shell test and seat test, with test reports being available upon request.

E. Corrosion-resistant bushings of the permanently lubricated type shall be provided in the body and the bonnet to support the rotating element trunnions. Bushings shall be stainless steel, bronze, or metal-jacketed fusion-bonded Nylon 11 suitable for sewage service. Valves 24-inch and larger shall have bronze bearings and stainless-steel sleeves. Tape, sprayed, or roll-on type bushings or sleeves are not acceptable.

F. The valve body seat contacting the rotating element shall be welded in overlay of not less than 90% pure nickel or fusion-bonded Nylon 11 coating. The seating surface of the rotating element shall be Hycar, Buna-N, neoprene or other material recommended by the manufacturer for the application specified.

G. 2331 Valves and actuators shall have seals on all shafts and gaskets on covers to prevent leakage of liquid out of or the entry of dirt or liquid into the valve.

H. Manual gear actuators shall be rated for bi-directional shutoff at the valves design pressure rating.

I. Grit seals are required on both the upper and lower plug shafts.

2.06 RESERVED

2.07 RELIEF VALVES

A. The relief valves for vertical slab mounting shall be Neenah R-5001-1 Type A, Traverse City No. A-37, or equal, and horizontal wall mounting shall be Neenah R-5002 Type B, Traverse City No. A-435, or equal. Valves shall be cast iron with neoprene seat. They shall have a grate to prevent solids from entering the valve body and 1/4-inch thick fiberglass lid.

2.08 MUD VALVES

A. Unless otherwise noted, mud valve shall be of the rising stem type. Mud valves shall be drilled for 125 pounds standard with cast iron frame, bronze mounting with machined gate and gate seat for accurate fit and tight shutoff.

B. The valve body shall be cast iron.

C. The stem, stem knot, disc ring, and seat ring shall be bronze.

D. Extension stems, operating nut, and hand wheel shall be provided as stated in the Valve Schedule and shown on the Drawings.

2.09 RESERVED

2.10 THREE-WAY AND FOUR-WAY PLUG VALVES

A. Unless otherwise specified in Part 4 of this Section or on the Drawings, three-way and four-way valves shall meet the specifications of a standard plug valve.

B. Opening combinations shall be as necessary to perform the services indicated in the Drawings or in Part 4 of this Section.

C. Valves shall have an indicator to indicate the position of the plug.

2.11 RESERVED

2.12 RESERVED

2.13 RESERVED

2.14 RESERVED

2.15 RESERVED

2.16 EXTENSION STEMS AND STEM GUIDES

A. Each valve shall be provided with extension stem, when required for ease of operation. Unless otherwise specified, each extension stem shall be made of cold-rolled steel material and the same size as the valve stem of the valve it operates. If the extension is more than 8-feet long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8-feet. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel 5/8-inch expansion bolts.

B. All valves which are to be operated by tee wrench shall have 2-inch square operating nut at the top of the extension stem.

C. Stems for operation of plug valves shall not be less than 1-1/4-inch diameter Schedule 80 galvanized steel pipe with intermediate steady guides. Weld socket for 2-inch valve nuts to bottom of extension stems and pin sockets to nuts with stainless steel 3/8-inch bolts. Provide a permanent lever or a 2-inch square operating nut at top of stems, in accordance with requirements of Drawings.

2.17 TEE WRENCHES

A. Tee wrenches shall be supplied in the number and length specified in Part 4 of this Section. The minimum length shall be 3 feet.

2.18 MANUAL OPERATION

A. Valves shall be equipped with nut, hand wheel crank, chain, gears, floor stand, and other appurtenances as required for manual operation as specified or scheduled. Operators shall be in accordance with AWWA specifications except as modified herein.

B. Each valve with a manual operator within a building which is more than 5-feet-6-inch above the floor to the rim of the manual operator shall have a chain wheel with galvanized chain looping 3-feet-6-inch from the floor. The valve shall be oriented to permit chain wheel operation or intermediate pulleys shall be installed to facilitate chain operation.

C. Operation shall be designed so that the effort required to operate the hand wheel, lever, or chain shall not exceed 25 pounds applied at the extremity of the wheel or lever. The hand wheels on valves 4-inch and larger shall not be less than 12-inch in diameter.

D. Gears for valve operation shall be installed in such a manner that the stuffing box will be accessible for packing.

2.19 HYDRAULIC OPERATION

A. Valves for hydraulic operation shall be equipped with cylinders in accordance with AWWA C504. The size of the cylinder shall be determined by the valve manufacturer to be adequate for specified pressure and operating conditions in each instance where a hydraulically operated valve is specified in the definitive specifications under Part 4 of this Section. Unless otherwise specified, cylinders above 12 inches in size, or where the cylinder pressure exceeds 100 pounds, shall be cast iron bronze-lined type.

2.20 ELECTRIC VALVE OPERATOR

A. General:

1. The operator shall be a helical and worm gear type drive by an electric motor.
2. The operator shall be suitable for use on a 460-volt, 3 phase, 60 Hz power supply and are to incorporate, integral reversing starter, local control facilities, and terminals for remote control and indication connections.
3. The operator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the 3-phase power supply connected to the actuator.
4. It shall be possible to carry out the setting of the torque, turns, and configurations of the indication contacts without the necessity to remove any electrical compartment covers.
5. The operator shall be capable of functioning in an ambient temperature ranging from minus 10 degrees F to 120 degrees F.
6. The operators shall be AUMA Model SA, Rotork Controls, Inc. Model IQM or Limitorque MX or QX for modulating service and Model IQ or Limitorque MX or QX for open-close service or equal. ***(Addendum 1, December 16, 2024)***

B. Operator Sizing - The operator shall be sized to guarantee valve closure at the specified differential pressure. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall be such as to give valve closing and opening at approximately 60 seconds unless otherwise stated in the specifications.

C. Motor:

1. The electric motor for modulating service shall be Class F insulated and the motor for open-close service shall be Class-F insulated. The motor shall be a suitable rated 4-poled motor.
2. Electrical and mechanical disconnection of the motor should be possible without draining or loss of the lubricant from the actuator gearcase. Plugs and sockets are not acceptable as a means of electrical connection for the motor.

3. Protection shall be provided for the motor as follows:

    a. The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve.

    b. Motor temperature shall be sensed by a thermostat to protect against overheating.

    c. Single phasing protection.

D. Gearing:

1. The operator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. All main drive gearing must be of metal construction. For modulating applications, the hammer blow backlash shall be omitted from the output gear train. For rising spindle valves, the output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type at the base of the actuator, and the design should be such as to permit the gearcase to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

2. Standard gear oil shall be used to lubricate the gearcase. Special or exotic lubricants shall not be used as they may be difficult to source in remote locations.

E. Hand Operation:

1. A hand wheel shall be provided for emergency operation engaged when the motor is declutched by a lever or similar means; the drive being restored to power automatically by starting the motor. The hand/auto selection lever should be padlockable in both HAND and AUTO positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the HAND-AUTO selection lever is locked in HAND without damage to the drive train.

2. The hand wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time. Clockwise operation of the hand wheel shall give closing movement of the valve unless otherwise stated in the job specifications.

F. Drive Bushing - The operator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base, should be of the sealed-for-life type.

G. Torque and Turns and Positional Accuracy:

1. Torque and turns limitation to be adjustable as follows:

2. Position setting range - 0.5 to 10,000 turns, with resolution to 15 degrees of operator output.

3. Torque setting – 40% to 100% rated torque.
4. "Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during mid-travel against high inertia loads.
5. With analogue inputs via the modulating controller, overall accuracy (actuator mechanical output/demand shall be 0.5%.
6. The electric circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

H. Remote Valve Position/Operator Status Indication:

1. The operator must provide an Absolute Position Encoder which provides continuous monitoring of valve position during motor or hand wheel operation even when the power supply is not present without the use of a battery to maintain the memory.
2. In the event of a main power supply loss or failure, the position Encoder must continue to monitor position.
3. If the actuator is not provided with an Absolute Position Encoder, a battery back-up power source must be provided in the actuator to ensure correct remote indication should the actuator be moved manually when the power supply is interrupted. The manufacturer shall provide a recommended maintenance interval schedule on replacement of the battery(s) and associated training for site personnel at no additional cost to the Site.
4. The position of the actuator and valve must be stored or updated contemporaneously, even when the power supply is not present.
5. Four contacts shall be provided which can be selected to indicate any position of the valve with each contact selectable as normally open or normally closed. The contacts shall be rated at 5-amp, 250 VAC, 30 VDC.
6. As an alternative to providing valve position, any of the four above contacts shall be selectable to signal one of the following:
    a. Valve Opening or Closing.
    b. Valve Moving (Continuous or Pulsing).
    c. Motor Tripped on Torque in Mid-Travel.
    d. Motor Stalled.
    e. Actuator Operated by Handwheel.

I. Local Position Indication:

1. The operator shall include a digital position indicator with a display from fully open to fully closed in 1% increments. Red, green, and yellow lights corresponding to Open, Close, and Intermediate positions shall be included on

the actuator. The digital display shall be maintained or stored even when the power to the actuator is isolated.

2. The local display should be large enough to be viewed from a distance of six feet when the actuator is powered up.

3. Operators for modulating service shall have a contactless transmitter to give a 4-20 mA analog signal corresponding to valve travel for remote indication. Operators for open-close service shall transmit an open or closed discrete signal.

J. Integral Starter and Transformer:

1. The reversing starter, control transformer, and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation buildup. For Open-Close service, this starter shall be electromechanical type suitable for 60 starts per hour and of rating appropriate to motor size. For modulating duty, the starter shall be solid state and suitable for up to a maximum of 1,200 starts per hour or as required by the application. The modulating service the actuator shall also include dynamic braking. The controls supply transformer shall be from two of the incoming three phases. It shall have the necessary tappings and be adequately rated to power for the following functions:

a. 120-VAC energization of the contactor coils.

b. 24-VDC output where required for remote controls.

c. Supply for all the internal electrical circuits.

2. The primary and secondary windings shall be protected by easily replaceable fuses.

K. Integral Pushbuttons and Selector:

1. Integral to the operator shall be local controls for Open, Close, and Stop, and a local/remote selector switch padlockable in any one of the following three positions:

a. Local Control Only

b. Off (No Electrical Operation)

c. Remote Control plus Local Stop Only

2. It shall be possible to select maintained or non-maintained local control.

3. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

L. Control Facilities:

1. The necessary wiring and terminals shall be provided in the operator for the following control functions:

a. Removable links for substitution by external interlocks to inhibit valve opening and/or closing.

b. Connections for external remote controls fed from an internal 24-VDC supply and/or from an external supply of (minimum 12-volt, maximum 120 volt) to be suitable for any one or more of the following methods of control:

1) Open, Close, and Stop.

2) Open and Close.

3) Overriding Emergency, Shutdown to Close (or Open) Valve from a “Make” Contact.

4) Two-Wire Control, Energize to Close (or Open), De-Energize to Open (or Close).

c. Selection of maintained or push-to-run control for modes (A) and (B) above shall be provided and it shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of approximately 300 ms.

d. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

M. Monitoring and Diagnostics Facilities:

1. Facilities shall be provided for monitoring operator operation and availability as follows:

2. Monitor (availability) relay, having one change-over contact, the relay being energized from the control transformer only when the Local/Off/Remote selector is in the “Remote” position to indicate that the actuator is available for remote (control room) operation.

3. Where required, it shall be possible to provide indication of thermostat trip and “Remote” selected as discreet signals.

4. A non-intrusive hand-held computer or software and cables capable of running on a standard laptop PC, capable of duplex communicator for uploading and downloading all variables for the actuator as well as performing detailed diagnostics shall be provided.

5. Provision shall be made for the addition of diagnostic module which will store and enable download of historical actuator data to permit analysis of changes in operator or valve performance.

6. Diagnostic status screens must be provided to show multiple functions simultaneously so troubleshooting can be affected rapidly and efficiently. All

diagnostic information should be contained on no more than seven or eight screens so multiple functions can be checked simultaneously.

N. Wiring and Terminals:

1. Internal wiring shall be of tropical grade PVC insulated stranded cable of appropriate size for the control and three-phase power. Each wire shall be clearly identified at each end.
2. The terminals shall be embedded in a terminal block of high tracking resistance compound.
3. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal.
4. The terminal compartment of the operator shall be provided with a minimum of three threaded cable entries.
5. All wiring supplied as part of the operator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.
6. Control logic circuit boards and relay boards must be mounted on plastic mounts to comply with double insulated standards. No more than a single primary size fuse shall be provided to minimize the need to remove single covers for replacement.
7. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of terminal box cover indicating:
    a. Serial Number.
    b. External Voltage Values.
    c. Wiring Diagram Number.
    d. Terminal Layout.
8. This must be suitable for the Contractor to inscribe cable core identification beside terminal numbers.

O. Enclosure:

1. Operator shall be O-ring sealed, watertight to NEMA 6 minimum, and shall at the same time have an inner watertight and dustproof O-ring seal between the terminal compartment and the internal electrical elements of the operator fully protecting the motor and all other internal electrical elements of the operator from ingress of moisture and dust when the terminal cover is removed on site for cabling.
2. Enclosure must allow for temporary site storage without the need for electrical supply connection.
3. All external fasteners should be of stainless steel.

4. Operator for explosion/hazardous applications shall in addition be certified flameproof for Zones 1 and 2 (Divisions 1 and 2) Group gases.

P. Startup Kit - Each operator shall be supplied with a startup kit comprising installation instruction, electrical wiring diagram, and sufficient spare cover screws and seals to make good any site losses during the commissioning period.

Q. Performance Test Certificate:

1. Each operator must be performance tested and individual test certificates shall be supplied free-of-charge. The test equipment should simulate a typical valve load and the following parameters should be recorded:

a. Current at maximum torque setting.

b. Torque at maximum torque setting.

c. Flash Test Voltage.

d. Actuator Output Speed or Operating Time.

2. In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

R. Warranty - Each operator shall be warranted for a minimum of 24 months of operation up to a maximum of 36 months from shipment.

2.21 SHOP PAINTING

A. All iron parts shall be painted before leaving the shop.

B. Unless otherwise specified, all internal ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of an asphalt varnish.

C. Unless otherwise specified, all exterior ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of a universally compatible primer or in the case of valves buried or submerged, with two coats of an asphalt varnish.

2.22 SOURCE QUALITY CONTROL

A. Each check, gate, butterfly, and ball valve shall be submitted to operation and hydrostatic tests at the manufacturer’s plant as specified in applicable AWWA Standards.

B. Other valves shall be tested in conformance with applicable specifications in Part 4 of this Section.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of Section 15210.

B. Stem guides shall be accurately aligned.

C. Double disc gate valves shall not be installed with the bonnet more than 90 degrees from an upright position.

D. Accessories:

1. Valve Boxes shall be installed in a plumb position and in alignment with the operating nut.

2. Extensions stems and stem guides shall be in alignment with operating nut and prevent binding and stresses on connecting pins.

3. When there is a change to the grade elevation, valve boxes new and existing shall be adjusted to the new grade elevation.

3.02 RESERVED

3.03 TESTING

A. All valves shall be tested in place by the Contractor as far as practicable under the conditions for the pipelines in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Project Field Representative.

PART 4 SPECIAL PROVISIONS

4.01 VALVE SCHEDULE

A. The following letter designations are used in the Valve Schedule:

Type Designation	Connection Designation	Operator Designation
CV - Check Valve	F - Flanged	FB -Floor Box
GV - Gate Valve	W - Wafer	TW - Tee Wrench
PV - Plug Valve	MJ - Mechanical Joint	G - Gear
BV – Ball Valve	PE - Plain End	HW - Handwheel
BFV - Butterfly Valve		C - Chain
3PV - 3-Way Plug Valve		M - Motor
MV - Mud Valve		L - Lever
PR - Pressure Relief Valve		VB - Valve Box
FG - Flap Gate		FS - Floor Stand
SG - Shear Gate		
TV - Telescoping Valve		

Use Designation	Service Designation	Location Designation
A - Air	O-C - Open-Close	
DS - Digester Sludge	M - Modulation	
DCW - Domestic Cold Water		
DHW - Domestic Hot Water		
DTW - Domestic Tempered Water		
SA - Domestic Waste		
ED - Equipment Drain		
FC - Ferric/Ferrous Chloride		
PR- Pressate		
NG - Natural Gas		
NPW - Non-Potable Water		
P - Polymer		
REF - Refrigerant		
V - Sanitary Vent		
SL - Sludge		
TD - Tank Drain		

B. The Schedule is as shown in the Drawings.

4.02 TEE WRENCHES

A. Contractor shall furnish 3 tee wrenches 4 feet in length and 3 tee wrenches 6 feet in length.

4.03 TELESCOPING VALVES

A. Telescoping valves shall provide travel as shown on Drawings.

B. Telescoping valves shall be of the rising stem type.

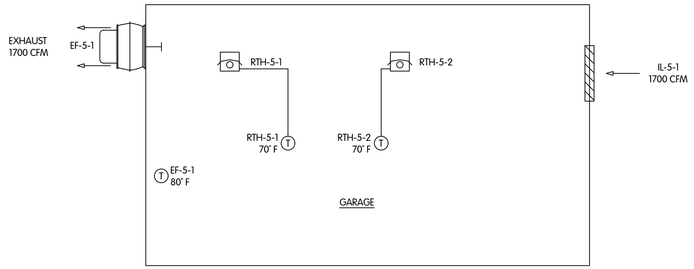
C. The telescoping valves shall consist of a 316 stainless steel pipe that shall slip into a flanged ductile iron stand pipe. The slip pipe shall be connected by a lifting strap to an extension stem. Both shall be made of stainless steel. The extension stem shall be threaded and have limit nuts. The handwheel operating nut shall be bronze.

D. The extension stems shall extend up and be fitted with a right angle gear box and handwheel with thrust ball bearings for operation. Stem cover shall be clear PVC pipe, Excelon R-4000 or equal. Cast iron or 316 stainless steel wall mounting brackets shall be supplied by manufacturer to fit the installation.

E. The watertight seal between the stand pipe and slip pipe shall be made of neoprene or other material recommended by the manufacturer for the liquid involved. Fasteners shall be stainless steel.

F. Telescoping valves shall be Waterman, Fontaine, Whipps, or equal.

END OF SECTION

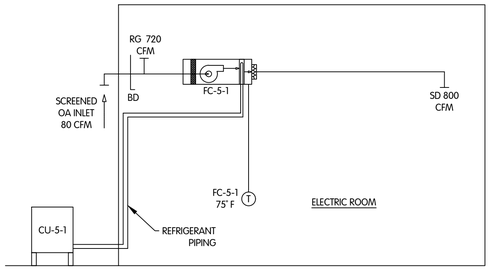


GARAGE AIRFLOW SCHEMATIC

GARAGE HEATING AND VENTILATION SEQUENCE OF OPERATION:

VENTILATION FOR THE GARAGE SHALL BE SUPPLIED BY A WALL MOUNTED CENTRIFUGAL EXHAUST FAN EF-5-1 AND INTAKE LOUVER IL-5-1. IL-5-1 SHALL BE CONTROLLED BY AN H-O-A SWITCH AND INTERLOCKED WITH EF-5-1. IN THE HAND POSITION, THE EXHAUST FAN MOTOR IS ACTIVATED. IN THE AUTO POSITION, A SINGLE TEMPERATURE WALL MOUNTED THERMOSTAT SHALL CYCLE THE FAN MOTOR. IL-5-1 SHALL PROVIDE MAKE-UP AIR FOR EF-5-1. IL-5-1 SHALL BE ACTIVATED OPEN WHENEVER THE EXHAUST FAN MOTOR IS ACTIVATED. WHENEVER THE EXHAUST FAN MOTOR IS DEACTIVATED, IL-5-1 SHALL BE DEACTIVATED.

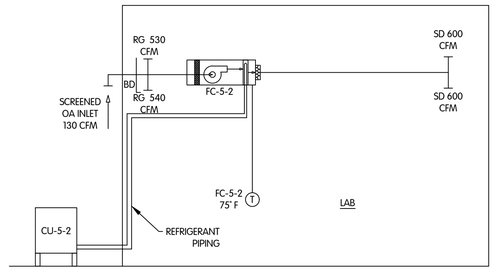
GAS FIRED RADIANT TUBE HEATERS RTH-5-1 AND RTH-5-2 SHALL EACH BE CONTROLLED BY A SINGLE TEMPERATURE, WALL-MOUNTED THERMOSTAT THAT MAINTAINS SPACE TEMPERATURE OF 70 DEGREES F BY CYCLING UNIT GAS AND FAN CONTROLS. UNITS SHALL BE EQUIPPED WITH A HIGH LIMIT AND FAN TIME DELAY RELAY. THE FAN TIME DELAY RELAY SHALL DELAY THE FAN START UNTIL THE HEAT EXCHANGER REACHES A PREDETERMINED TEMPERATURE AND ALLOW THE FAN TO OPERATE AFTER BURNER SHUTDOWN TO REMOVE RESIDUAL HEAT FROM THE THE HEAT EXCHANGER. PROVIDE FACTORY ASSEMBLED FLUE VENT FAN SHALL BE ACTIVATED IN RESPONSE TO THE SPACE THERMOSTAT. A FACTORY PROVIDED COMBUSTION AIR PRESSURE PROVING SWITCH SHALL VERIFY PROPER POWERED VENT FLOW PRIOR TO ALLOWING GAS VALVE TO OPERATE.



ELECTRIC ROOM AIRFLOW SCHEMATIC

ELECTRIC ROOM HVAC SEQUENCE OF OPERATION:

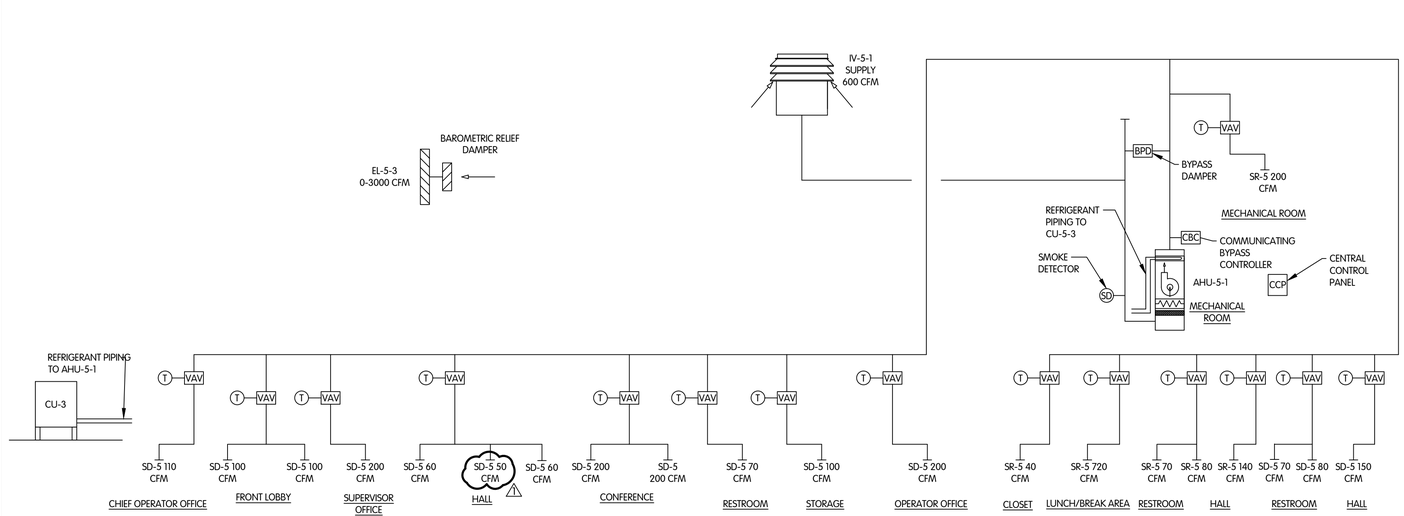
HEAT AND COOL THE ELECTRIC ROOM BY A SPLIT SYSTEM CONSISTING OF AN INDOOR FAN COIL UNIT FC-5-1 AND OUTDOOR AIR COOLED CONDENSING UNIT CU-5-1. CONTROL THE SYSTEM BY A SINGLE STAGE HEAT/SINGLE STAGE COOL, WALL MOUNTED THERMOSTAT WITH MANUAL/AUTOMATIC HEAT-COOL CHANGEOVER. ENERGIZE FAN COIL UNIT FAN AND CONDENSING UNIT COMPRESSOR WHENEVER THE THERMOSTAT CALLS FOR COOLING TO MAINTAIN SET-POINT. COMPRESSOR SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. DE-ENERGIZE THE COOLING AND FAN WHEN THERMOSTAT HAS REACHED SET-POINT. ENERGIZE FC-5-1 FAN AND STAGE ELECTRIC RESISTANCE HEATING COIL WHENEVER THE THERMOSTAT CALLS FOR HEATING TO MAINTAIN SET-POINT. THE HEATING COIL SHALL BE ACTIVATED IN STAGES. DE-ENERGIZE THE HEATING COIL, AND FAN WHEN THE THERMOSTAT HAS REACHED SET-POINT.



LAB AIRFLOW SCHEMATIC

LAB HVAC SEQUENCE OF OPERATION:

HEAT AND COOL THE LAB BY A SPLIT SYSTEM CONSISTING OF AN INDOOR FAN COIL UNIT FC-5-2 AND OUTDOOR AIR COOLED CONDENSING UNIT CU-5-2. CONTROL THE SYSTEM BY A SINGLE STAGE HEAT/SINGLE STAGE COOL, WALL MOUNTED THERMOSTAT WITH MANUAL/AUTOMATIC HEAT-COOL CHANGEOVER. ENERGIZE FAN COIL UNIT FAN AND CONDENSING UNIT COMPRESSOR WHENEVER THE THERMOSTAT CALLS FOR COOLING TO MAINTAIN SET-POINT. COMPRESSOR SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. DE-ENERGIZE THE COOLING AND FAN WHEN THERMOSTAT HAS REACHED SET-POINT. ENERGIZE FC-5-2 FAN AND STAGE ELECTRIC RESISTANCE HEATING COIL WHENEVER THE THERMOSTAT CALLS FOR HEATING TO MAINTAIN SET-POINT. THE HEATING COIL SHALL BE ACTIVATED IN STAGES. DE-ENERGIZE THE HEATING COIL, AND FAN WHEN THE THERMOSTAT HAS REACHED SET-POINT.



ADMINISTRATION BUILDING (5) AIRFLOW SCHEMATIC

ADMINISTRATIVE AREA HVAC SEQUENCE OF OPERATION:

THE ADMINISTRATIVE AREA SHALL BE HEATED AND COOLED BY A SPLIT SYSTEM CONSISTING OF AN INDOOR GAS-FIRED FURNACE AHU-5-1 WITH EVAPORATOR COIL AND AN OUTDOOR AIR COOLED CONDENSING UNIT CU-5-1. AHU-5-1 SHALL HAVE A TWO STAGE GAS VALVE FOR TWO STAGE HEATING, AND THREE STAGE COOLING. CONTROL SHALL BE VIA A CHANGEOVER-BYPASS VAV SYSTEM. THIS SYSTEM RESPONDS TO CHANGING COOLING OR HEATING REQUIREMENTS VARYING THE QUANTITY OR VOLUME OF AIR DELIVERED TO EACH ZONE. EACH ZONE HAS A THERMOSTAT FOR INDIVIDUAL COMFORT CONTROL. AHU-5-1 DELIVERS A CONSTANT VOLUME OF AIR TO THE SYSTEM. AS THE VOLUME OF AIR REQUIRED BY THE ZONE CHANGES, EXCESS SUPPLY AIR IS DIRECTED TO THE RETURN DUCT VIA A BYPASS DUCT AND DAMPER.

A ZONE TEMPERATURE SENSOR WITH LC DISPLAY IS COMPATIBLE WITH THE VAV DAMPERS AND CONTROLLERS. THE TEMPERATURE SENSOR IN EACH ZONE COMMUNICATES INFORMATION TO AN ELECTRONIC CONTROLLER ON THE VAV DAMPER. THE CONTROLLER MODULATES THE ZONE DAMPER OPEN OR CLOSED, SUPPLYING HEATING OR COOLING AIR TO THE ZONE. THE VAV DAMPER CONTROLLER COMMUNICATES ZONE TEMPERATURE INFORMATION TO A CENTRAL CONTROL PANEL. THE CENTRAL CONTROL PANEL ALSO GATHERS INFORMATION FROM THE SYSTEM, INCLUDING DUCT STATIC PRESSURE AND SUPPLY AIR TEMPERATURE. THE CENTRAL CONTROL PANEL DETERMINES ZONE HEATING OR COOLING NEEDS USING A VOTING OR POLLING LOGIC, THEN REQUESTS HEATING OR COOLING FROM AHU-5-1 BY THE ABILITY OF AUTO CHANGEOVER BETWEEN THESE TWO MODES. THE CENTRAL CONTROL PANEL COMPARES THE ZONE TEMPERATURES TO THE SPACE TEMPERATURE SETPOINTS. IF THE SUPPLY AI DOES NOT MEET THE CRITERIA FOR THE HEAT OR COOL MODE CALLED FOR, THE CENTRAL CONTROL PANEL SENDS A SIGNAL TO AHU-5-1 TO CHANGE THE SYSTEM TOT HE OPPOSITE MODE.

A COMMUNICATING BYPASS CONTROLLER LOCATED IN THE AHU-5-1 SUPPLY AIR DISCHARGE DUCTWORK IS A SINGLE CONTROL ENCLOSURE THAT INCLUDES AN INTEGRATED UCM BOARD, STATIC PRESSURE SENSOR, AND DISCHARGE AIR TEMPERATURE SENSOR. THE STATIC PRESSURE SENSOR MEASURES DUCT STATIC PRESSURE AND POSITIONS THE BYPASS DAMPER TO MAINTAIN THE STATIC PRESSURE SETPOINT. THE DUCT SUPPLY AIR TEMPERATURE SENSOR ALLOWS THE CENTRAL CONTROL PANEL TO CONTROL HEATING AND COOLING STAGES TO MAINTAIN SUPPLY AIR TEMPERATURE. THE COMMUNICATING BYPASS CONTROLLER DIRECTLY CONTROLS THE BYPASS DAMPER AND COMMUNICATES DUCT CONDITIONS TO THE CENTRAL CONTROL PANEL VIA A SIMPLE TWISTED SHIELDED WIRE PAIR. THE SUPPLY AIR TEMPERATURE SENSOR ALLOWS THE CENTRAL CONTROL PANEL TO CONTROL HEATING AND COOLING STAGES TO MAINTAIN THE SUPPLY AIR TEMPERATURE. THE STATIC PRESSURE SENSOR MEASURES DUCT STATIC PRESSURE AND POSITIONS THE BYPASS DAMPER TO MAINTAIN THE STATIC PRESSURE SETPOINT.

ADMINISTRATIVE AREA HVAC SEQUENCE OF OPERATION (CONTINUED):

DUCT MOUNTED SMOKE DETECTOR SD LOCATED IN THE RETURN DUCT TO AHU-5-1 SHALL DEACTIVATE THE FAN IF SMOKE IS DETECTED. SD SHALL AUTOMATICALLY BE RESET.

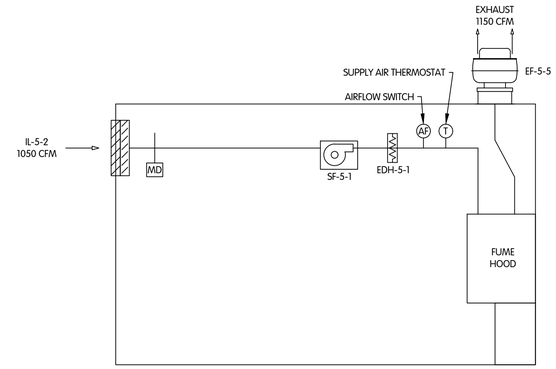
THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM 600 CFM OF OUTSIDE AIR DURING ALL HOURS.

THE AIR HANDLER CONTROL PANEL SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE OUTSIDE AND RETURN AIR DAMPERS TO MAINTAIN A SETPOINT 2 °F LESS THAN THE COOLING SUPPLY AIR TEMPERATURE SETPOINT. THE ECONOMIZER SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS LESS THAN 65 °F.
- AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 22 BTU/LB.
- AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.
- AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY.
- AND THE SUPPLY FAN STATUS IS ON.

THE OUTSIDE AIR DAMPER SHALL GO TO ITS MINIMUM POSITION WHENEVER:

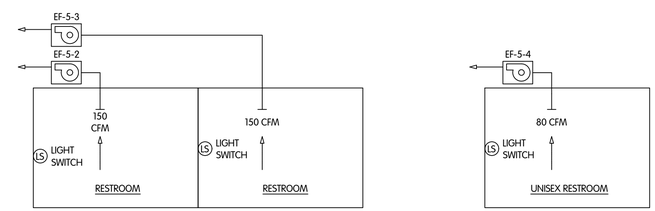
- MIXED AIR TEMPERATURE DROPS FROM 40 °F TO 35 °F
- OR ON LOSS OF SUPPLY FAN STATUS
- THE BAROMETRIC RELIEF DAMPER ASSOCIATED WITH EL-5-3 SHALL MODULATE AS NECESSARY TO REDUCE BUILDING PRESSURE



ADMINISTRATION BUILDING (5) FUME HOOD AIRFLOW SCHEMATIC

LABORATORY HVAC SEQUENCE OF OPERATION:

WHEN THE FUME HOOD IS ENERGIZED, EXHAUST FAN EF-5-5 SHALL BE ACTIVATED TO EXHAUST FUME HOOD, AND SUPPLY FAN SF-5-1 AND INTAKE LOUVER SHALL ALLOW SUPPLY AUXILIARY AIR TO THE FUME HOOD. SF-5-1 SHALL NOT ACTIVATE UNLESS EF-5-5 IS RUNNING. AN ELECTRIC DUCT HEATER EDH-5-1 LOCATED IN THE SUPPLY DUCTWORK FOR SF-5-1 SHALL BE ACTIVATED BY AN AIRFLOW SWITCH MOUNTED IN THE SUPPLY DUCT AND A TWO-STAGE DUCT MOUNTED THERMOSTAT. THE FIRST STAGE OF THE DUCTSTAT SHALL ACTIVATE THE FIRST STAGE OF THE DUCT HEATER TO MAINTAIN 70 DEGREES F SUPPLY AIR TEMPERATURE. IF THIS TEMPERATURE CANNOT BE MAINTAINED, THE SECOND STAGE OF THE DUCTSTAT SHALL ACTIVATE THE SECOND STAGE OF THE DUCT HEATER.



ADMINISTRATION BUILDING AIRFLOW SCHEMATIC

ADMINISTRATIVE AREA RESTROOM VENTILATION SEQUENCE OF OPERATION:

RESTROOM EXHAUST FAN EF-5-2 SHALL BE CONTROLLED AND INTERLOCKED WITH THE ROOM LIGHT SWITCH. WHEN THE LIGHT SWITCH IS ACTIVATED, EXHAUST FAN EF-5-2 SHALL BE ACTIVATED. WHEN THE LIGHT SWITCH IS DE-ACTIVATED, EXHAUST FAN EF-5-2 SHALL BE DE-ACTIVATED.

RESTROOM EXHAUST FAN EF-5-3 SHALL BE CONTROLLED AND INTERLOCKED WITH THE ROOM LIGHT SWITCH. WHEN THE LIGHT SWITCH IS ACTIVATED, EXHAUST FAN EF-5-3 SHALL BE ACTIVATED. WHEN THE LIGHT SWITCH IS DE-ACTIVATED, EXHAUST FAN EF-5-3 SHALL BE DE-ACTIVATED.

UNISEX RESTROOM EXHAUST FAN EF-5-4 SHALL BE CONTROLLED AND INTERLOCKED WITH THE ROOM LIGHT SWITCH. WHEN THE LIGHT SWITCH IS ACTIVATED, EXHAUST FAN EF-5-4 SHALL BE ACTIVATED. WHEN THE LIGHT SWITCH IS DE-ACTIVATED, EXHAUST FAN EF-5-4 SHALL BE DE-ACTIVATED.

STATE OF OHIO
BRIAN SCHULMANN
E-58395
12/12/2024
REGISTERED
PROFESSIONAL ENGINEER

MECHANICAL
SEQUENCE OF OPERATIONS AND AIR FLOW SCHEMATICS

CITY OF GREENVILLE, OHIO
WWTP SOLIDS HANDLING FACILITY AND ADMINISTRATION BUILDING

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1	12/2/24	HALL 50 CFM CHANGE	ASB

Jones & Henry Engineers, Ltd.
Fluid thinking©.
www.JHeng.com

JOB NO. 039-8084.003
SCALE AS NOTED
THIS LINE SCALES 1" WHEN PLOTTED TO NOTED SCALE
DESIGNED ASB | DRAWN AAE | CHECKED
STATUS: ISSUED FOR BID
DATE: NOVEMBER 2024
SHEET NO.
M-0.7
128 OF 182

TOL-8084(003)9\M-0.7 SEQUENCE OF OPERATIONS
JJU/2024.12.19 8:15 AM L:\BROWN
12/19/2024 8:15 AM