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Delaware County Regional Sewer District
Northstar WRF Upgrades
Preliminary Engineering Report

Draft
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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

Abbreviation	Definition
AACE	Association for the Advancement of Cost Estimating
BNR	Biological Nutrient Removal
$cBOD_5$	Carbonaceous Biochemical Oxygen Demand
cfm	Cubic Feet per Minute
COD	Chemical Oxygen Demand
DCRSD	Delaware County Regional Sewer District
DO	Dissolved Oxygen
ft	Feet
ft^3	Cubic Feet
gal	Gallons
gpm	Gallons per Minute
H_2S	Hydrogen Sulfide
hp	Horsepower
IMLR	Internal Mixed Liquor Recycle
in	Inches
LAMP	Land Application Management Plan
mg/L	Milligrams per Liter
mgd	Million Gallons per Day
mL	Milliliter
MLSS	Mixed Liquor Suspended Solids
MOPO	Maintenance of Plant Operations
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPW	Non-Potable Water
NWRF	Northstar Water Reclamation Facility
OEPA	Ohio Environmental Protection Agency

Abbreviation	Definition
OPCC	Opinion of Probable Construction Cost
PER	Preliminary Engineering Report
ppm	Parts per Million
RAS	Return Activated Sludge
rpm	Revolutions per Minute
scfm	Standard Cubic Feet per Minute
sf	Square Feet
SWD	Side Water Depth
TDH	Total Dynamic Head
TIN	Total Inorganic Nitrogen
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UV	Ultraviolet
WAS	Waste Activated Sludge

Executive Summary

Northstar Water Reclamation Facility (NWRF) in Sunbury, Ohio was constructed in 2007 and has been owned by Delaware County Regional Sewer District (DCRSD) since 2017 following several years during which the plant was out of service. Based on an evaluation of the treatment and hydraulic capacity at NWRF completed by Hazen in 2021, DCRSD has elected to pursue a number of improvements at the facility. The improvements are intended to allow the facility to treat its design permitted capacity of 0.4 mgd, while upgrading the treatment processes to meet the more stringent effluent limits which would be required by a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit would replace the current Land Application Management Plan (LAMP) permit, with treated effluent from the NWRF being directed to Little Walnut Creek through a new effluent force main rather than to land application.

Significant improvements are proposed for NWRF's biological treatment tanks to allow for greater flexibility in plant operations. Modifications to the influent piping are proposed to provide the plant with the ability to route influent flow to the biological treatment tanks without pumping from the equalization tanks to the distribution box. Furthermore, to optimize conditions in the biological treatment tanks for biological nutrient removal (BNR), an internal mixed liquor recycle (IMLR) pumping system is proposed to convey fully nitrified flow from the downstream end of the biological treatment trains back to the upstream end for denitrification. Floating mixers will be installed in select basins so each anoxic zone will have mixing capabilities, and the existing large bubble mixing system present in the basins will be removed. These improvements will provide additional treatment capacity for operations staff to operate with only one biological treatment train online for most (if not all) foreseeable influent conditions. The improvements would also eliminate the need for continuous pumping from the equalization tanks to the diversion box, which would improve reliability and reduce power costs.

To improve solids collection within the clarifiers and to more directly control return activated sludge (RAS) removal and distribution, the existing telescoping valves in the RAS wet well will be removed and replaced with direct connections from the RAS header to the RAS pumps. This direct piping connection will also require changing the existing submersible pumps to dry pit pumps. Other pipes which currently drain to the RAS pump station, including scum lines from the clarifiers and drains from the RAS distribution vault and the chlorine valve box, will be directed to a new manhole and from there will flow by gravity to the existing plant drain pump station. Additional RAS improvements include connecting the two individual RAS lines at the influent end of the plant, allowing for RAS to be distributed to either biological treatment train from either of the two valves in the RAS distribution vault, and lowering the RAS piping to below the operating water level of the biological treatment tanks to decrease the risk of freezing.

Proposed improvements at the final treatment building include retrofitting the two empty filter cells with cloth media type disc filters. This technology uses a cloth media rather than granular media to filter TSS from wastewater and assist in meeting anticipated effluent limits for phosphorous. To accommodate the proposed conversion from a LAMP permit to NPDES permit and the anticipated minimum dissolved oxygen requirement in the NWRF effluent discharge, installation of post aeration using coarse bubble

diffusers in the clearwell is proposed. The existing blowers have the capacity to support post aeration demand.

Additional improvements around the NWRF include replacing the flanged connection gasket and ductwork transition on the headworks building odor control exhaust fan to provide an airtight seal, and removing the existing crane/hoist so the headworks building is in compliance with National Fire Protection Association (NFPA) 820 standards. The existing non-potable water system for the plant, which exhibits numerous leaks, should be completely replaced to allow the system to remain pressurized and operational at all times.

To prepare for regular use of the existing dewatering facilities, the open air truck bay should be enclosed and a photoionization odor control system installed. Existing unused sodium hypochlorite and ferric chloride chemical storage and feed systems located in the dewatering building will be repurposed for to accommodate alum and supplemental carbon feeds. Alum is proposed to assist in meeting NPDES effluent limits for phosphorus, and supplemental carbon is required to accomplish denitrification in the biological treatment tanks to meet the anticipated effluent limit for total inorganic nitrogen.

Miscellaneous improvements around the site include an automatic electric gate operator for the existing slide gate at the main entrance driveway to ease entry and exit for authorized personnel, and a security camera system to increase safety and security of the site.

A Class 3 Engineer's Opinion of Probable Construction Cost (OPCC) was prepared for the preliminary design phase of the project. Class 3 estimates are for projects having a project definition level of 10% to 40%, and typically have accuracy ranges of -15% to +20%. For consistency with the cost estimates presented in the 2021 Northstar WRF evaluation completed by Hazen, the improvements described herein have been grouped into four categories:

1. Baseline improvements: minimum recommended improvements for consistency of operation and maintenance as plant flows increase to 0.4 mgd. Refer to Table ES-1.
2. Improvements necessary to meet expected future LAMP permit conditions at permitted capacity of 0.4 mgd. Refer to Table ES-2.
3. Improvements necessary to meet expected future NPDES permit conditions at permitted capacity of 0.4 mgd. Refer to Table ES-3.
4. Improvements requested by DCRSD which do not fall into other categories. Refer to Table ES-4.

Table ES-1: Cost Summary of Baseline Improvements

Improvement	Opinion of Probable Construction Cost	Notes
Reconfiguration of RAS control	$146,000	Includes new drain/scum manhole and piping connections in addition to 3 new RAS pumps
Temporary bypass pumping system	$50,000	
Connection of RAS header at influent end of biological treatment	$32,000	
Lower RAS piping		Labor only – no new materials
NPW system replacement	$82,000	Full piping replacement rather than leak repair
Influent header extension with valves	$167,000	Includes relocation of a portion of existing air piping
Dewatering Building unloading area enclosure	$34,000	
Electrical and I&C allowances	$17,000	
Direct Construction Subtotal	**$528,000**	
General Conditions	$79,000	15% of direct construction subtotal
Contractor Overhead and Profit	$121,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$38,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$23,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$237,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$1,026,000**	
Low Range Estimate (-15%)	*$873,000*	
High Range Estimate (+20%)	*$1,232,000*	

Table ES-2: Cost Summary of Improvements for Future LAMP Effluent Permit Conditions

Improvement	Opinion of Probable Construction Cost	Notes
Supplemental carbon feed	$45,000	Reuse of existing chemical equipment not feasible
BNR improvements	$150,000	Includes new piping and basin slide gates in addition to 2 new IMLR pumps
Electrical and I&C allowances	$11,000	
Direct Construction Subtotal	**$206,000**	
General Conditions	$31,000	15% of direct construction subtotal
Contractor Overhead and Profit	$47,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$15,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$9,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$92,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$400,000**	
Low Range Estimate (-15%)	*$340,000*	
High Range Estimate (+20%)	*$480,000*	

Table ES-3: Cost Summary of Improvements for Future NPDES Effluent Permit Conditions

Improvement	Opinion of Probable Construction Cost	Notes
Alum Feed	$44,000	Reuse of existing chemical equipment not feasible
Conversion to disc filters	$742,000	
Post aeration	$70,000	Diffused aeration in existing clearwell, and repurpose existing blower
Effluent force main to Little Walnut Creek	$173,000	
Electrical and I&C allowances	$121,000	
Direct Construction Subtotal	**$1,150,000**	
General Conditions	$173,000	15% of direct construction subtotal
Contractor Overhead and Profit	$265,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$82,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$50,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$516,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$2,236,000**	
Low Range Estimate (-15%)	*$1,901,000*	
High Range Estimate (+20%)	*$2,684,000*	

Table ES-4: Cost Summary of Improvements for Requested by Owner

Improvement	Opinion of Probable Construction Cost	Notes
Odor control system	$220,000	
Floating mixers	$79,000	4 new mixers and 1 relocated existing mixer
BNR aeration system upgrades	$46,000	Replacement of existing diffusers with fine bubble diffusers
Headworks Building upgrades	$6,000	
Miscellaneous plant improvements	$15,000	Security camera system, entrance gate operator
Electrical and I&C allowances	$72,000	
Direct Construction Subtotal	**$438,000**	
General Conditions	$66,000	15% of direct construction subtotal
Contractor Overhead and Profit	$101,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$31,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$19,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$197,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$852,000**	
Low Range Estimate (-15%)	*$725,000*	
High Range Estimate (+20%)	*$1,023,000*	

1. Background

1.1 Plant History

The Northstar Water Reclamation Facility (NWRF) was initially constructed in 2007 to serve the Northstar community in Sunbury, Ohio but was out of service until December 2016. In February 2017, rehabilitations were completed around the existing tanks and the Delaware County Regional Sewer District (DCRSD) accepted ownership of NWRF. NWRF has a design permitted capacity of 0.4 million gallons per day (mgd), which is equivalent to 1,379 single family residential sanitary sewer connections. At the time of writing, NWRF treats an average daily flow rate of 0.022 mgd. NWRF's current effluent discharge limits are controlled by a Land Application Management Plan (LAMP) permit as presented in Table 1-1.

Table 1-1: Current LAMP Permit Limits by Constituent

Pollutant	Monthly Average
Total Suspended Solids (TSS), mg/L	45
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$), mg/L	40
Total Inorganic Nitrogen (TIN), mg/L	10 (max)
E. Coli, #/100 mL	126 (max)
Oil & Grease, mg/L	10 (max)
pH	6.0 - 9.0
Permitted Design Flow Capacity (mgd)	0.4

1.2 Summary of Treatment Processes

Raw influent from the Northstar community is conveyed to the NWRF via a pump station located remote from the NWRF site. Pumped influent enters the headworks building where flow passes through a grinder and mechanical screen. Screened influent is discharged to equalization tanks, where equalization pumps convey flow to the biological treatment process, which includes aeration and anoxic/aeration basins. Mixed liquor is conveyed from the biological treatment tanks to a distribution box, from which it flows to the secondary clarifiers. The clarifiers have suction tube headers that convey return activated sludge (RAS) to the RAS pump station, where submersible pumps direct activated sludge flow through a distribution valve vault either back to the biological treatment tanks or as waste activated sludge (WAS) to sludge storage tanks.

Secondary clarifier effluent is conveyed to sand filters located inside the final treatment building. Filtered effluent flows to the downstream clearwell, which contains the filter backwash pumps in addition to non-potable water (NPW) pumps, then through ultraviolet (UV) disinfection. Final effluent pumps convey treated effluent to a reservoir / holding pond at the NWRF. From the reservoir, the effluent flows to an irrigation system at the Northstar Golf Club by a pump station that is neither owned nor operated by DCRSD.

A summary of the major unit processes is presented in Table 1-2. Figure 1-1 displays a process schematic for reference.

Table 1-2: Summary of NWRF Unit Processes

Unit Process	Quantity	Design Criteria	Notes
Influent Pumps	2	923 gpm at 65.9 ft TDH (each pump)	Flygt NT-3171.170 HT (offsite pump station)
Influent Grinder	1	Sized for 1.0 mgd avg daily flow	JWC Muffin Monster Model No. CMD3210-AD
Influent Screens	1 + 1	Mechanical screen sized for 1.0 mgd average daily flow. Manual bar screen intended for backup.	(1) JWC Muffin Monster Model No. AMA3200 (1) manually cleaned screen in bypass channel
Odor Control Biofilter	2	600 sf, 2000 cfm each bed 99% H_2S removal	Activated soil media with 20-year design life
Equalization Tanks	2	110,330 gal (each)	
EQ Pump	2	350 gpm at 20 ft TDH (each pump)	Flygt NP-3085
Axonic / Aeration Tanks	4	61,920 gal (each)	14 ft SWD, Pulsair large bubble mixing
Aeration Tanks	2	61,950 gal (each)	14 ft SWD, coarse bubble diffusers
Secondary Clarifiers	2	149,183 gal (each)	46 ft diameter, 12 ft SWD
Return Activated Sludge (RAS) Pumps	2	700 gpm at 34 ft TDH	Flygt NP-3127.180 Both VFD equipped
Sand Filter	2	120 sf, 8,229 gal (each)	(2) 840 gpm backwash pumps
Clearwell	1	35,429 gal	9.17 ft SWD
UV Disinfection	1		Trojan UV3800K-1
Effluent Pumps	2	525 gpm at 30 ft TDH	Flygt NP-3127
Blowers	3	Aeration: 691 cfm (2 Operating)	Gardner Denver 559 centrifugal
	1	Flow EQ: 505 scfm	Roots URAI-68 positive displacement
	3	Sludge Holding: 765 scfm (2 Operating)	Roots URAI-711 positive displacement
	1	Air Scour: 120 scfm	Roots URAI-33 positive displacement

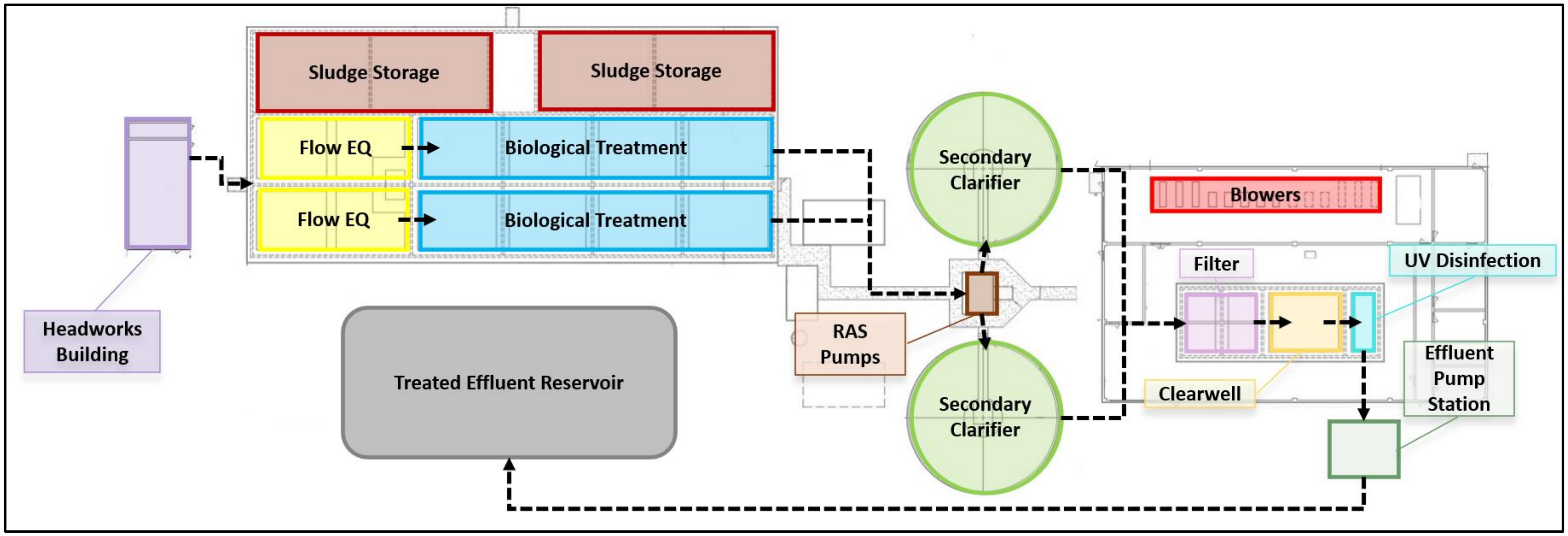


Figure 1-1: NWRF Facility Layout and Process Flow Diagram

1.3 Objectives of Report

In 2021, DCRSD engaged Hazen to evaluate the NWRF treatment and hydraulic capacity under various flow and discharge permit conditions. The resulting report, dated September 30, 2021, described a number of improvement alternatives at the NWRF necessary to meet the proposed flow and discharge permit conditions. DCRSD has elected to pursue improvements to the NWRF in order to allow the facility to treat its design permitted capacity of 0.4 mgd, while upgrading the treatment processes to meet the more stringent effluent limits which would be required by a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit would replace the current LAMP permit, with treated effluent from the NWRF being directed to Little Walnut Creek rather than to land application. This Preliminary Engineering Report (PER) expands upon the improvements discussed in the September 30, 2021 report by presenting preliminary design criteria for the various improvements, along with a discussion of the permitting requirements necessary to convert from the existing LAMP permit to a new NPDES permit.

2. Proposed Improvements

2.1 Headworks Building

2.1.1 Existing Conditions

Raw influent enters the NWRF treatment process at the headworks building, where a drum screen and grinder remove larger solids from the influent flow. A manual bar screen exists in parallel if bypass of the drum screen is ever necessary. Grindings are discharged to a hopper from which they are removed and disposed off site. An exhaust fan with intake louver and gravity backdraft damper provide odor control for the building. Exhausted air is directed to odor control biofilter beds located in the grassed area north of the headworks building. Figure 2-1 presents a photograph of the interior of the headworks building.

Figure 2-1: Headworks Building

2.1.2 Proposed Improvements

The odor control exhaust fan provides 12 air changes per hour but the ventilation is not continuous as required by National Fire Protection Association (NFPA) 820 standards. The air inside the building is noted to be odorous, and a previous inspection of the facility by Arcadis in 2017 identified leaks on the discharge end of the exhaust fan. Air leakage was noted from the flanged connection between the fan and the odor control ductwork as well as from the ductwork material transition, causing odorous air that is meant to be exhausted to be reintroduced to the headworks building. The flanged connection gasket and ductwork transition will be replaced to provide an airtight seal. The controls of the exhaust fan should also be adjusted to provide for continuous operation so the system is in compliance with NFPA 820.

The majority of equipment in the headworks building has explosion proof ratings. One exception is the existing crane/hoist, which is not rated for use in a Division 1 classified area. Since the crane/hoist is currently locked out and was seldom, if ever, used, its complete removal is recommended so the facility is in compliance with NFPA 820. A portable crane/hoist could be brought into the building in the event the existing screen requires removal.

2.2 Equalization and Biological Treatment Tanks

2.2.1 Existing Conditions

Downstream of the headworks building, influent flow is discharged to the north equalization tank. The north and south equalization tanks can be hydraulically connected by opening a mud valve in the north equalization tank on a buried pipe that leads to the south equalization tank. The flow equalization pumps in the north equalization tank convey influent up to the distribution box continuously (unless a low level of liquid is present in the equalization tank), where it is distributed to the north and/or south biological treatment tanks using manually adjustable weirs (see Figure 2-2).

Figure 2-2: Influent Distribution Box

From the distribution box, influent can be routed to any of the biological treatment basins by gravity via exposed pipes by lowering the manual weirs. Each train consists of four biological treatment tanks, with two tanks designated as anoxic/aeration basins and two tanks designated as aeration basins. Figure 2-3 displays the layout of the equalization and biological treatment tanks. At present, a single anoxic/aeration basin (Anoxic/Aeration 3) and a single aeration basin (Aeration 4) are utilized for biological treatment. The two in-use basins utilize floating mixers, while the other basins have coarse bubble diffusers to provide mixing and/or aeration of the tank contents. The anoxic/aeration basins also have Pulsair large bubble mixing systems to provide mixing without aeration, but these mixing systems are not in use and their effectiveness has been limited in the experience of the operators. Mixed liquor can be routed from any of the aerobic zones to the secondary clarifiers, which provides some flexibility in operational tank volume.

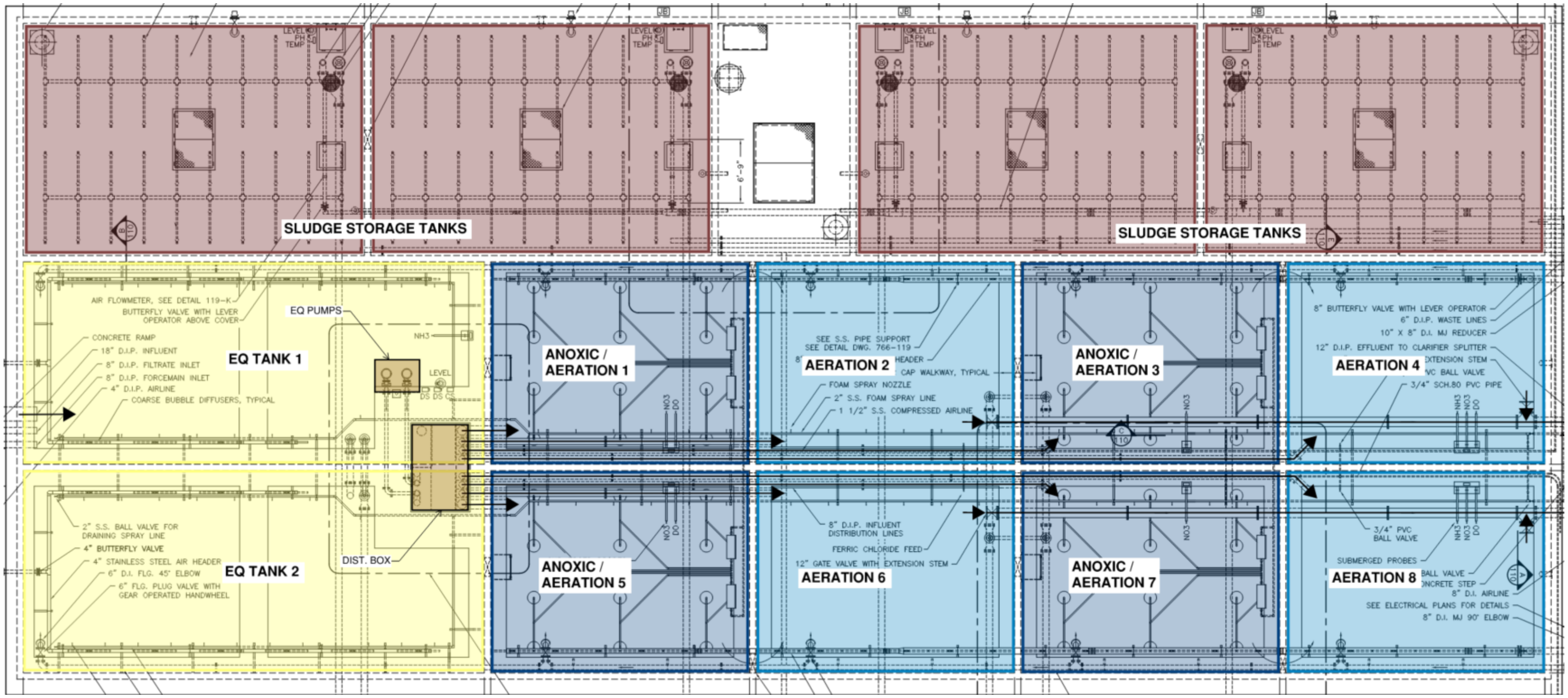


Figure 2-3: Layout of Equalization and Biological Treatment Tanks

2.2.2 Proposed Improvements

In the present configuration, NWRF does not have the ability to route influent flow to the biological treatment tanks without pumping from the equalization tanks to the distribution box. However, sufficient hydraulic head to flow directly to biological treatment from the influent line without pumping. The proposed improvement would extend the 18-inch ductile iron influent line from the headworks for conveyance of influent to either equalization tank (EQ Tank 1 and EQ Tank 2) or to the first tank in both biological treatment trains (Anoxic/Aeration 1 and Anoxic/Aeration 5), as shown in Figure 2-4. New wall opening with slide gates would also be installed between EQ Tank 1 and Anoxic/Aeration 1, and between EQ Tank 2 and Anoxic/Aeration 2. This configuration would allow operation of NWRF without continuously pumping influent from the equalization tanks, which would improve reliability and reduce power costs. A process flow diagram of the biological treatment train with proposed improvements is shown in Figure 2-5.

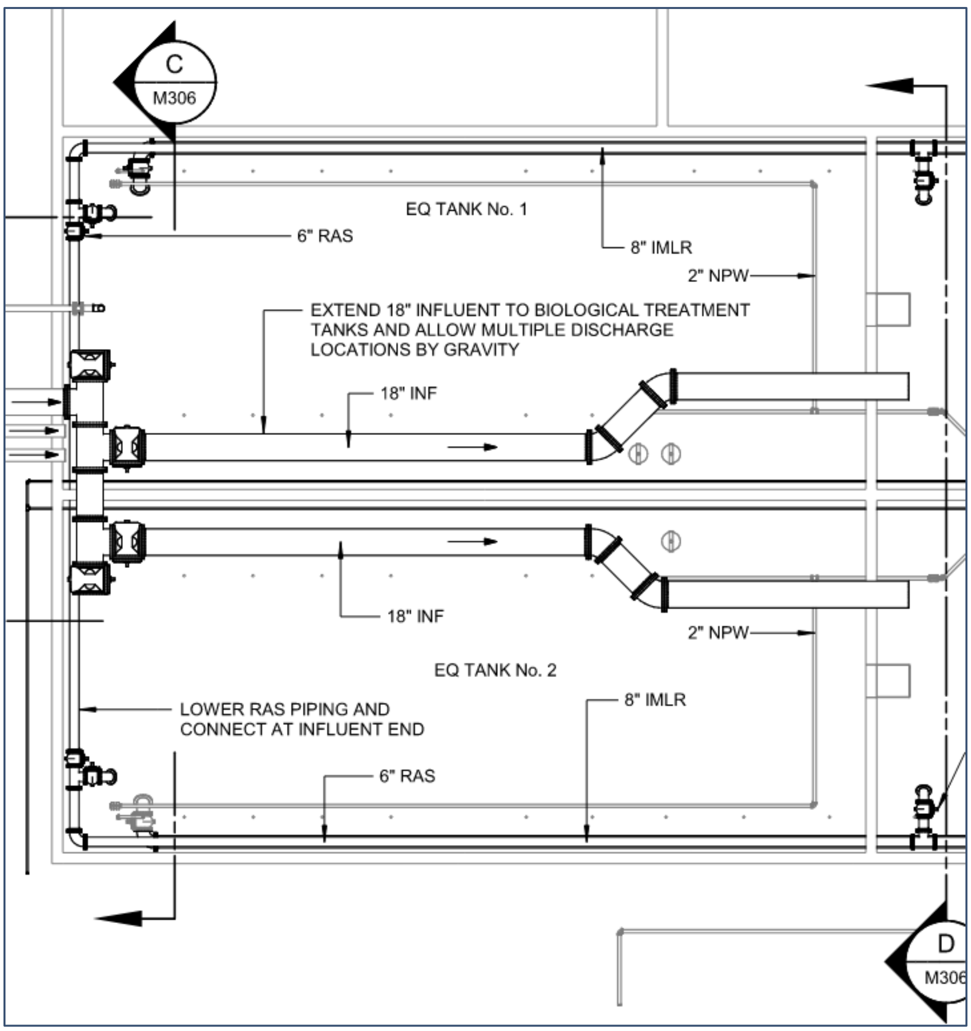


Figure 2-4: Proposed Extension of Influent Lines to Biological Treatment

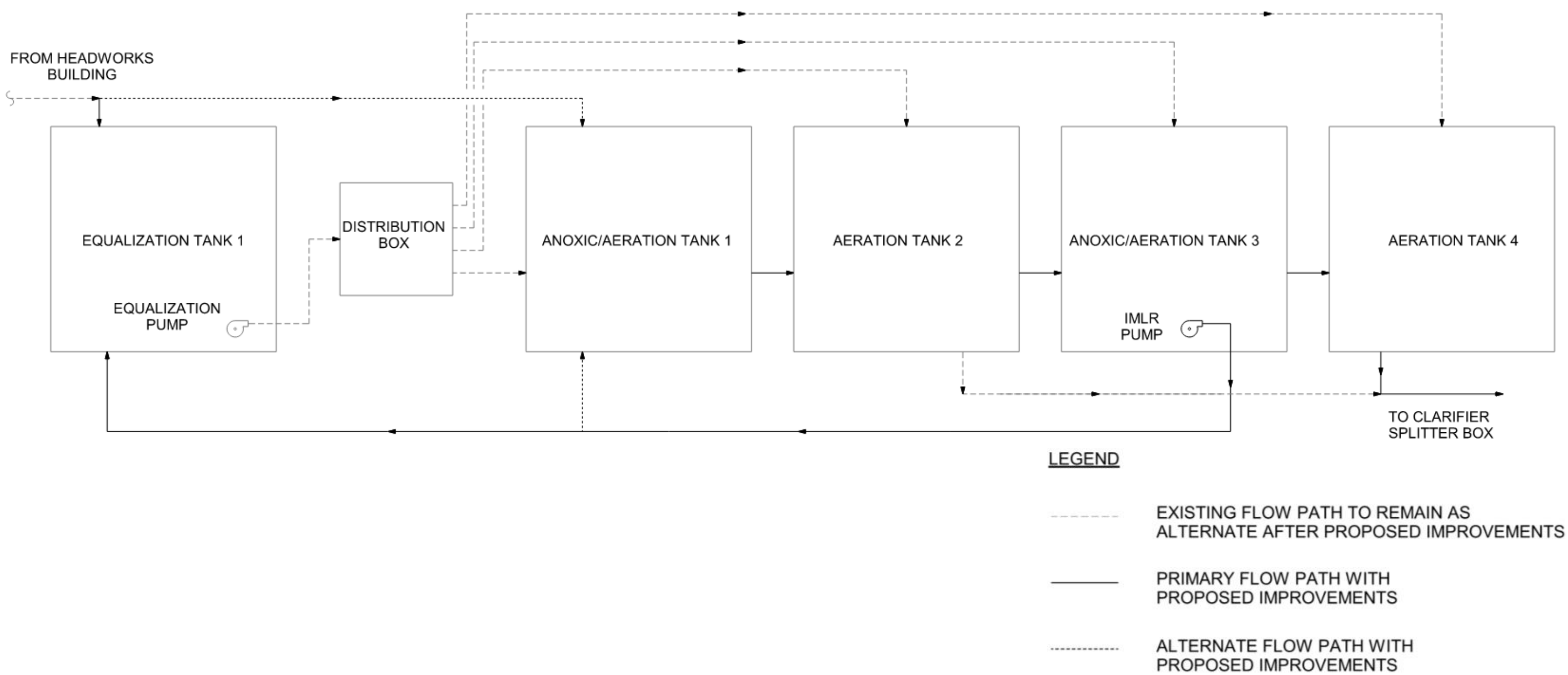


Figure 2-5: Process Flow Diagram of Biological Treatment with Proposed Improvements

To optimize conditions in the biological treatment tanks for biological nutrient removal (BNR), an internal mixed liquor recycle (IMLR) pumping system is proposed to convey fully nitrified flow from the downstream end of the biological treatment trains back to the upstream end for denitrification. This practice takes advantage of the influent carbonaceous biochemical oxygen demand ($cBOD_5$) as a carbon source for denitrification. The proposed IMLR system consists of two submersible pumps located in Anoxic/Aeration 3 and Anoxic/Aeration 7 which convey mixed liquor flow to back to EQ Tank 1, EQ Tank 2, Anoxic/Aeration 1 and Anoxic/Aeration 5. Since the equalization tanks are not required for flow equalization under normal operations due to relatively low flow conditions and excess volume available in the other treatment tanks, the equalization tanks can be repurposed into pre-anoxic treatment tanks. When EQ Tank 1 and EQ Tank 2 are in use for treatment, IMLR will be directed to the equalization tanks. When EQ Tank 1 and EQ Tank 2 are in use for flow equalization under potential high flow wet weather conditions, IMLR will be directed to Anoxic/Aeration 1 and Anoxic/Aeration 5. Figure 2-6 displays the preliminary layout of the IMLR system, and Table 2-1 presents the proposed design criteria for the IMLR pumps.

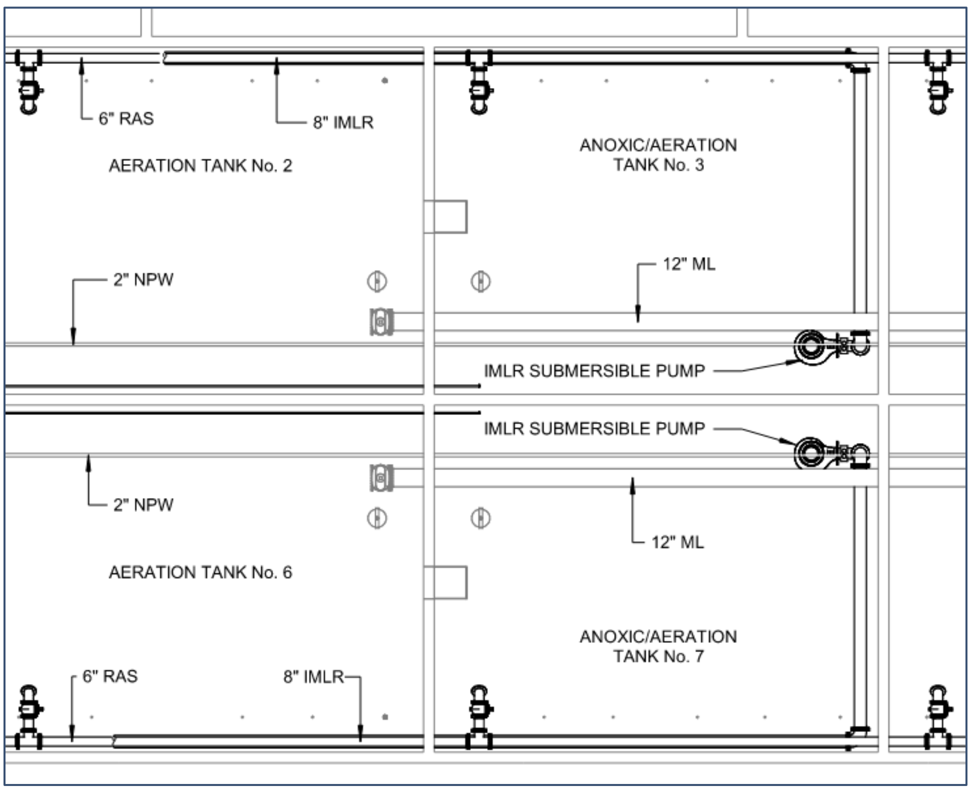


Figure 2-6: Proposed IMLR System Configuration

Table 2-1: Design Criteria of Proposed IMLR Pumps

Characteristic	
Type of Pump	Submersible
Number of Pumps	2
Capacity (gpm)	850
Total Dynamic Head (feet)	14
Maximum Pump Speed (rpm)	3,600
Motor Power (hp)	5
Fluid Pumped	Mixed Liquor
Maximum Size of Solids (in)	2
Drive Type	Variable

Conversion of the equalization tanks to treatment volume would provide additional treatment capacity for operations staff to operate with only one biological treatment train online for most (if not all) foreseeable influent conditions, with the potential exception of rare high flow occurrences. In addition, this conversion would eliminate the need for continuous pumping from the equalization tanks to the diversion box when implemented alongside the previously described influent piping improvements.

Since the IMLR pumps will be able to discharge to either the equalization tanks or to the first set of tanks in the biological treatment train, mixers will be installed in EQ Tank 1, EQ Tank 2, Anoxic/Aeration 1, and Anoxic/Aeration 5. For consistency with the mixing system currently installed in the active biological treatment basins, floating mixers are proposed for EQ Tank 1, EQ Tank 2, Anoxic/Aeration 1, and Anoxic/Aeration 5. Design criteria for the mixers are presented in Table 2-2. The floating mixer currently installed in Aeration 4 will be relocated to Anoxic/Aeration 7 so each anoxic zone will have mixing capabilities. The existing Pulsair large bubble mixing system present in the anoxic/aeration basins will be removed. The existing coarse bubble diffusers will be replaced with fine bubble diffusers improved oxygen transfer during aeration.

Table 2-2: Design Criteria of Proposed Floating Mixers

Characteristic	EQ Tank 1, EQ Tank 2	Anoxic/Aeration 1, Anoxic/Aeration 5
Type of Mixer	Floating	Floating
Number of Mixers	2 (1 per basin)	2 (1 per basin)
Mixing Speed (rpm)	1,200	1,200
Motor Power (hp)	5	3
Fluid Mixed	Mixed Liquor	Mixed Liquor
Drive Type	Variable	Variable

2.3 RAS System

2.3.1 Existing Conditions

Mixed liquor suspended solids (MLSS) is conveyed from the biological treatment tanks to a distribution box, which contains a manually cleaned bar rack and gates to isolate each clarifier before feeding the MLSS to one or both clarifiers. Under existing conditions, only one clarifier is needed for treatment. The secondary clarifiers have suction tube headers that convey RAS to the RAS pump station, which contains submersible pumps. The RAS withdrawal rate is controlled via manual telescoping valves in the RAS pump station, and the pumps run based on wet well level via variable frequency drives. Characteristics of the existing RAS pumps are displayed in Table 2-3. Each RAS pump has a design capacity of 700 gpm at 34 feet TDH. The RAS pumps have been in service for 5 years. Under current operating practices, RAS flow varies with plant influent flow. Since only one clarifier is required under existing flow conditions, only one RAS pump is needed at any given time.

Table 2-3: Design Criteria of Existing RAS Pumps

Characteristic	
Type of Pump	Submersible
Number of Pumps	2
Capacity (gpm)	700
Total Dynamic Head (feet)	34
Maximum Pump Speed (rpm)	1445
Motor Power (hp)	10
Fluid Pumped	Return Activated Sludge
Solids Concentration (%)	0.2-0.4
Drive Type	Variable

RAS / WAS routing is accomplished in the RAS / WAS distribution valve vault. The vault contains electrically actuated open/close valves to route RAS to either the north or south biological treatment train, or WAS to the sludge storage tanks. Because the valve actuators are open/close service rather than modulating, a flow balance to the different locations could be difficult to achieve at NWRF's full capacity. The electric actuators are located above grade.

2.3.2 Proposed Improvements

To improve solids collection within the clarifiers and to directly control RAS removal and distribution, the existing telescoping valves in the wet well will be removed and replaced with direct connections from the RAS header to the RAS pumps. The proposed reconfiguration is shown in Figure 2-7. This direct piping connection will also require changing the existing submersible pumps to dry pit pumps. Three pumps with a smaller capacity are proposed, as the existing pumps are significantly oversized and a three-pump configuration will provide greater flexibility for the range of current and future RAS flows. The proposed RAS pump design criteria are presented in Table 2-4.

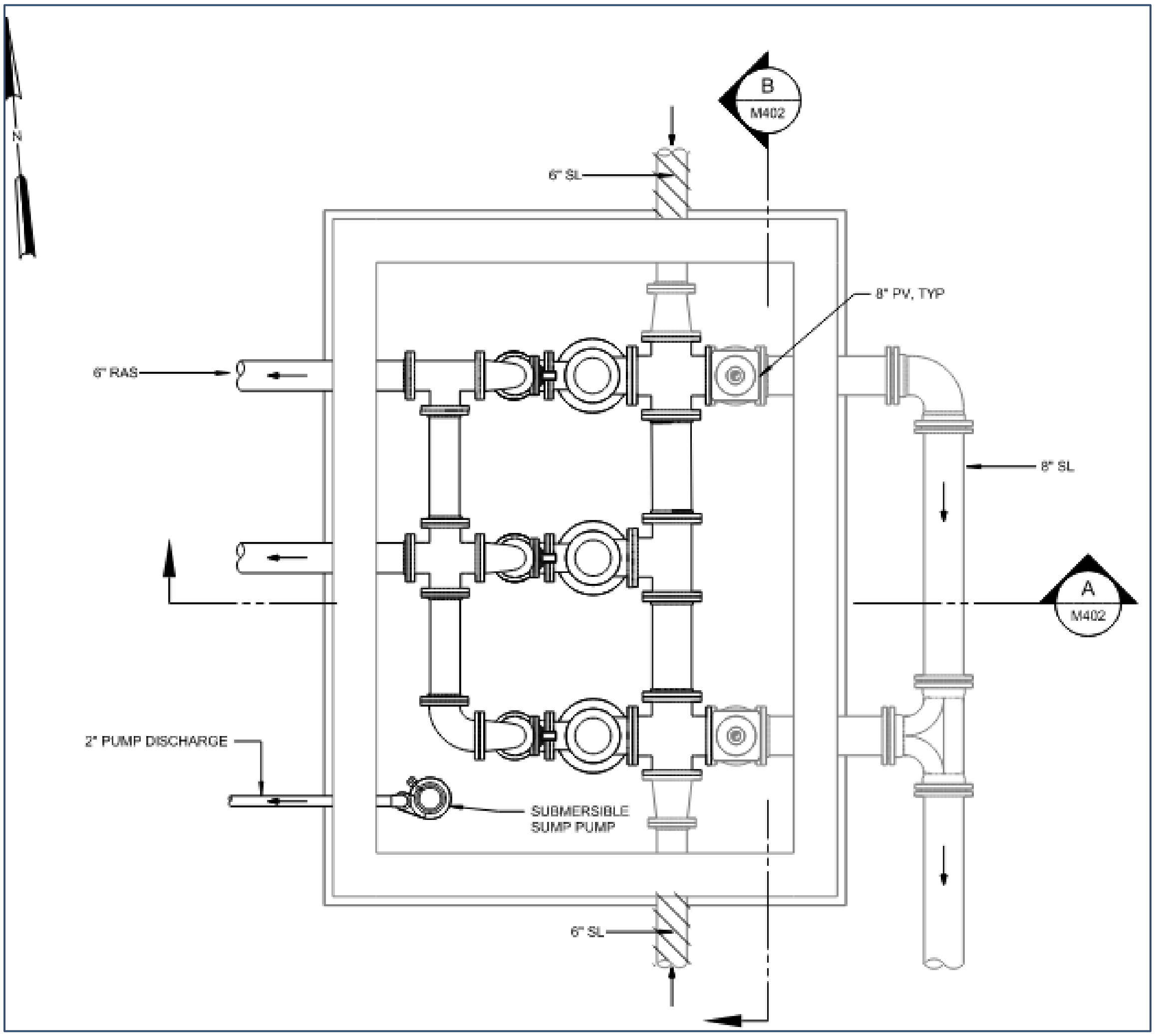


Figure 2-7: Proposed Reconfiguration of RAS Pump Station

Table 2-4: Design Criteria of Proposed RAS Pumps

Characteristic	
Type of Pump	Dry Pit
Number of Pumps	3
Capacity (gpm)	100
Total Dynamic Head (feet)	34
Maximum Pump Speed (rpm)	1760
Motor Power (hp)	6.5
Fluid Pumped	Return Activated Sludge
Solids Concentration (%)	0.2-0.4
Drive Type	Variable

Switching from submersible to dry pit pumps will force other pipes which currently drain to the RAS pump station to be directed elsewhere since the RAS pump station will no longer act as a wetwell. Two 6-inch scum lines (one from each clarifier), a 4-inch drain from the RAS / WAS distribution vault, and a 4-inch drain from the chlorine valve box will all be redirected to flow by gravity to a new manhole located south of the RAS / WAS distribution vault, as shown in Figure 2-8. A new sump pump will be added to the RAS pump station to collect any infiltration or leakage which occurs, with the discharge also directed to the new manhole. Drainage from the new manhole will flow by gravity to the existing plant drain pump station.

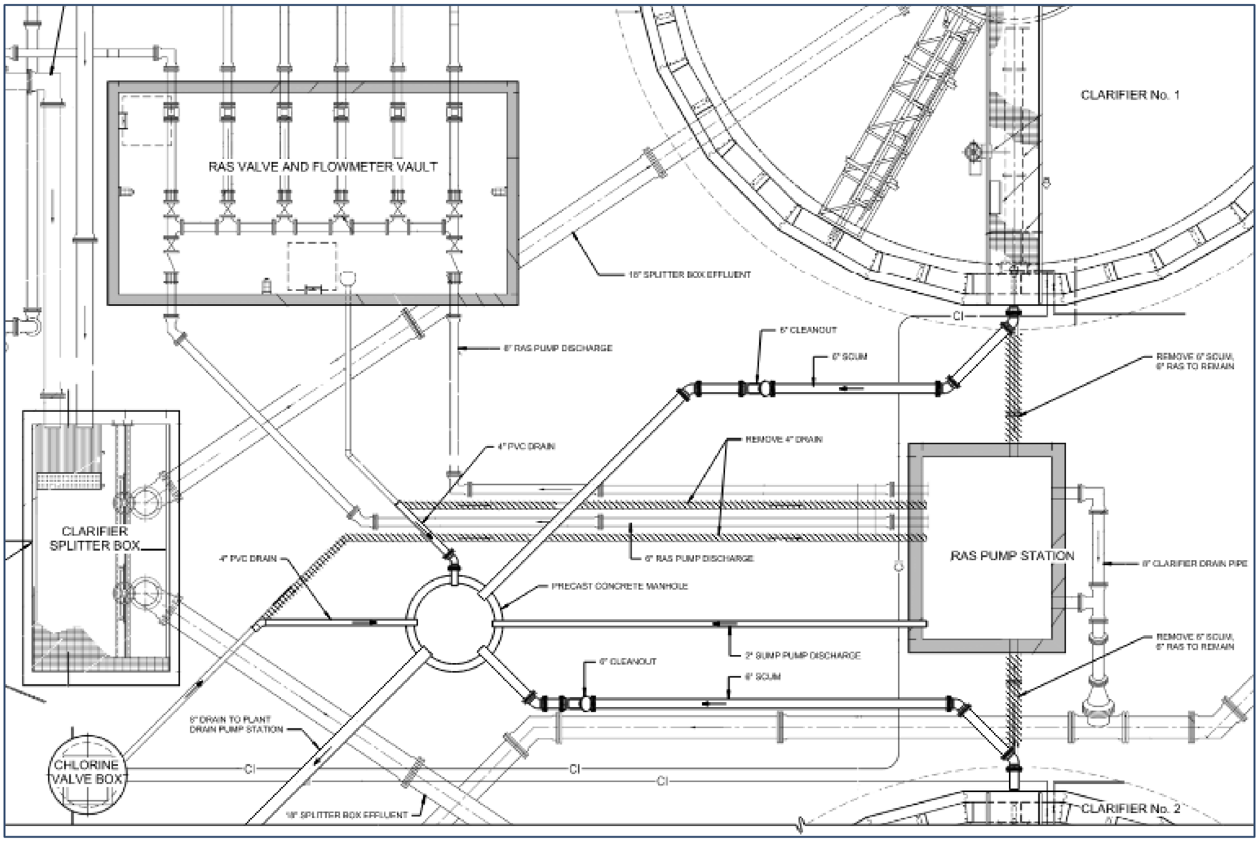


Figure 2-8: Proposed Drainage Reconfiguration

The current configuration of the RAS / WAS distribution valve vault and piping provides for transmission of RAS to the biological treatment trains through two dedicated RAS pipes, one discharging to each train. This limits the flexibility of NWRF to operate the biological treatment system, since the biological treatment train in operation cannot be changed without also changing the combination of opened and closed valves at the RAS / WAS distribution valve vault. The proposed improvement would connect the two individual RAS lines at the influent end of the plant, allowing for RAS to be distributed to either biological treatment train from either of the two RAS valves in the vault. This piping connection is displayed in Figure 2-9.

The existing RAS piping is also located near the top of the equalization and biological treatment tanks, meaning it is exposed to external weather temperatures and is at risk of freezing. To prevent this, the RAS piping will be lowered to below the operating water level of the tanks. Isolation valves will be used to keep the RAS piping empty in offline tanks.

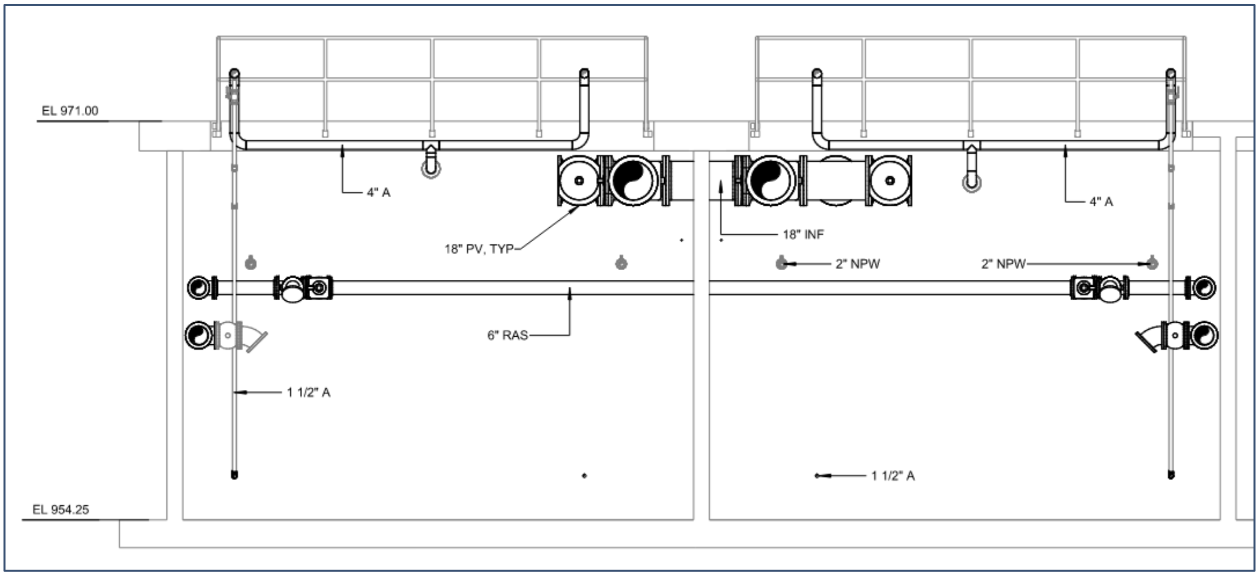


Figure 2-9: Proposed Reconfiguration of RAS Pipe

2.4 Tertiary Filtration

2.4.1 Existing Conditions

Secondary clarifier effluent is conveyed through a 16-inch ductile iron pipe to a filter distribution box inside the final treatment building. The water in the distribution box is directed into two filter influent troughs by way of two adjustable-height 90-degree v-notch weirs. The water leaves the troughs through adjustable v-notch weir plates on both sides of the trough to enter the filters. The original design loading rate of the filters was 1.15 gpm/sf at 0.4 mgd with two cells online, or 2.30 gpm/sf at 0.4 mgd with one cell online. Two additional filter cells were intended for future capacity expansion of the facility. Filter backwash water is supplied from the downstream clearwell. Figure 2-10 presents the layout of the filtration process.

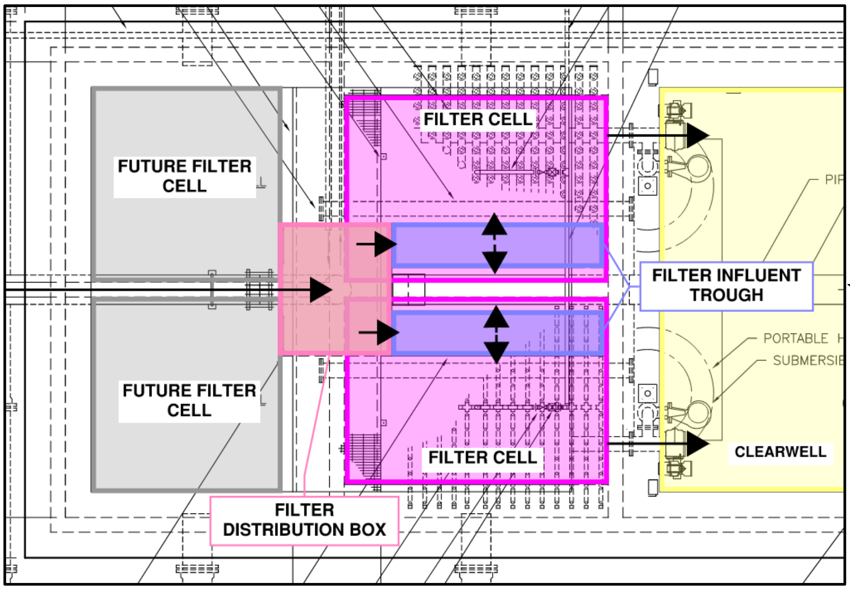


Figure 2-10: Existing Filter Layout

Since a flood event occurring in October 2021, the two filters have been decommissioned and the sand media has been removed. Secondary clarifier effluent continues to flow through the filter cells without any filtration taking place. To increase the non-potable water storage capacity of the plant, secondary clarifier effluent is now also discharged from the filter distribution box into the two “future” filter cells for pumping by the NPW system.

2.4.2 Proposed Improvements

The two 12-foot by 10-foot empty filter cells will be retrofitted with cloth media type disc filters. This technology uses a cloth media rather than granular media to filter TSS from wastewater and assist in meeting anticipated effluent limits for phosphorous. The cloth media filters have a smaller footprint but provide more filtration area which increases the hydraulic capacity of the filters. Cloth media filters also have reduced operation and maintenance costs compared to conventional media filters, since there is no migration of media to other process units during backwashing, and no air scour is necessary.

Veolia (Kruger) Hydrotech Discfilter and Westech SuperDisc are two cloth media filtration manufacturers that implement an inside-to-out flow pattern. Figure 2-11 provides an overview of function for an inside-to-out flow pattern filter. The influent flows into a center drum and then passes through the filter media discs with pore sizes of 10 µm on each side. The solids are retained on the media within the discs. Once the filter reaches a certain headloss, the control system will automatically initiate backwash. The backwash spray nozzles will wash the solids into a sludge trough as the discs rotate. The cloth media filter unit has its own backwash pump included in the assembly. Table 2-5 presents the design criteria for the proposed filters.

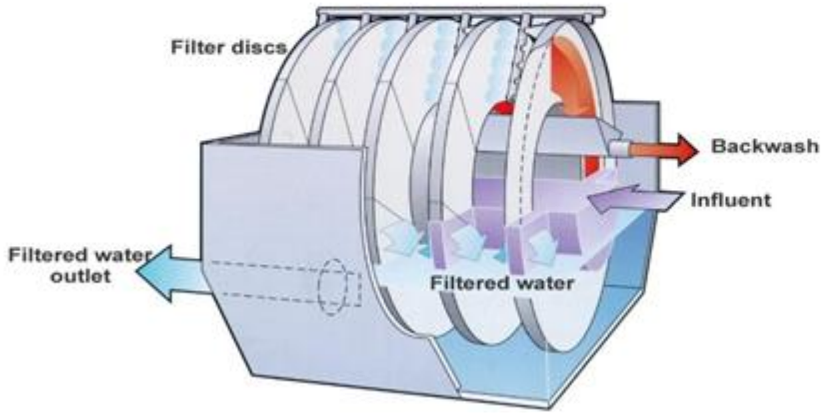


Figure 2-11: Kruger Hydrotech Discfilter Configuration

Table 2-5: Cloth Filtration System Design Criteria

Characteristic	
Number of Units	2
Peak Hour Flow for Filter System (mgd)	1.3
Design Flow for Filter System (mgd)	0.4
Average Flow for Filter System (mgd)	0.022
Maximum Filter Influent TSS (mg/L)	30
Average Filter Influent TSS (mg/L)	15
Monthly Average Filter Effluent TSS (mg/L)	≤ 5
Number of Discs Per Unit	5
Disc Diameter (m)	2.2
Peak Hydraulic Loading Rate (gpm/sf)	4.61
Maximum Headloss (in)	18

The internal walls dividing the four filter cells will need to be demolished to provide clearance for the piping to and from the filters, as presented in Figure 2-12. Two ships ladders will be provided for access to the filter piping and valves. Hatches on the top of the filters can be accessed by the plant staff from the existing walkways. Clearance at the rear of the filter units will be provided to access the backwash pump and motor, along with other filter instrumentation.

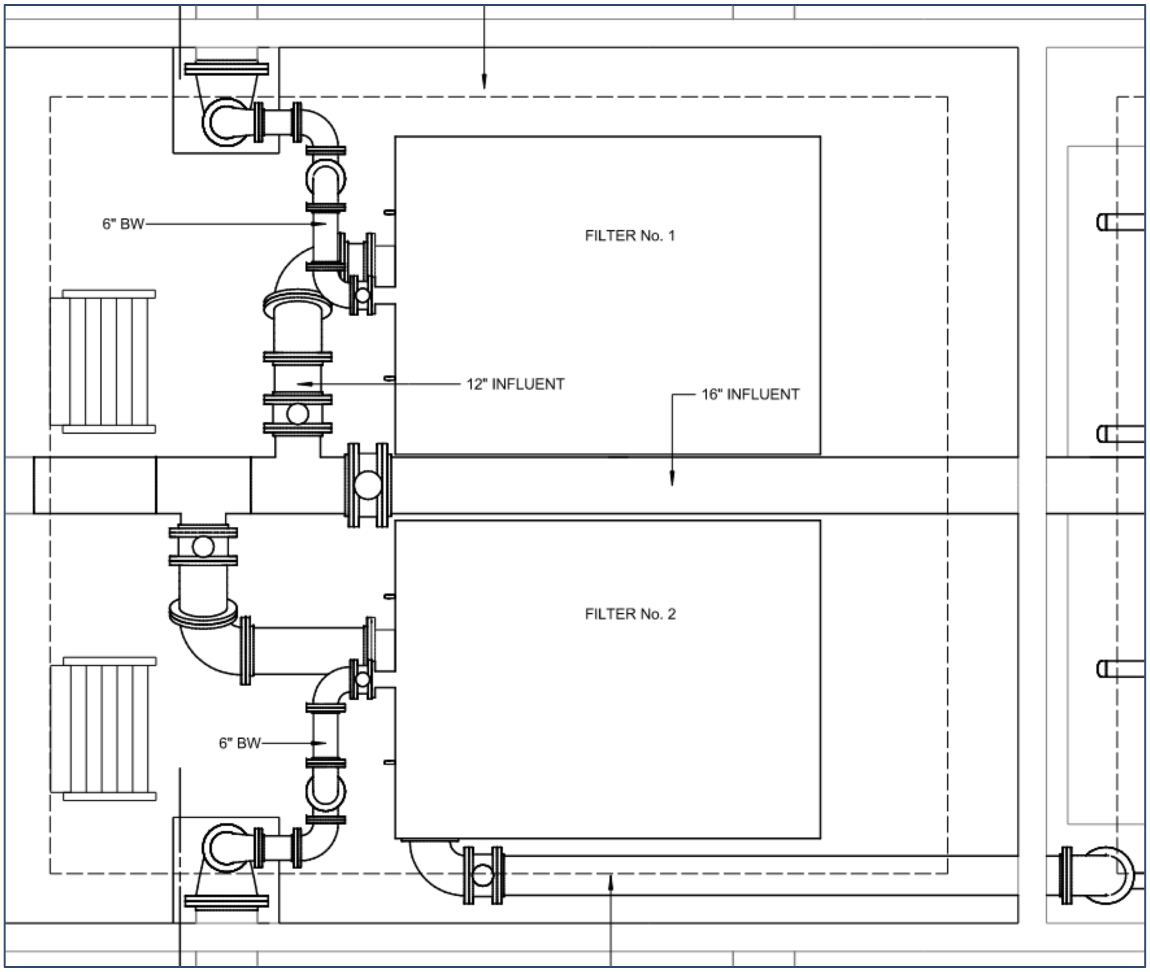


Figure 2-12: Proposed Filtration System and Piping Layout

2.5 Clearwell

2.5.1 Existing Conditions

Under current plant operations, secondary clarifier effluent passes through the filter cells without being filtered and flows directly from the filter cells into the clearwell through 8-inch filter effluent pipes. The filter effluent pipes also served as backwash supply pipes when the sand filters were operational. The 25-foot by 20.67-foot clearwell contains two submersible filter backwash pumps and two submersible non-potable water pumps.

2.5.2 Proposed Improvements

The current LAMP permit effluent limits do not have a dissolved oxygen (DO) requirement. To accommodate the proposed conversion from a LAMP permit to a NPDES permit, the NWRF effluent discharge will be required to have a minimum of 6 mg/L DO. Raising the effluent DO will be accomplished by installing post aeration using coarse bubble diffusers in the clearwell. A new blower will be required to supply air to the coarse bubble diffusers, unless one of the existing blowers can be repurposed for use with the new post aeration system. The existing blowers for the biological treatment system are known to have excess capacity, and the blower previously used for filter air scour will no longer be required for the new cloth media filtration system. Further evaluation of the existing blowers will be conducted during detailed design to establish their potential for reuse with the post aeration system.

To provide additional space in the clearwell for the diffusers, the two submersible filter backwash pumps and piping will be demolished, since the new cloth media filter system includes dedicated backwash pumps in the filtration assembly. Figure 2-13 presents the proposed layout of the coarse bubble diffusers in the clearwell.

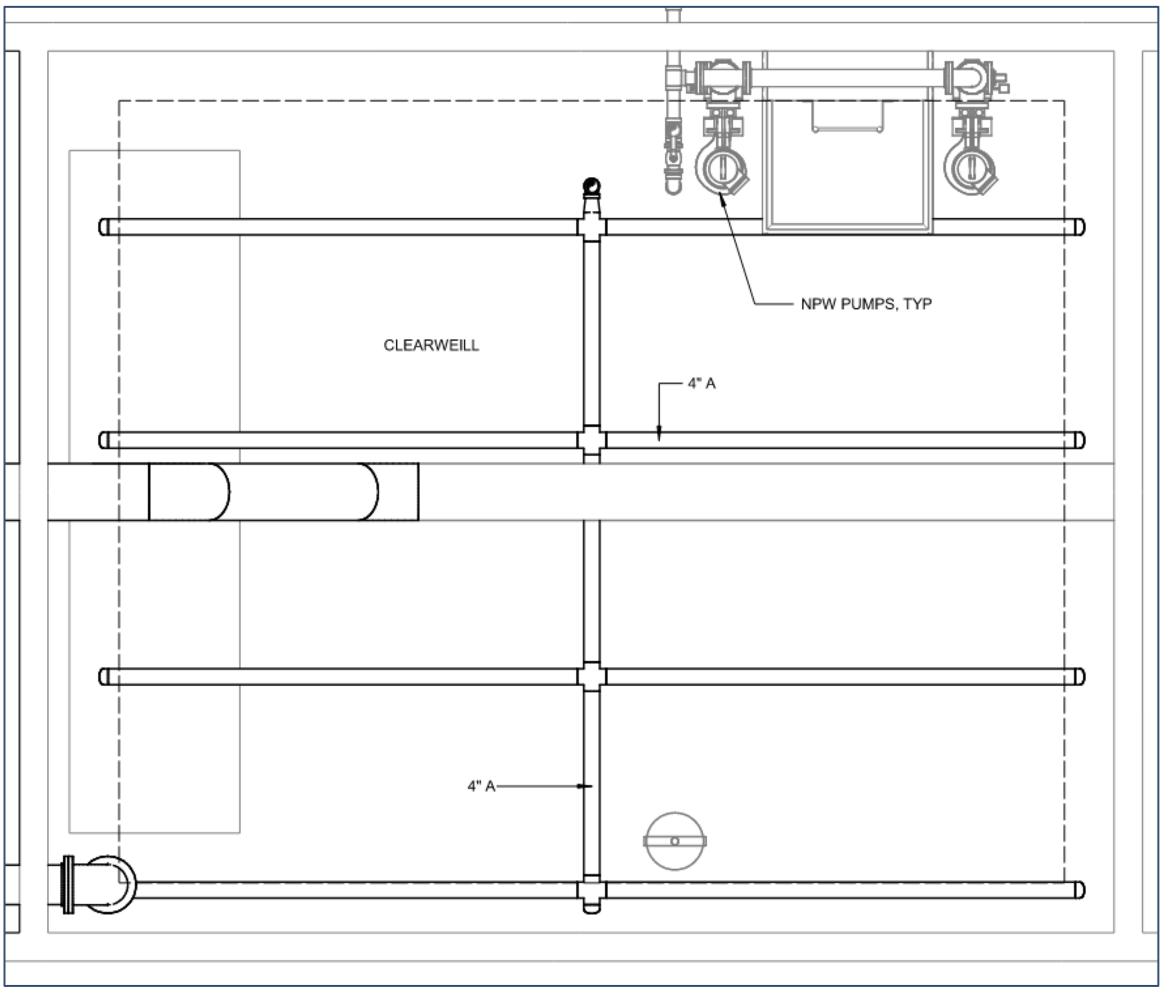


Figure 2-13: Coarse Bubble Diffuser Layout

2.6 Non-Potable Water System

2.6.1 Existing Conditions

The existing NPW pumps withdraw filtered water from the clearwell and convey it through buried piping to various locations around the NWRF, including the headworks building, dewatering building, biological treatment tanks, final clarifiers, and numerous hydrants. DCRSD staff have indicated that several leaks are present in the buried NPW system around the plant. Due to the leaks, operators do not turn on the NPW system until it is needed, so water is not consistently available to processes where it should be used regularly, such as spray down of the mechanical screen in the headworks building. Figure 2-14 shows a yard piping plan of the plant with the NPW system highlighted in red.

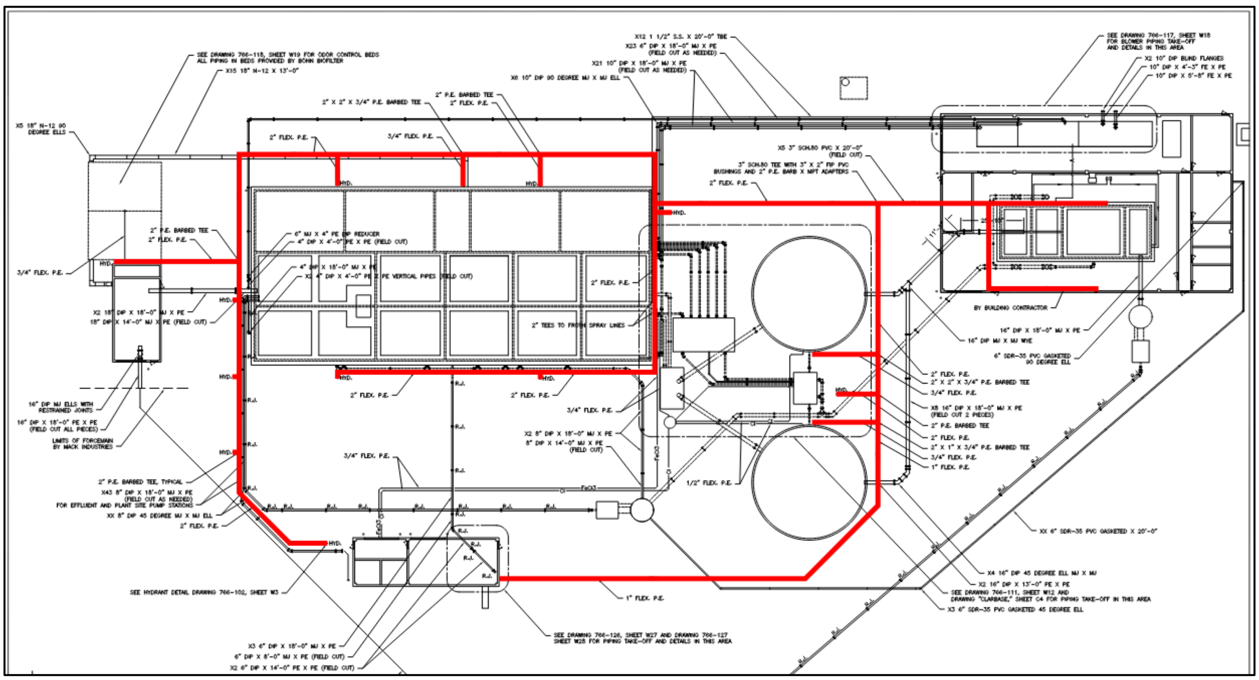


Figure 2-14: NPW Piping System

2.6.2 Proposed Improvements

The existing NPW system should be completely replaced to allow the system to remain pressurized and operational at all times. As the leaks are reported to be numerous and the locations of the leaks are unknown, it is recommended to completely replace the piping system rather than attempt to locate, isolate, and repair each individual leak. Pipe sizes and routing can be identical to the existing system, with existing connections to processes and hydrants reused to limit the disturbance required for completing the work.

2.7 Chemical Storage and Feed Systems

2.7.1 Existing Conditions

When the treatment plant was initially constructed, bulk storage tanks and chemical feed pumps were installed for ferric chloride and sodium hypochlorite chemical feed systems. However, these chemical feed systems have never been in regular operation. Since the NWRF is now using UV disinfection, the sodium hypochlorite chemical feed system is no longer required. Furthermore, ferric chloride, which can be used to optimize soluble phosphorous removal, often has an adverse impact on UV operation, so would be unlikely to see use at NWRF.

2.7.2 Proposed Improvements

2.7.2.1 Alum

To accommodate the anticipated NPDES effluent limits for phosphorus, an operational metal salt chemical feed is recommended in conjunction with the conversion of tertiary filtration to cloth media desc filters. Although some enhanced biological phosphorus removal may be realized with the pre-anoxic zones, a metal salt to precipitate soluble phosphorus is recommended as a backup to meet the effluent limit. As an alternative to ferric chloride, aluminum sulfate (alum) can be used to precipitate phosphorus.

Table 2-6 displays the proposed design criteria for the alum chemical feed system at both the current average plant flow rate and the design flow rate. A bulk tank is not necessary for the low storage volume requirements at the current average plant flow rate. Storing the chemical in 330-gallon totes is more reasonable for current conditions, and the number of totes kept on-hand can be increased as plant flow and chemical storage requirements increase. The existing ferric chloride feed system in the dewatering building will be demolished to make room for the totes. The containment area and the existing piping for the ferric chloride can be reused for the alum feed and storage system. Total of two new feed pumps, one duty and one spare pump, are needed for the alum chemical feed system. Alum will be injected into the clarifier splitter box.

Table 2-6: Alum Chemical Feed System Design Criteria

Parameter	Current Conditions	Design Conditions
Plant Influent Flow (mgd)	0.022	0.4
Alum Dose (mg/L)	40	40
Chemical Feed Rate (gpd)	1.4	30[1]
Chemical Feed Rate (gph)	0.058	1.25
Total Volume Required for 30 Days of Storage (gal)	45	900
Number of 330-gallon Totes Required for 30 Days of Storage	1	3

1. Per biological modeling completed for Northstar Water Reclamation Facility Technical Report, Sept. 30, 2021

2.7.2.2 Supplemental Carbon

Due to low cBOD5 concentration in the plant influent, supplemental carbon will be required to accomplish denitrification in both pre- and post-anoxic zones to meet the anticipated TIN effluent limit. The supplemental carbon is proposed to be some form of glycerol product. EOSi's MicroC 2000 is a non-hazardous glycerin-based product with a consistent chemical oxygen demand (COD) value of 1,100 g/L COD. Other various glycerin products (> 99% purity) have a range of 925 to 1,600 g/L COD.

The sodium hypochlorite storage area in the dewatering building will be repurposed for carbon chemical storage and feed system. The sodium hypochlorite chemical storage and feed system will be demolished, including the bulk tank, feed pump, instrumentation, and any exposed piping and conduits.

Table 2-7 displays the proposed design criteria for the supplemental carbon chemical feed system at both the current average plant flow rate and the design flow rate. A bulk tank is not necessary for the low storage volume requirements at the current average plant flow rate. Storing the chemical in totes is more reasonable for current conditions, and the number of totes kept on-hand can be increased as plant flow and chemical storage requirements increase. MicroC 2000 is available in 256-gallon totes, and other glycerin products are available in 330-gallon totes. A total of three chemical feed pumps will be provided, one duty feed pump for each biological treatment train and one common spare. Each biological treatment train would have two supplemental carbon injection points, one for each of the two anoxic zones per train. New pipes will be installed from the feed pumps to the aeration tanks, with valves to allow operators to select the injection point depending on which anoxic zone basin is in operation.

Table 2-7: Supplemental Carbon Chemical Feed System Design Criteria

Parameter	Current Conditions	Design Conditions
Plant Influent Flow (mgd)	0.022	0.4
Chemical Feed Rate (gpd)[1]	2.2	40[2]
Chemical Feed Rate (gph)	0.092	1.67
Total Volume Required for 30 Days of Storage (gal)	66	1,200
Number of 256-gallon Totes Required for 30 Days of Storage	1	5

1. Based on 1,000 g/L COD
2. Per biological modeling completed for Northstar Water Reclamation Facility Technical Report, Sept. 30, 2021

2.8 Dewatering Building

2.8.1 Existing Conditions

NWRF has approximately 380,000 gallons of aerated sludge holding volume in four below grade sludge storage tanks, which provides more than 60 days of aerobic detention time under the permitted influent capacity of 0.4 mgd. Under current operational practices, most of this volume is unused as liquid sludge is most often hauled to one of DCRSD's other plants for dewatering. However, the original design for NWRF intended for sludge dewatering to occur on site. An existing dewatering centrifuge located in the dewatering building has reportedly never been in regular operation. The centrifuge discharges to an existing pleated belt conveyor, which lifts dewatered sludge to a covered open air truck bay adjacent to the dewatering building. Figure 2-15 displays a photograph of the dewatering building and truck loading bay.

Figure 2-15: Dewatering Building Unloading Area

2.8.2 Proposed Improvements

To prepare for regular use of the existing dewatering facilities, the open-air truck bay should be enclosed for odor control purposes. A dump truck or dumpster can be parked to store dewatered solids discharged from the centrifuge, but there is no means to limit migration of odors if solids were stored in this area in its current configuration. Converting the truck bay to a fully enclosed building and connecting the ventilation system exhaust from the bay to a new odor control system would limit the spread of odors to surrounding areas.

The NWRF currently uses biological odor control filters to mitigate odors from the headworks building and sludge storage tanks. However, the location of the existing biological odor control filters on site is not conducive to expansion of the system for treatment of odors from the dewatering building. A new odor control system dedicated to the dewatering building is proposed. DCRSD has experienced success with Neutralox photoionization systems for odor control at its other treatment facilities and has expressed interest in continuing to use the technology. Photoionization utilizes ultraviolet light and a catalyst media to break down and degrade odor compounds in the air. Table 2-8 presents the proposed design criteria for the dewatering building odor control system.

Table 2-8: Design Criteria of Dewatering Building Odor Control System

Characteristic	
Type of System	Photoionization
Volume of Odor Controlled Space (ft^3)	13,750
Flow Rate (cfm)	3,025
H_2S Concentration (ppm)	10 (average) / 20 (peak)
TRS Concentration (ppm)	< 2
Housing Materials of Construction	304/316 Stainless Steel
Number of Fans	1
Power Demand (hp)	10

2.9 Plant Effluent

2.9.1 Existing Conditions

The effluent pump station is a below grade facility with a wetwell and valve vault located directly south of the final treatment building. Treated effluent from the UV disinfection process flows through a 16-inch ductile iron pipe to the pump station wetwell, where two submersible effluent pumps, each with a design point of 525 gpm at 30 feet TDH, direct flow through an 8-inch ductile iron pipe to the reservoir / holding pond. Figure 2-16 displays a photograph of the effluent pump station. From the reservoir, the effluent is pumped to an irrigation system at the Northstar Golf Club.

Figure 2-16: Effluent Pump Station

2.9.2 Proposed Improvements

Converting the NWRF from its existing LAMP permit to a new NPDES permit, with an anticipated discharge location to Little Walnut Creek, will require approximately 1,000 feet of effluent force main from the effluent pump station. The proposed force main routing was conceptually designed by Terrain Evolution in 2017 and determined to be feasible using a relatively direct route. An existing casing pipe below Wilson Road was installed for this purpose and will be used for the proposed force main routing. The casing pipe is believed to be more than adequately sized for an 8-inch force main, which is the size of the existing force main to the reservoir / holding pond.

The existing effluent pumps, if operating at their original capacity, are each capable of conveying up to 1.0 mgd to the proposed discharge location at Little Walnut Creek, therefore no changes to the pumps are anticipated. A tee with valves will need to be installed downstream of the effluent pump station to allow operators to direct effluent flow from the NWRF to either Little Walnut Creek or to the reservoir / holding pond, as it is assumed that Northstar Golf Club will continue to require a portion of treated effluent flows for its irrigation operations. Figure 2-17 displays the proposed routing of the effluent force main to Little Walnut Creek.

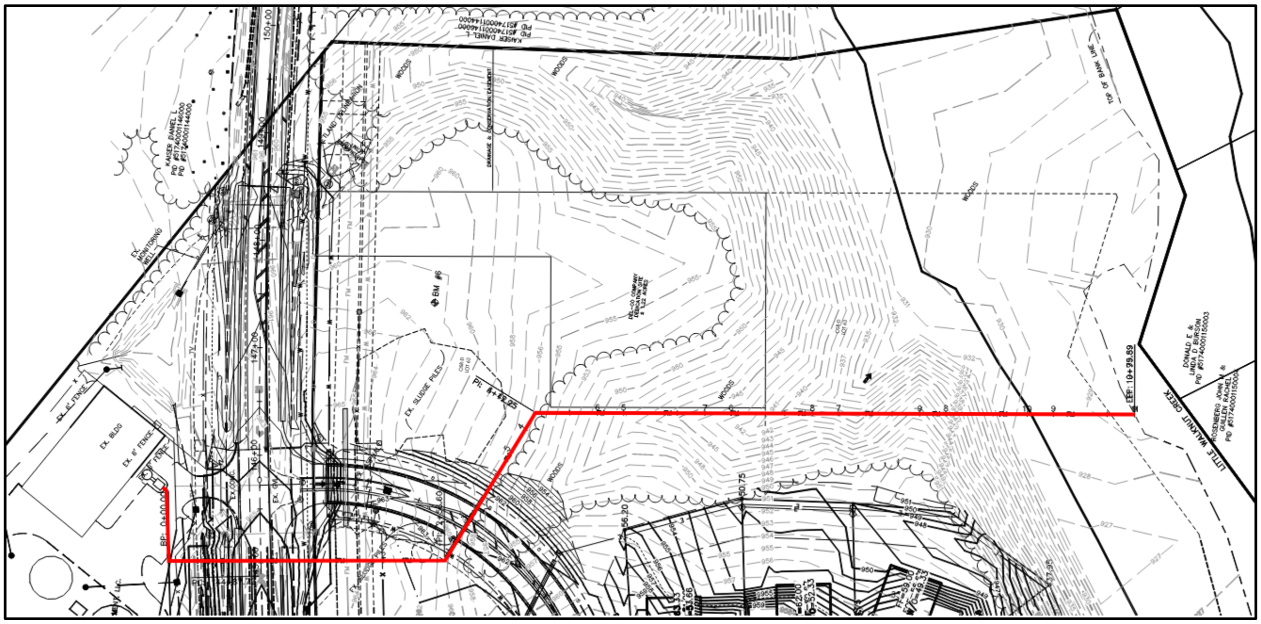


Figure 2-17: Effluent Force Main Routing

2.10 Miscellaneous Works

In addition to the treatment process upgrades described in the preceding sections, DCRSD has identified further improvements to NWRF which will be included as part of the project design. An automatic electric gate operator will be added to the existing slide gate at the main entrance driveway to the facility to ease entry and exit for authorized personnel. A security camera system will also be installed around NWRF to increase safety and security of the site.

3. Permitting Requirements

3.1.1 Discharge Permits

As part of the proposed plant improvements, NWRF aims to move away from applying treated effluent to spray fields to discharging treated effluent to Little Walnut Creek. Land application is governed by an existing Land Application Management Plan (LAMP) permit awarded to NWRF by the Ohio Environmental Protection Agency (OEPA). Discharging treated effluent to surface water such as Little Walnut Creek will require a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits are also issued by the OEPA and have pollutant concentration and flow rate limitations. Due to NWRF's circumstances, the NPDES permit application will require an anti-degradation report as part of the process. Anti-degradation reports aim to ensure that the surface water's existing uses are protected, and that adequate consideration has been taken with respect to alternative discharge options such as pumping effluent to another treatment plant. Anti-degradation reports are open to public comment for a period of no less than 6 months.

3.1.2 Total Maximum Daily Load Modifications

Little Walnut Creek is part of the Big Walnut Creek watershed. In 2005, OEPA issued Total Maximum Daily Load (TMDL) limitations for Big Walnut Creek. As defined by OEPA, "A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant." Big Walnut Creek's TMDL limits total phosphorus and fecal coliform within Little Walnut Creek.

Load limitations are categorized as either nonpoint or point source. Nonpoint source loads come from diffuse sources such as agricultural fertilizer runoff to source waters or bacteria and nutrients from livestock or faulty septic systems leaching into the receiving water. Point sources by contrast are direct discharges to the surface water from industrial or sewage treatment plants. Nonpoint and point source loads are allocated separately and summed to create a TMDL for a surface waterbody. Presently, Big Walnut Creek's TMDL does not allocate for any point source loading within Little Walnut Creek. To allow for NWRF to discharge directly to Little Walnut Creek, Big Walnut Creek's TMDL requires modification. This modification will allocate point source loads equivalent to NWRF's effluent loads and reduce nonpoint source loads by an agreed upon amount decided by OEPA. The Big Walnut Creek TMDL modification will be a joint effort between DCRSD and OEPA. Like the anti-degradation report, the TMDL modification will be open to public comment for a period of no less than 3 months.

3.1.3 Construction Permits

Any modifications to an existing wastewater treatment system require the preparation and filing of a Wastewater Permit-to-Install (PTI) with the Ohio Environmental Protection Agency (OEPA) Division of Surface Water. The PTI application generally consists of a series of forms to be completed detailing the project; engineering plans and specifications stamped and dated by a professional engineer registered in the State of Ohio; and a check made payable to the State of Ohio for the application fee. Upon receipt of the required information, OEPA conducts administrative and technical reviews of the application prior to issuing a permit decision. OEPA may take up to 6 months to approve a PTI, although this timeline can typically be reduced to one to two months by initiating in-person meetings with OEPA to review the PTI shortly upon its submission.

Alternations to the existing structures at the WWTP site, including the proposed enclosure of the dewatering building truck bay, will require a building permit from the Delaware County Building Safety Department and a zoning permit from the Kingston Township Zoning Commission. The applications generally consist of summary forms and engineering plans for review by the respective agencies. The number and length of reviews is subject to the complexity of the proposed work, so it is recommended that correspondence with the Delaware County Building Safety Department and the Kingston Township Zoning Commission be initiated early in the design process to discuss the project and permit application requirements.

A public utility construction permit will also be required through the Delaware County Engineer for work within the public right-of-way. Although a casing pipe for the proposed effluent force main already exists under Wilson Road, which will limit disturbance to the road surface, some excavation within the right-of-way is still expected. A crossing of the Woodruff Drive right-of-way is also expected along the route of the proposed force main.

4. Preliminary MOPO Strategy

Maintenance of plant operations (MOPO) during construction of the proposed improvements are expected to only require a single treatment train to be in operation where parallel trains exist with current flows through the NWRF. The proposed improvements at the headworks building, which include repair of the odor control fan ductwork and removal of the existing crane, can be completed without disruption to the liquid treatment process. The odor control system will be offline while the ductwork is repaired, and the contractor will be working within a classified space. The dewatering building is not currently in use and is not expected to be in use until construction is complete, so upgrades to the chemical feed systems, enclosure of the truck bay, and installation of an odor control system can also be completed without disruption to the treatment process. Miscellaneous works such as security camera installation and perimeter fence slide gate operator installation can be completed at any time.

The majority of the improvements proposed at the equalization and biological treatment tanks can be completed while one train remains in operation. Influent piping, IMLR pump and piping, and floating mixers can be installed and commissioned in the offline treatment train, which will then become the active train while installation of these components occurs in the second train. The existing plug valves which allow for hydraulic connection between the two trains will be closed during this work. The new RAS piping connection and lowering the elevation of the RAS piping can occur in the same manner. An exception to this would be for connection of the new influent header pipe to the existing 18-inch ductile iron influent line from the headworks, which will likely require bypass from the headworks to the biological treatment tanks.

Conversion of the RAS pumps from submersible to dry pit will require bypass around the RAS pump station. Installation of the reconfigured drainage system, including the manhole collecting the two clarifier scum lines and drains from the RAS / WAS distribution vault and chlorine valve box, should be completed prior to RAS pump replacement. The drainage system installation can be completed without interruption to the treatment process, though the active clarifier may need to be changed when scum line connections are completed.

Existing bypass piping in the final treatment building will allow the filter cells and clearwell to be bypassed during installation of the new cloth media filters and clearwell aeration system. Scheduling this work for outside the normal disinfection season will minimize any impacts to the treatment process. The existing NPW pumps will be impacted when bypassing the clearwell, so connection to the new NPW system piping should be coordinated simultaneously. NPW piping installation itself could occur parallel to the existing piping if desired to limit system downtime. Temporary supply of non-potable water can be provided where needed during this work.

Nearly all of the new effluent force main can be installed without disruption to NWRF operations. The exception is the tee connection to the existing effluent force main downstream of the effluent pump station, which will require the existing force main to be shut down and bypass piping to be utilized around the work site.

5. Opinion of Probable Construction Cost

A Class 3 Engineer's Opinion of Probable Construction Cost (OPCC) was prepared for the preliminary design phase of the project. The OPCC was prepared following the general guidelines of the Association for the Advancement of Cost Estimating International (AACE) Recommended Practice No. 18R-97. Class 3 estimates are for projects having a project definition level of 10% to 40%, and typically have accuracy ranges of -15% to +20%.

For consistency with the cost estimates presented in the 2021 Northstar WRF evaluation completed by Hazen, the improvements described herein have been grouped into four categories:

1. Baseline improvements: minimum recommended improvements for consistency of operation and maintenance as plant flows increase to 0.4 mgd. Refer to Table 5-1.
2. Improvements necessary to meet expected future LAMP permit conditions at permitted capacity of 0.4 mgd. Refer to Table 5-2.
3. Improvements necessary to meet expected future NPDES permit conditions at permitted capacity of 0.4 mgd. Refer to Table 5-3.
4. Improvements requested by DCRSD which do not fall into other categories. Refer to Table 5-4.

Table 5-1: Cost Summary of Baseline Improvements

Improvement	Opinion of Probable Construction Cost	Notes
Reconfiguration of RAS control	$146,000	Includes new drain/scum manhole and piping connections in addition to 3 new RAS pumps
Temporary bypass pumping system	$50,000	
Connection of RAS header at influent end of biological treatment	$32,000	
Lower RAS piping		Labor only – no new materials
NPW system replacement	$82,000	Full piping replacement rather than leak repair
Influent header extension with valves	$167,000	Includes relocation of a portion of existing air piping
Dewatering Building unloading area enclosure	$34,000	
Electrical and I&C allowances	$17,000	
Direct Construction Subtotal	**$528,000**	
General Conditions	$79,000	15% of direct construction subtotal
Contractor Overhead and Profit	$121,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$38,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$23,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$237,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$1,026,000**	
Low Range Estimate (-15%)	*$873,000*	
High Range Estimate (+20%)	*$1,232,000*	

Table 5-2: Cost Summary of Improvements for Future LAMP Effluent Permit Conditions

Improvement	Opinion of Probable Construction Cost	Notes
Supplemental carbon feed	$45,000	Reuse of existing chemical equipment not feasible
BNR improvements	$150,000	Includes new piping and basin slide gates in addition to 2 new IMLR pumps
Electrical and I&C allowances	$11,000	
Direct Construction Subtotal	**$206,000**	
General Conditions	$31,000	15% of direct construction subtotal
Contractor Overhead and Profit	$47,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$15,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$9,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$92,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$400,000**	
Low Range Estimate (-15%)	*$340,000*	
High Range Estimate (+20%)	*$480,000*	

Table 5-3: Cost Summary of Improvements for Future NPDES Effluent Permit Conditions

Improvement	Opinion of Probable Construction Cost	Notes
Alum Feed	$44,000	Reuse of existing chemical equipment not feasible
Conversion to disc filters	$742,000	
Post aeration	$70,000	Diffused aeration in existing clearwell, and repurpose existing blower
Effluent force main to Little Walnut Creek	$173,000	
Electrical and I&C allowances	$121,000	
Direct Construction Subtotal	**$1,150,000**	
General Conditions	$173,000	15% of direct construction subtotal
Contractor Overhead and Profit	$265,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$82,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$50,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$516,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$2,236,000**	
Low Range Estimate (-15%)	*$1,901,000*	
High Range Estimate (+20%)	*$2,684,000*	

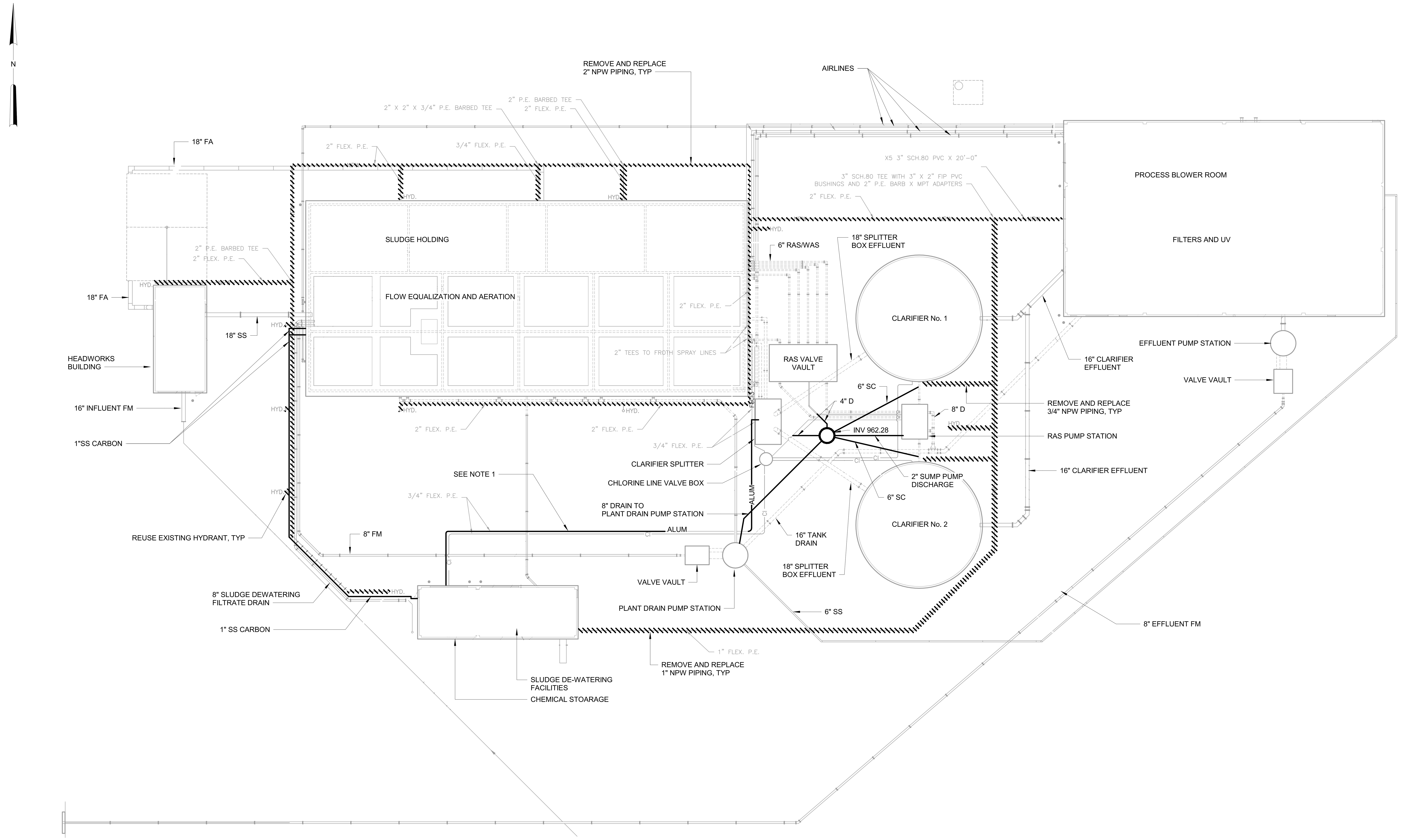
Table 5-4: Cost Summary of Improvements for Requested by Owner

Improvement	Opinion of Probable Construction Cost	Notes
Odor control system	$220,000	
Floating mixers	$79,000	4 new mixers and 1 relocated existing mixer
BNR aeration system upgrades	$46,000	Replacement of existing diffusers with fine bubble diffusers
Headworks Building upgrades	$6,000	
Miscellaneous plant improvements	$15,000	Security camera system, entrance gate operator
Electrical and I&C allowances	$72,000	
Direct Construction Subtotal	**$438,000**	
General Conditions	$66,000	15% of direct construction subtotal
Contractor Overhead and Profit	$101,000	20% of the sum of direct construction subtotal and general conditions
Escalation	$31,000	6% of the sum of direct construction subtotal, general conditions, and overhead and profit
Bonds and Insurance	$19,000	3% of the sum of direct construction subtotal, general conditions, overhead and profit, and escalation
Contingency	$197,000	30% of the sum of direct construction subtotal, general conditions, overhead and profit, escalation, and bonds and insurance
Opinion of Probable Construction Cost	**$852,000**	
Low Range Estimate (-15%)	*$725,000*	
High Range Estimate (+20%)	*$1,023,000*	

Appendix A: Preliminary Design Drawings

NOTES:

1. REUSE PORTION OF EXISTING FERRIC CHLORIDE PIPING FOR NEW ALUM CHEMICAL FEED LINE.



NPW PIPING

NOT TO SCALE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR
CONSTRUCTION

Hazen

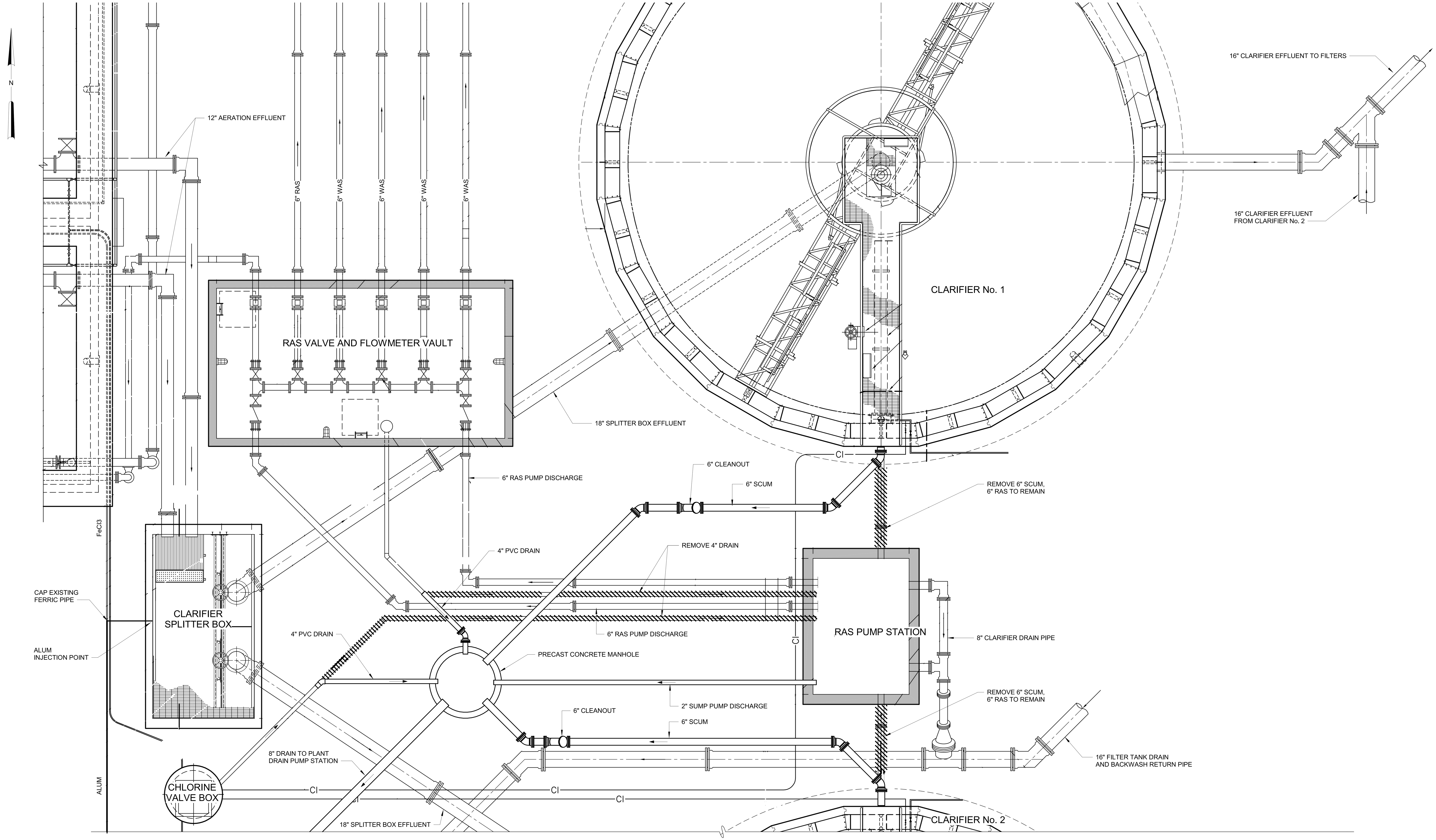
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

CIVIL
SITE PIPING PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	C001



SCUM/DRAIN MANHOLE

NOT TO SCALE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: P. MACCLELLAN
DRAWN BY: P. VANGORDEN
CHECKED BY: S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

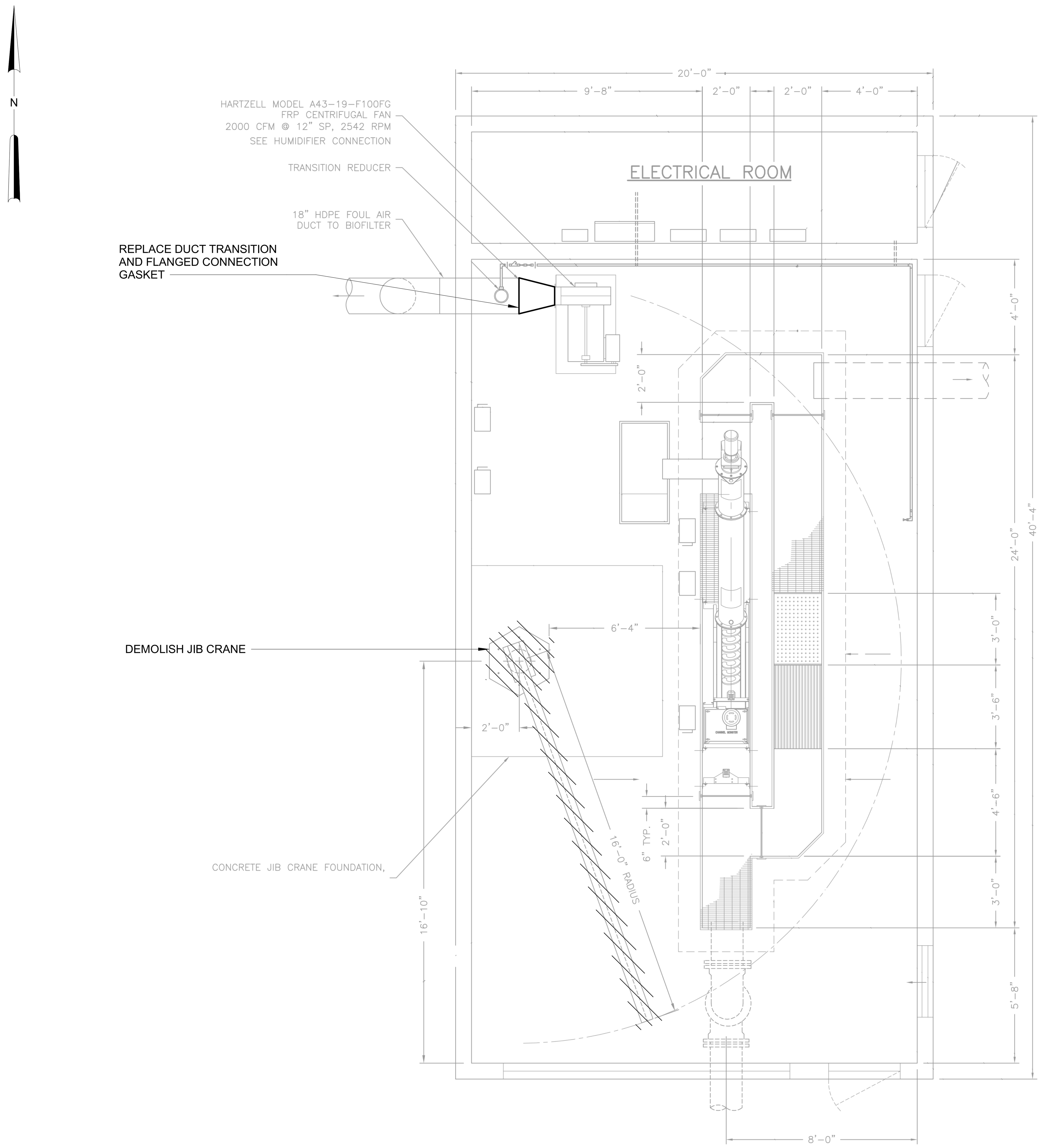
NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

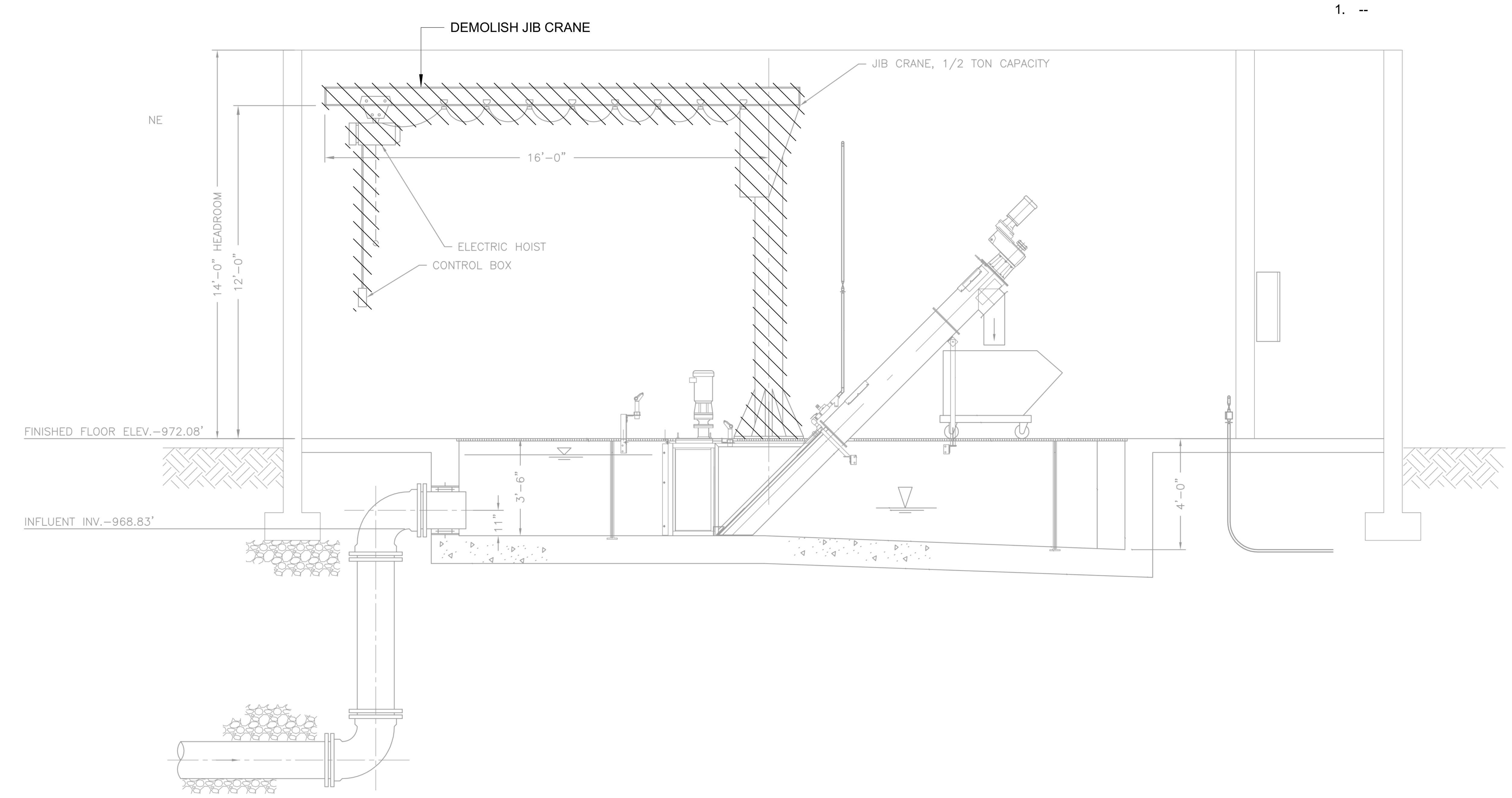
CIVIL
SCUM/DRAIN MANHOLE

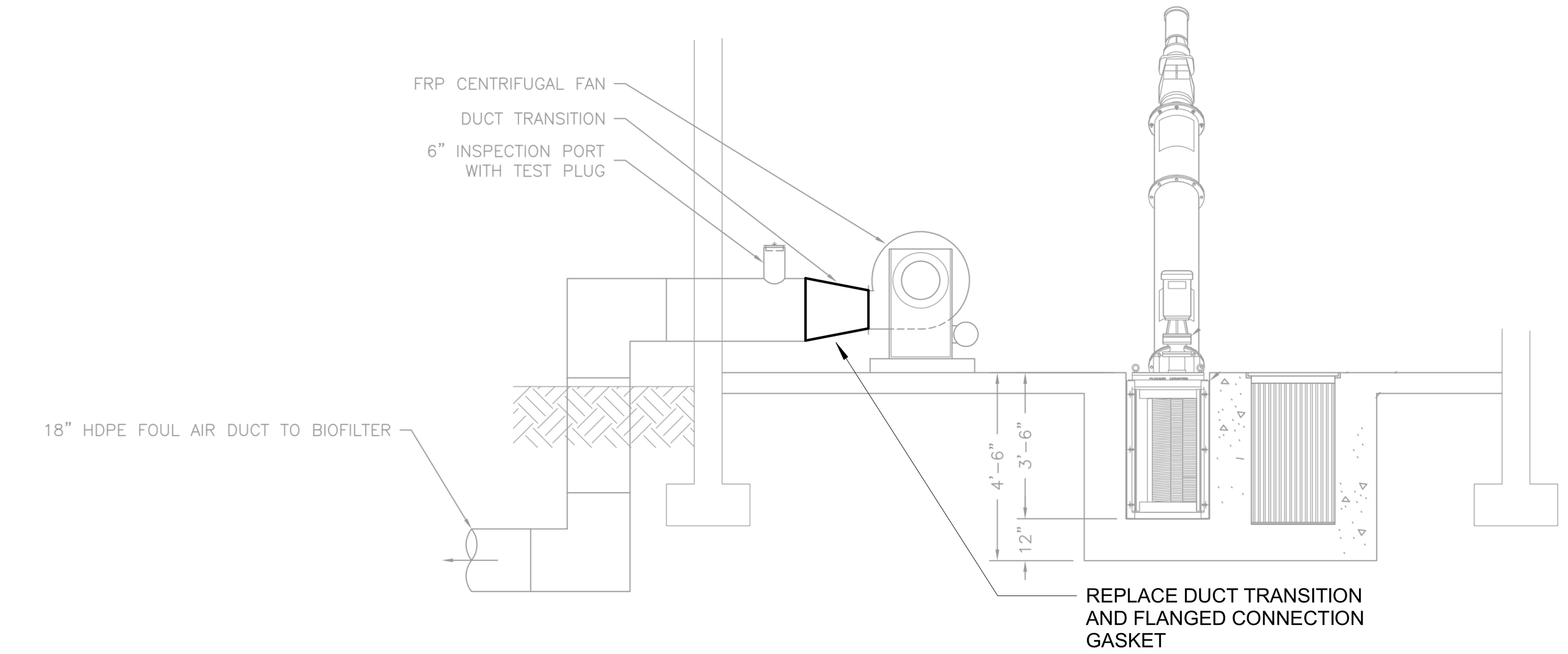
DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: C002

NOTES:

1. --







EXISTING HEADWORKS

NOT TO SCALE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR
CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

HEADWORKS BUILDING
MECHANICAL
PLAN AND SECTIONS

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M001

NOTES:

1. PROCESS FLOW DIAGRAM SHOWN FOR ONE BIOLOGICAL TREATMENT TRAIN ONLY. PROCESS IS SIMILAR FOR SECOND TRAIN.

PROCESS FLOW DIAGRAM
NOT TO SCALE

LEGEND

EXISTING FLOW PATH TO REMAIN AS ALTERNATE AFTER PROPOSED IMPROVEMENTS

PRIMARY FLOW PATH WITH PROPOSED IMPROVEMENTS

ALTERNATE FLOW PATH WITH PROPOSED IMPROVEMENTS

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

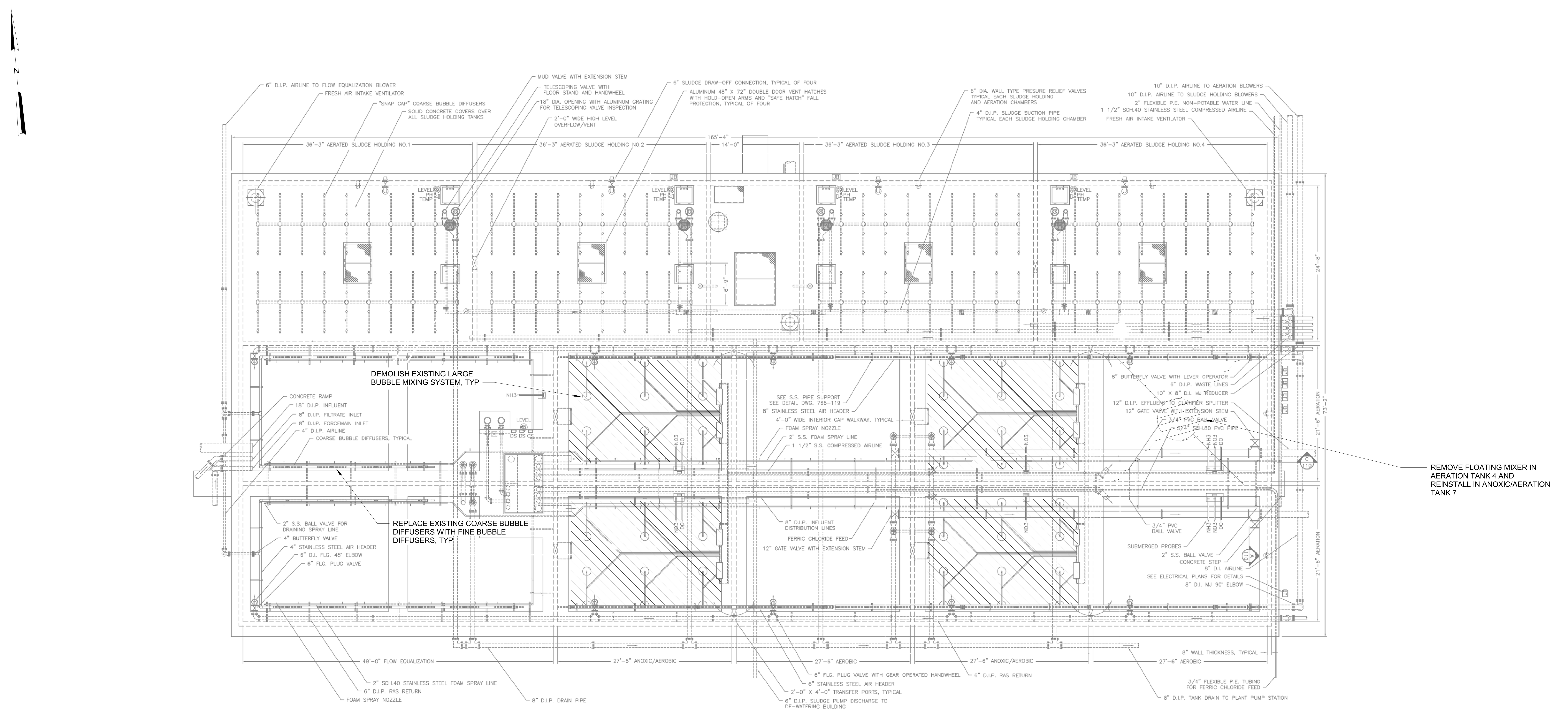
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
PROCESS FLOW DIAGRAM

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M300



DEMOLITION PLAN

1/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

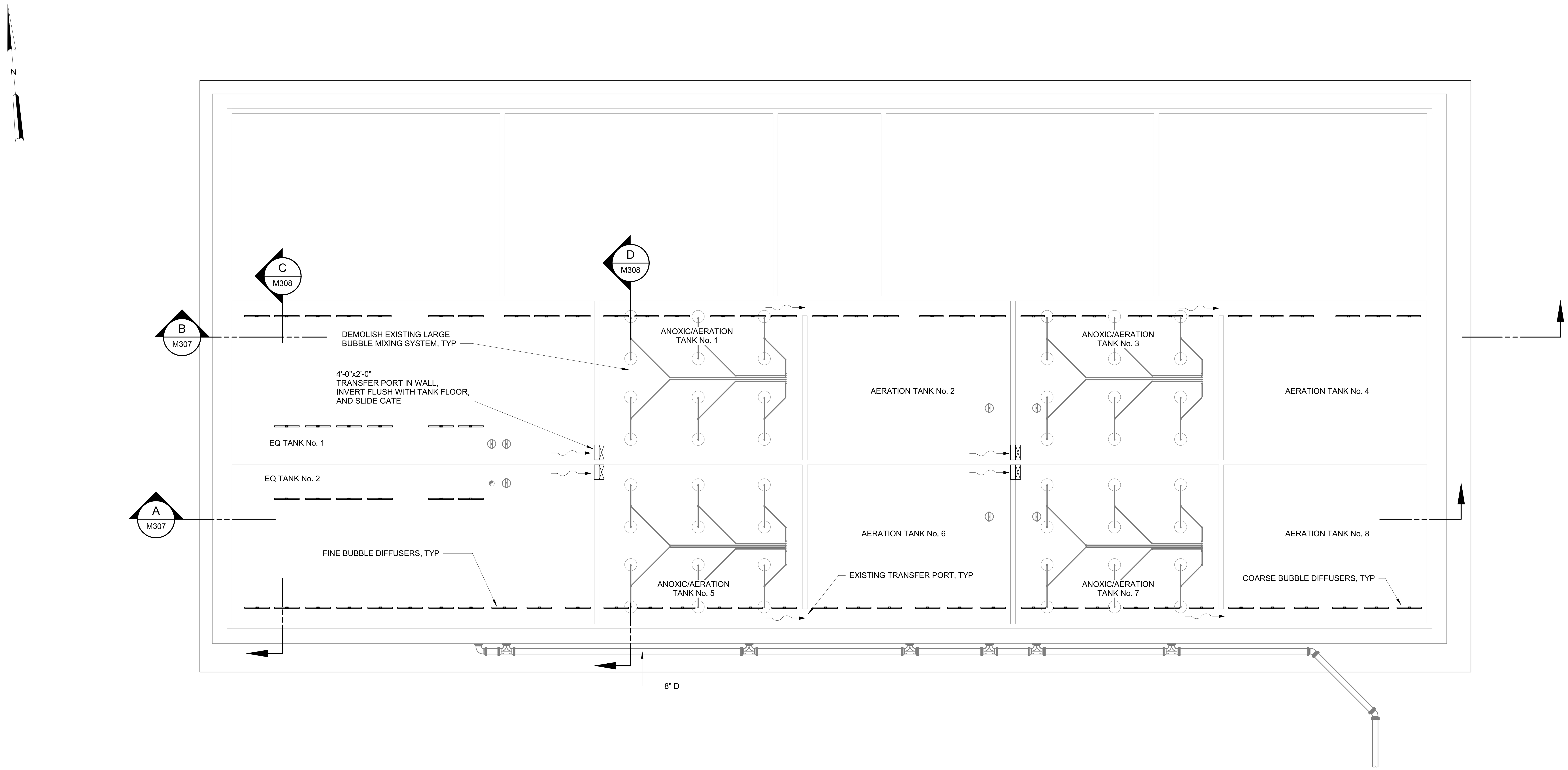
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
OVERALL DEMOLITION PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M301



BOTTOM PLAN

1/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

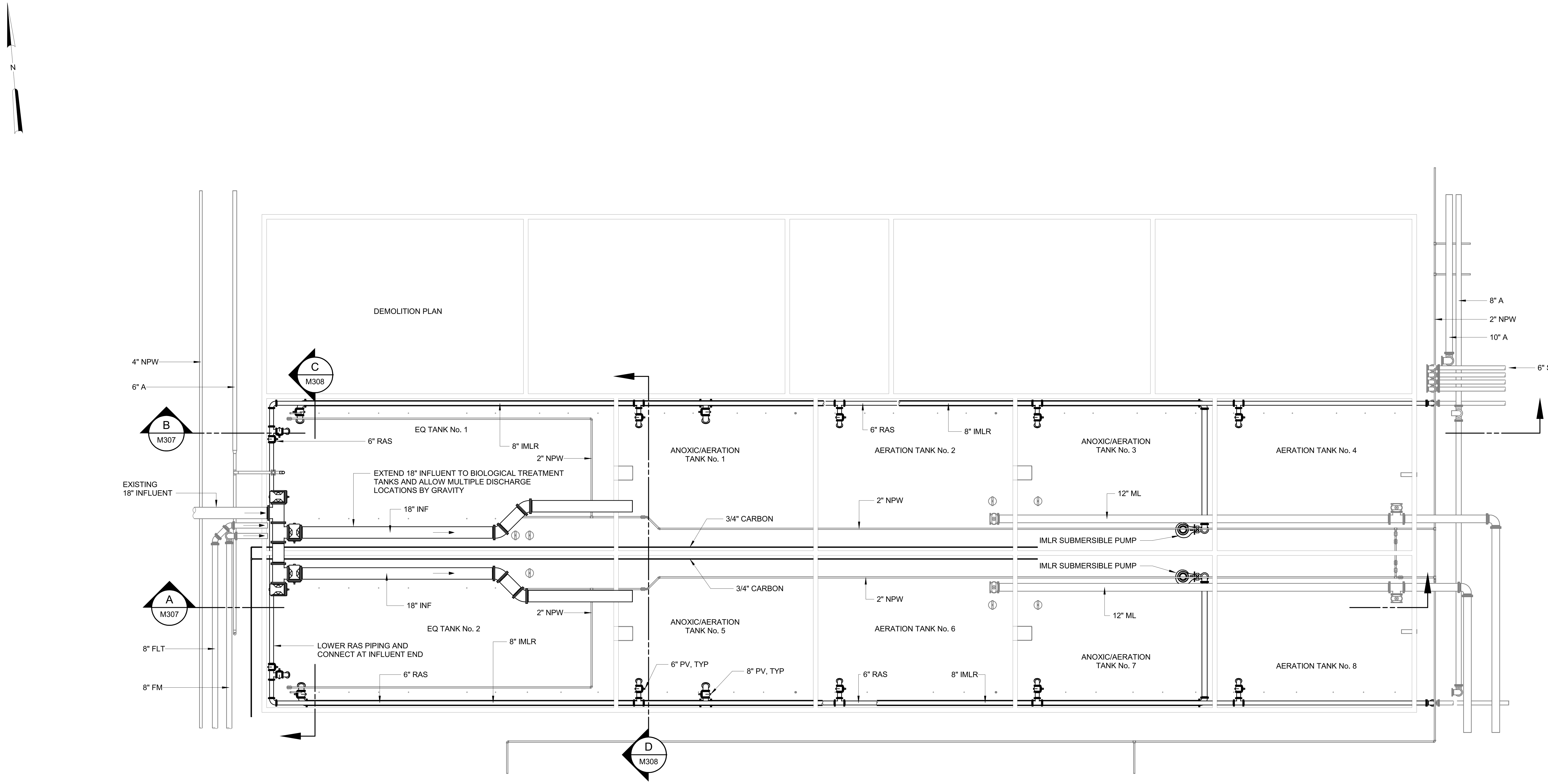
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
BOTTOM PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M302



INTERMEDIATE PLAN

1/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

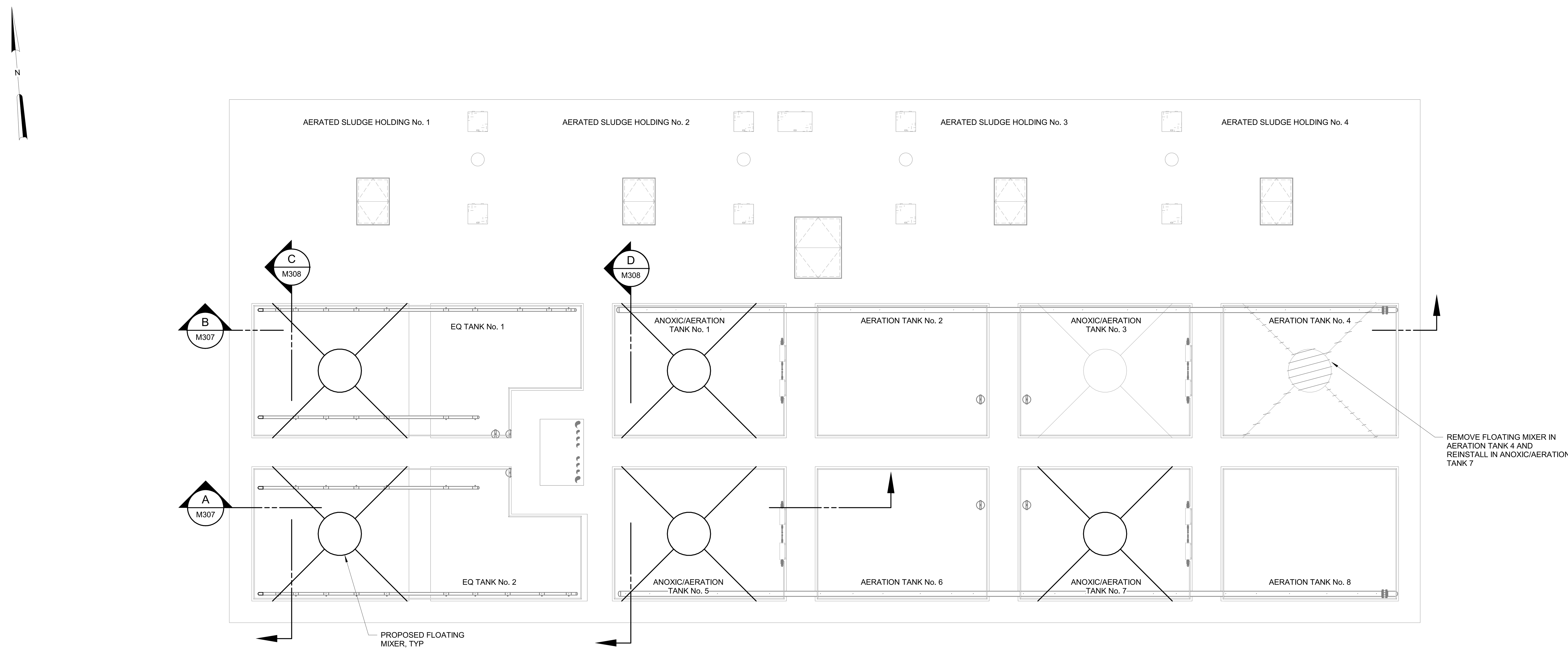
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
INTERMEDIATE PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M303



TOP PLAN

1/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: P. MACCLELLAN
DRAWN BY: P. VANGORDEN
CHECKED BY: S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

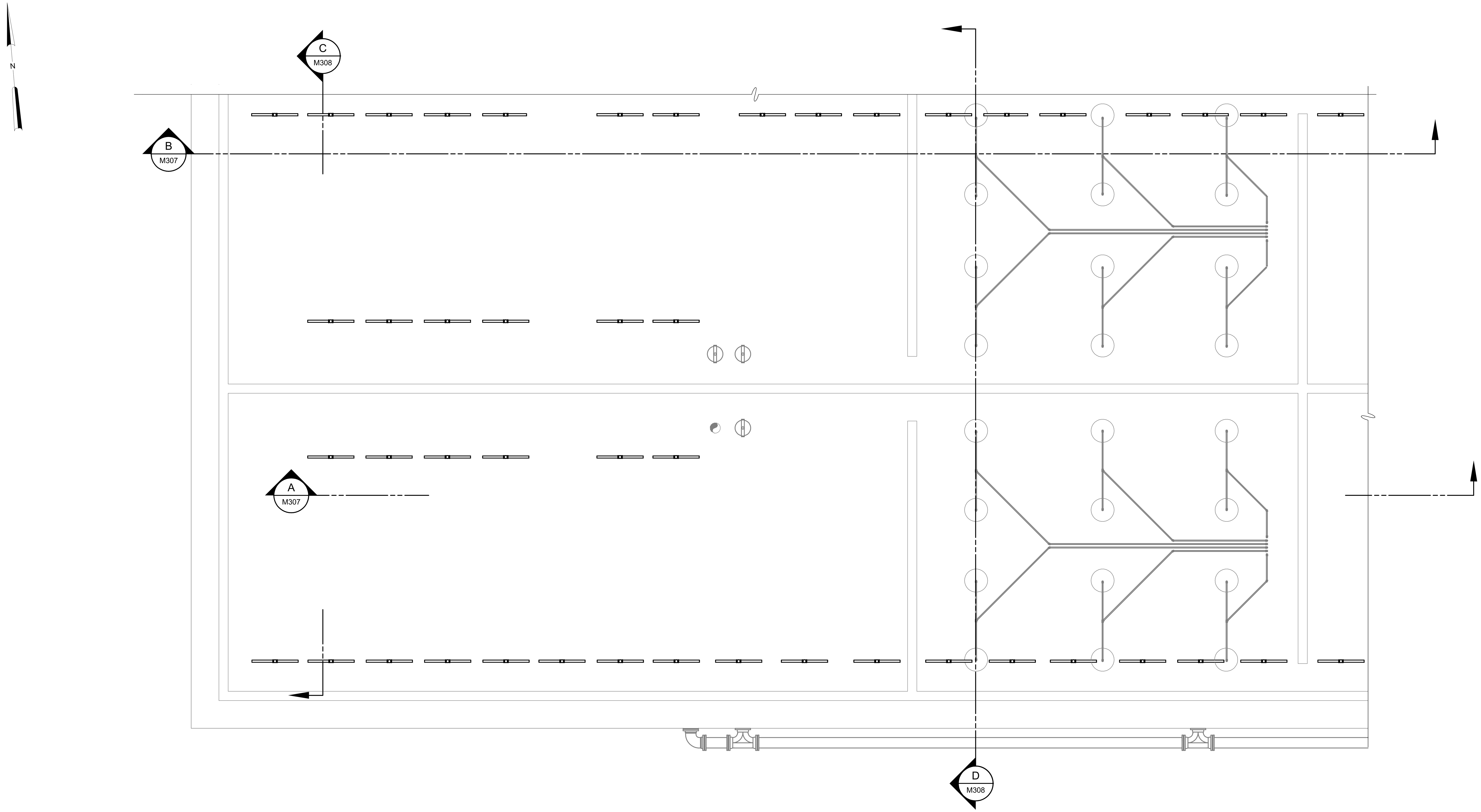
Hazen
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
TOP PLAN

DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: M304



ENLARGE PARTIAL BOTTOM PLAN

1/4" = 1'-0"

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 1/2" 1")

REV	ISSUED FOR	DATE	BY

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
ENLARGED PARTIAL BOTTOM PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M305

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-300-BLT-M.rvt
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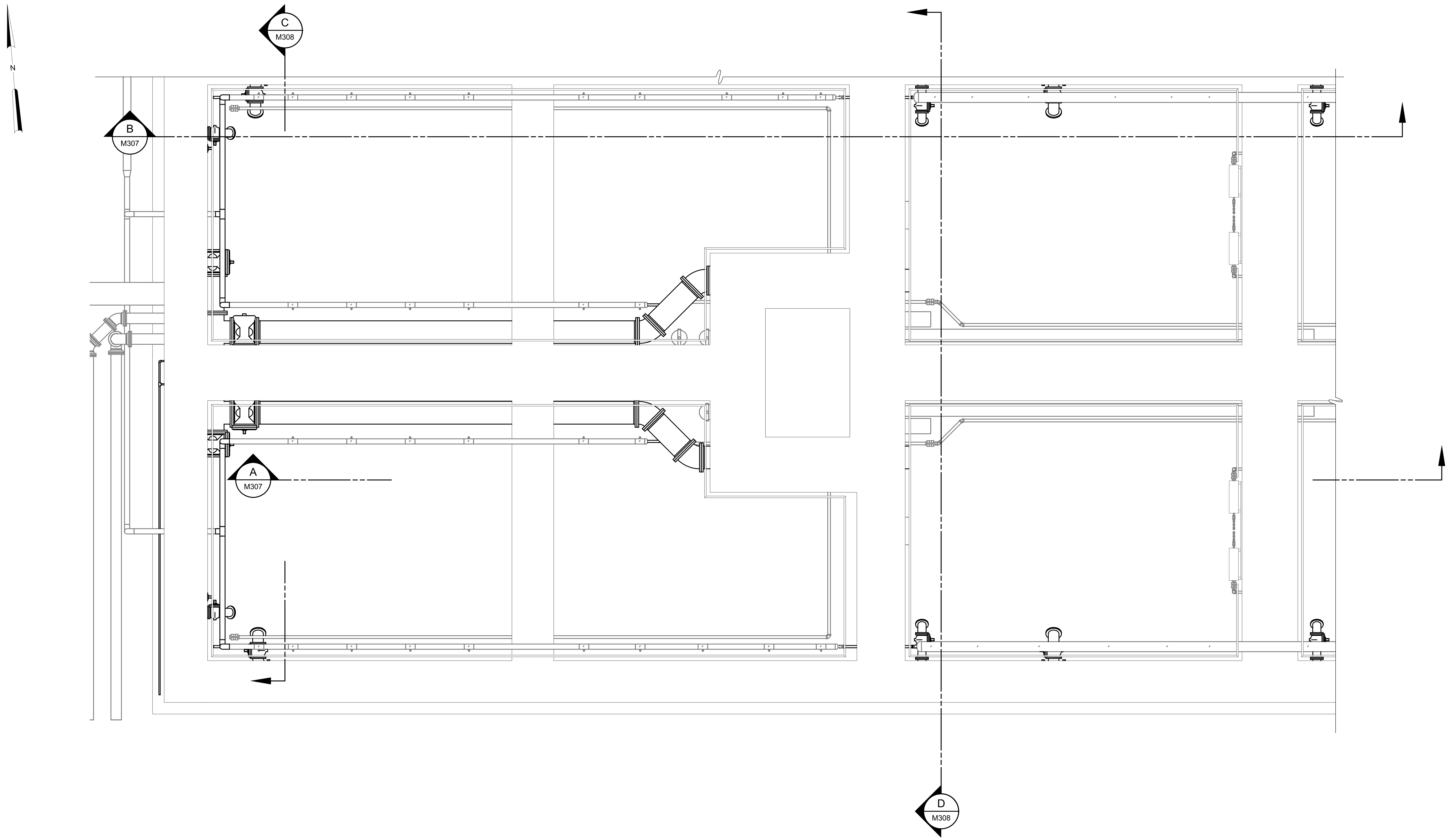

ENLARGE PARTIAL TOP PLAN

1/4" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
ENLARGED PARTIAL TOP PLAN

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M306

SECTION (A / M302)
3/16" = 1'-0"

SECTION (B / M302)
3/16" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: P. MACCLELLAN
DRAWN BY: P. VANGORDEN
CHECKED BY: S. PHIPPS
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
SECTION

DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: M307

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-300-BLT-M.rvt
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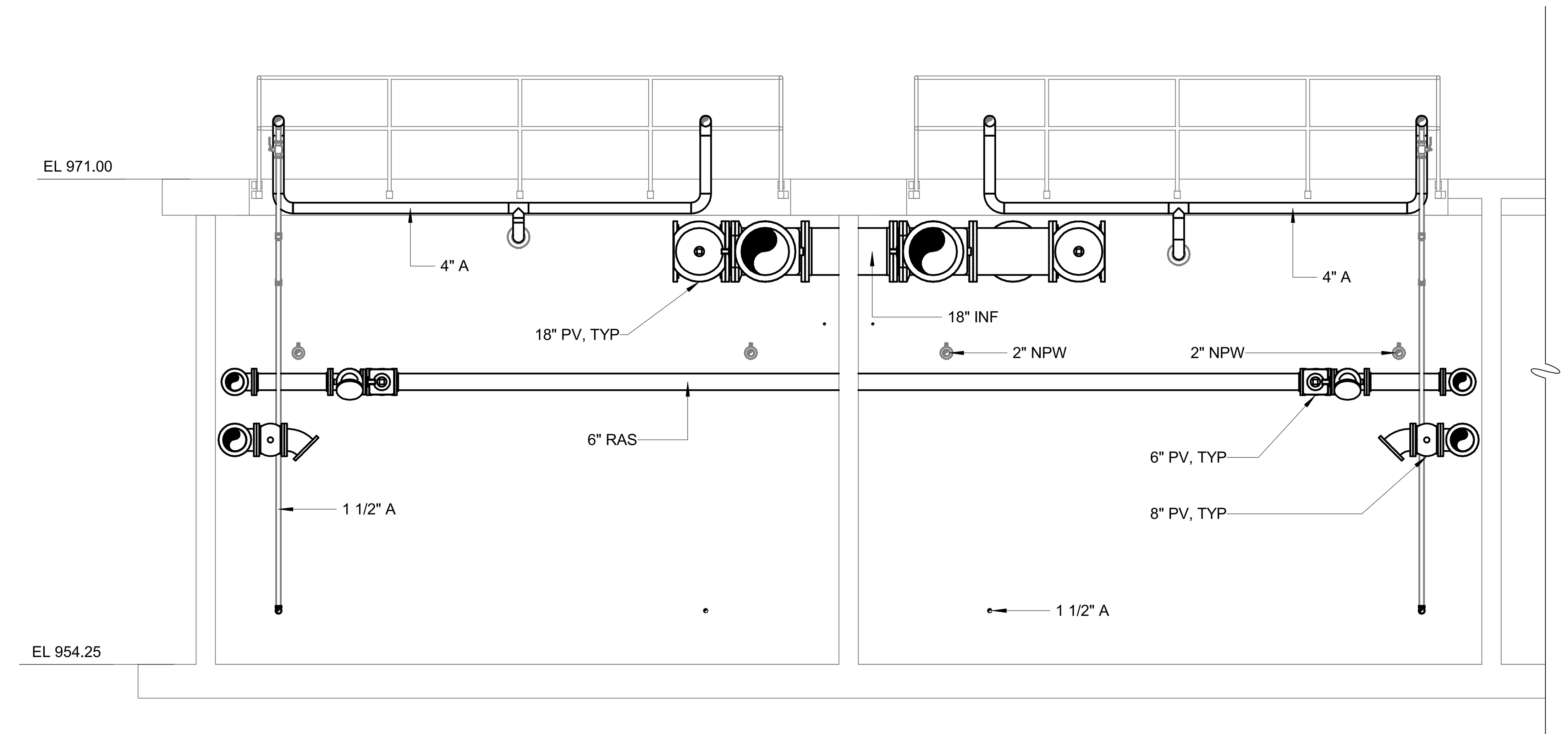
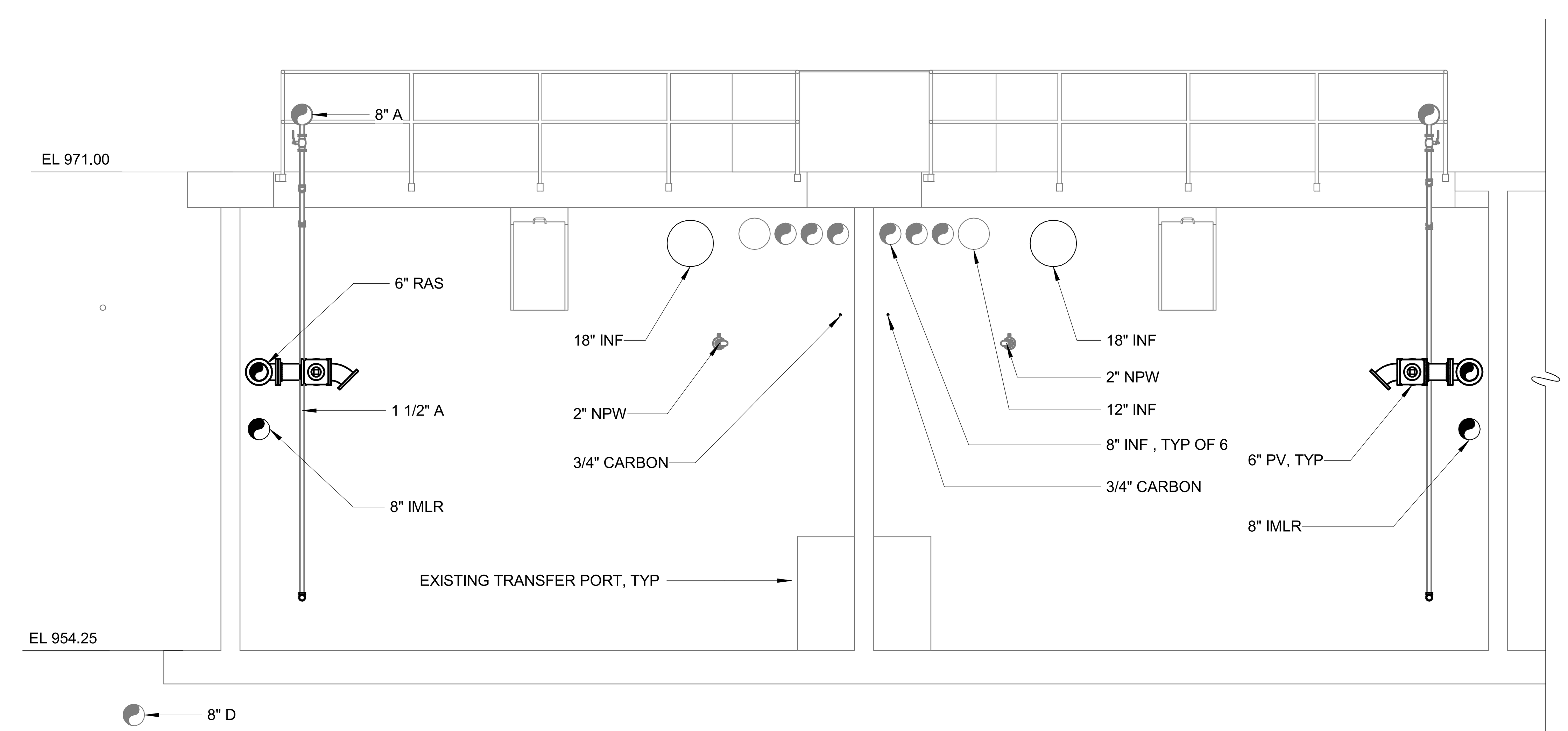


SECTION C M302
1/4" = 1'-0"



SECTION D M302
1/4" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	P. MACCLELLAN
DRAWN BY:	P. VANGORDEN
CHECKED BY:	S. PHIPPS

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

AERATION TANKS
MECHANICAL
SECTION

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M308

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-300-BLT-M.rvt
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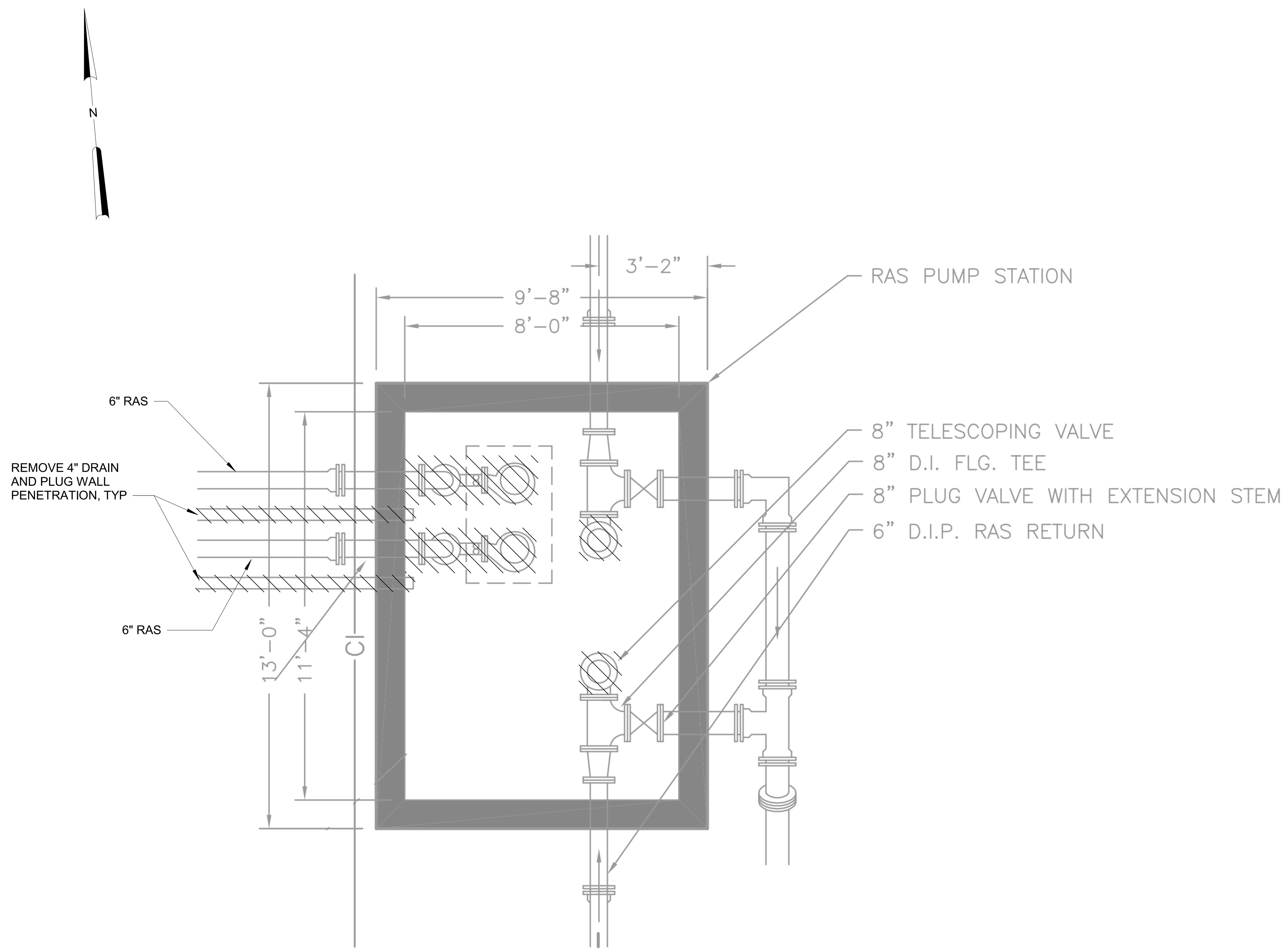
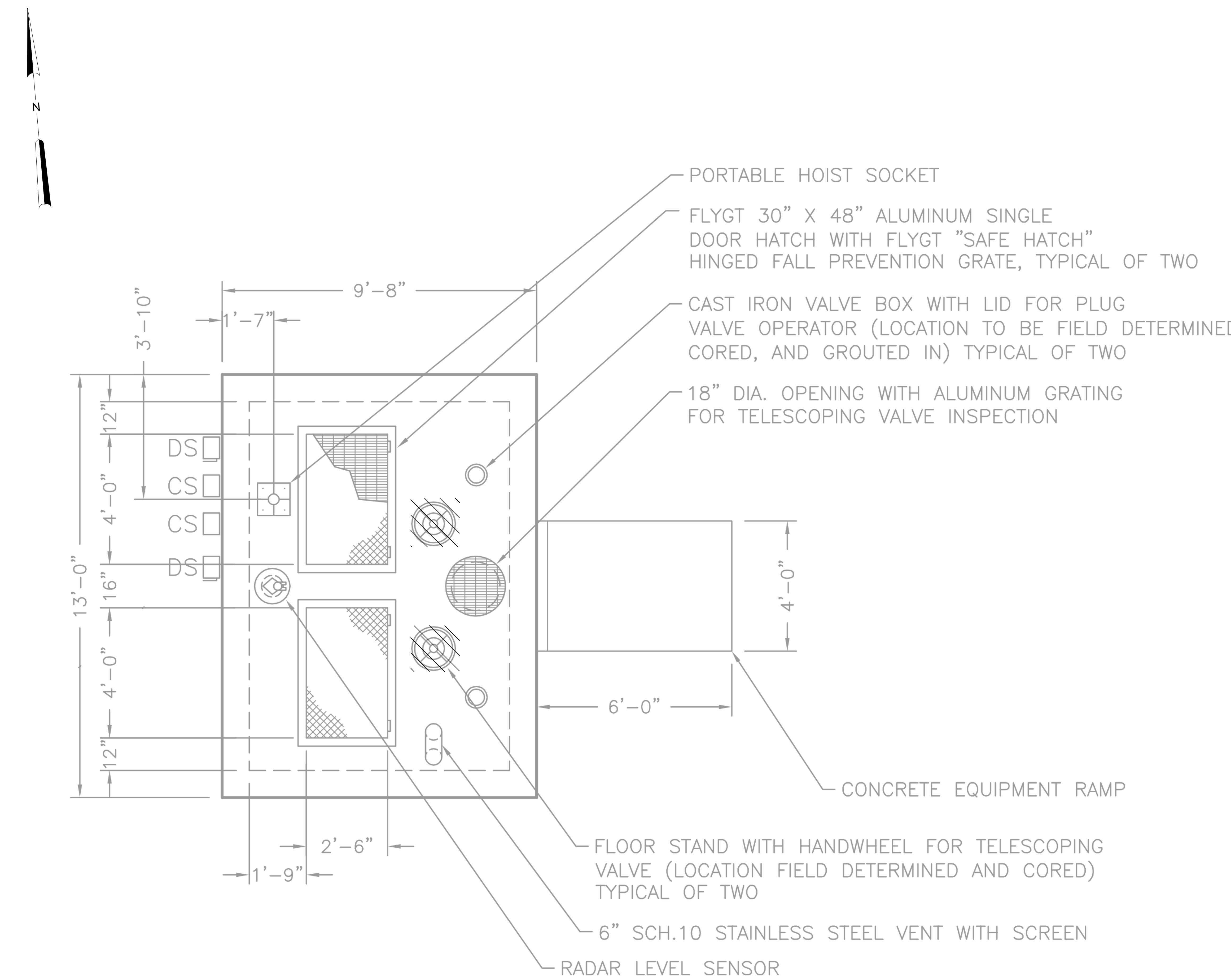


BOTTOM PLAN

3/8" = 1'-0"



TOP PLAN

3/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	S. PHIPPS
DRAWN BY:	P. VANGORDEN
CHECKED BY:	H&S
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

RAS PUMP STATION
MECHANICAL
DEMOLITION PLANS AND SECTIONS

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M400

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-400-RAS-M.rvt
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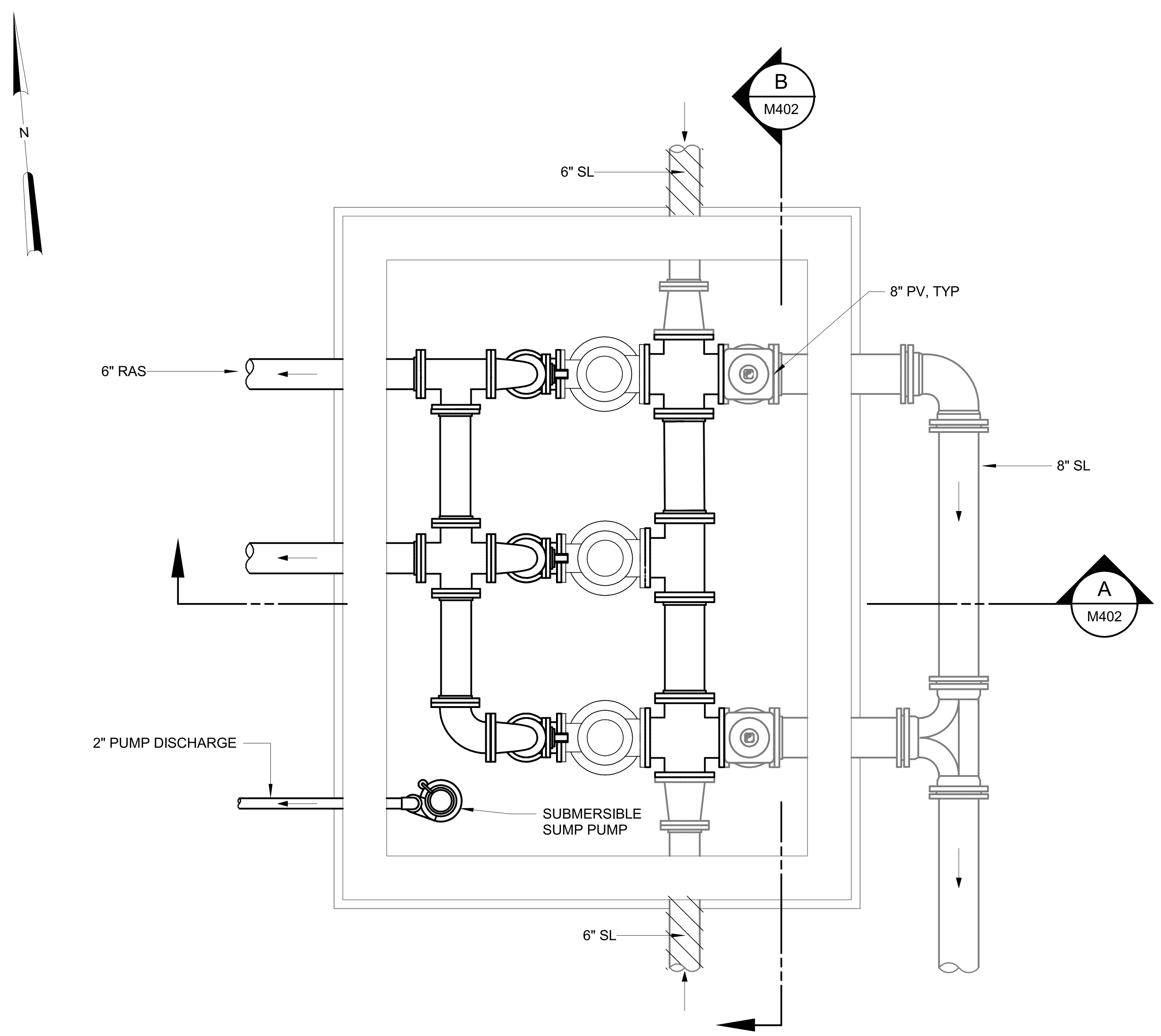
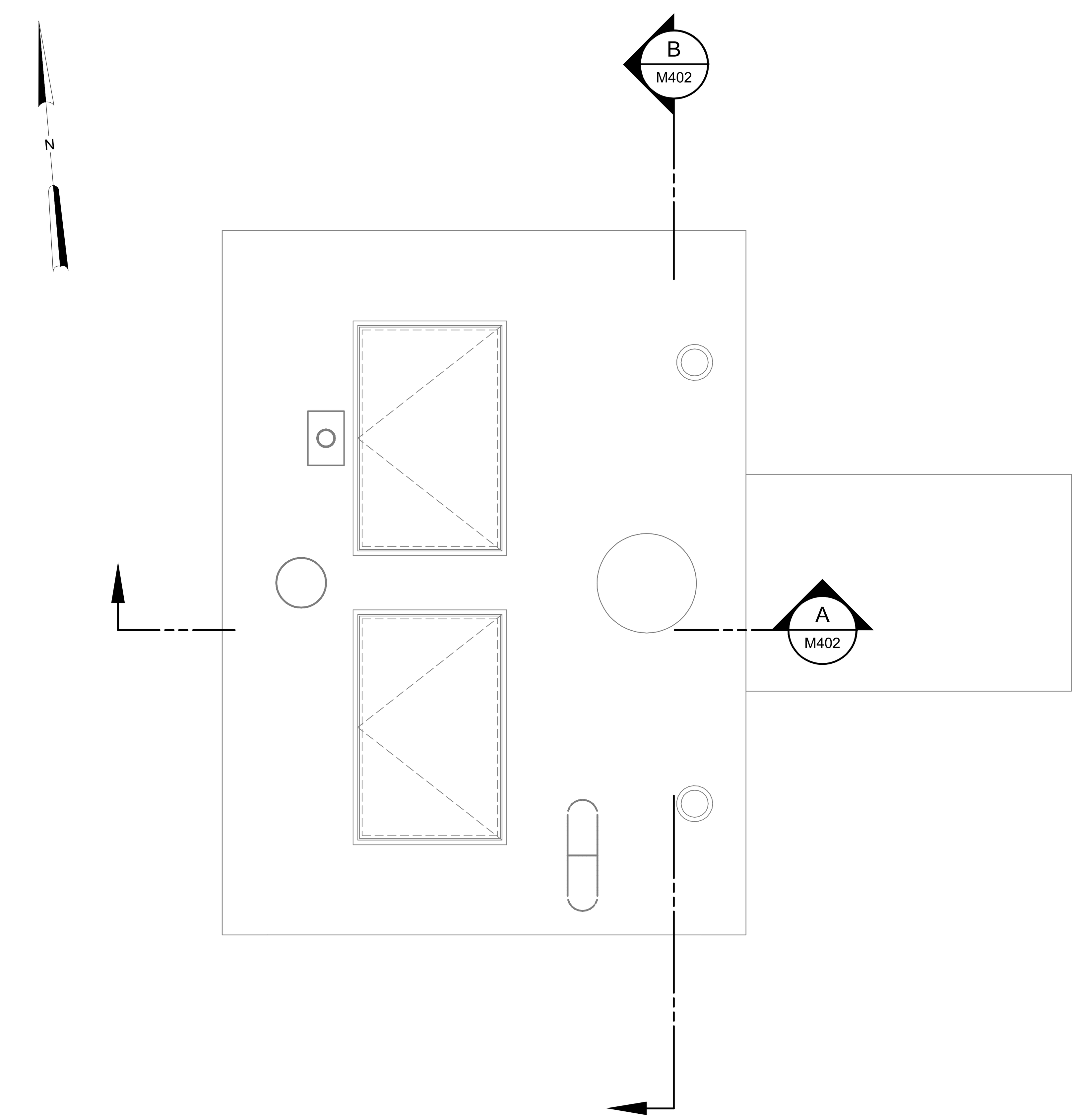


BOTTOM PLAN
1/2" = 1'-0"



TOP PLAN
1/2" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	S. PHIPPS
DESIGNED BY:	S. PHIPPS
DRAWN BY:	P. VANGORDEN
CHECKED BY:	Checker
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

30% DRAWING
DO NOT USE FOR
CONSTRUCTION

Hazen

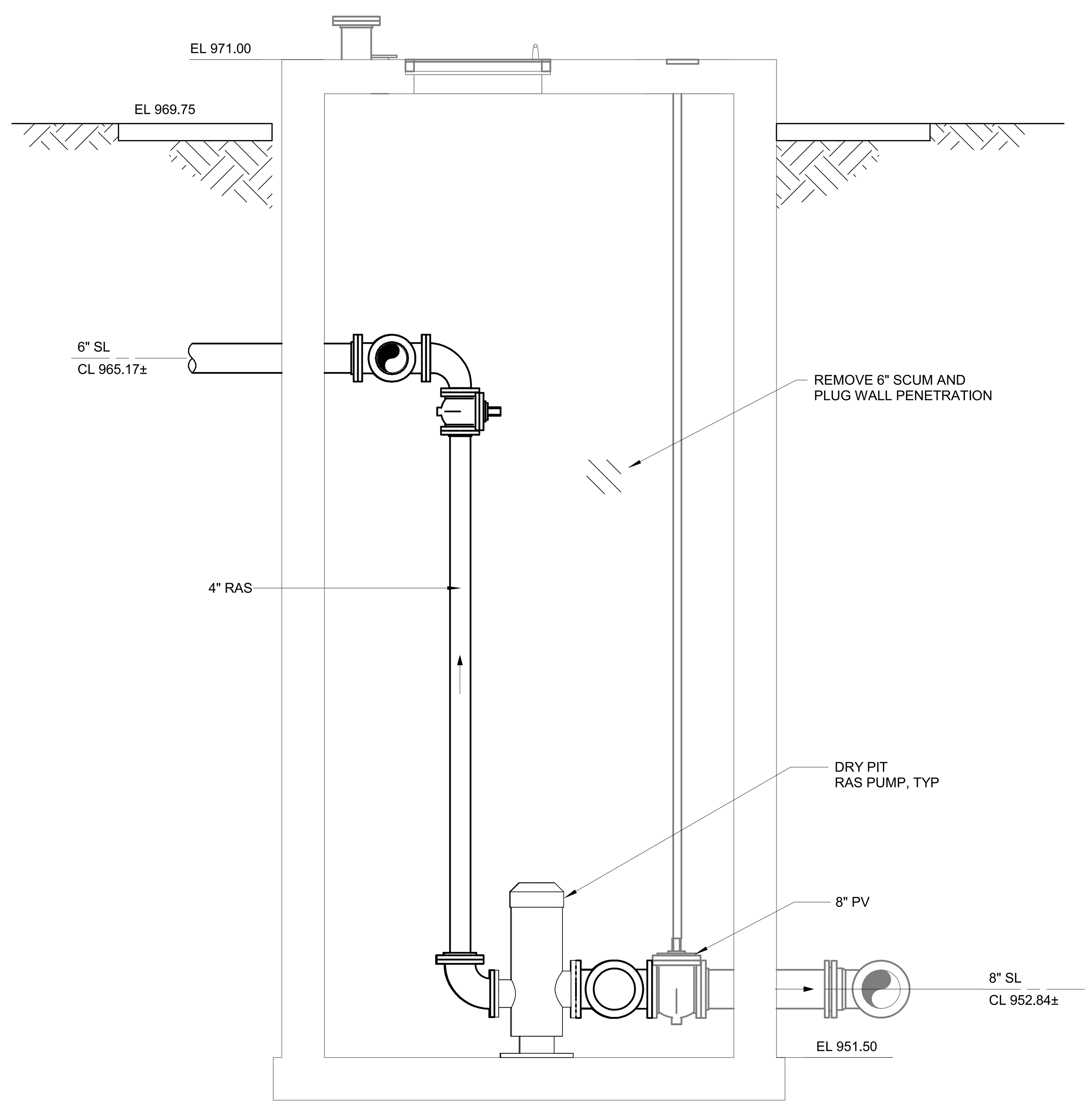
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

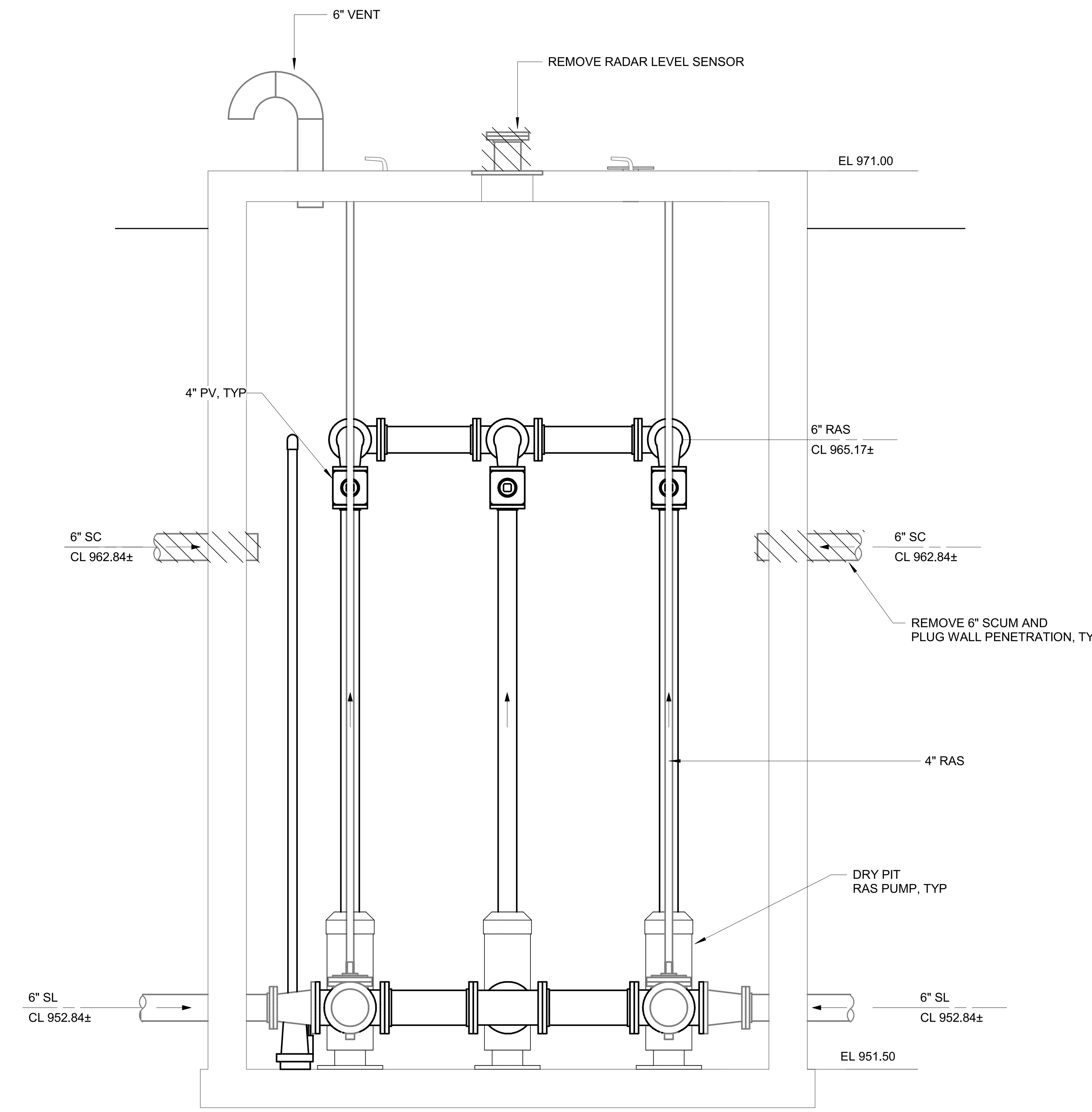
NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

RAS PUMP STATION
MECHANICAL
PLANS

DATE:	OCTOBER 2022
HAZEN NO.:	50098-010
CONTRACT NO.:	1
DRAWING NUMBER:	M401



SECTION A
1/2" = 1'-0" M401



SECTION B
1/2" = 1'-0" M401

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: S. PHIPPS
DRAWN BY: P. VANGORDEN
CHECKED BY: Checker
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR
CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

RAS PUMP STATION
MECHANICAL
SECTION AND DETAILS

DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: M402

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-400-RAS-M.rvt
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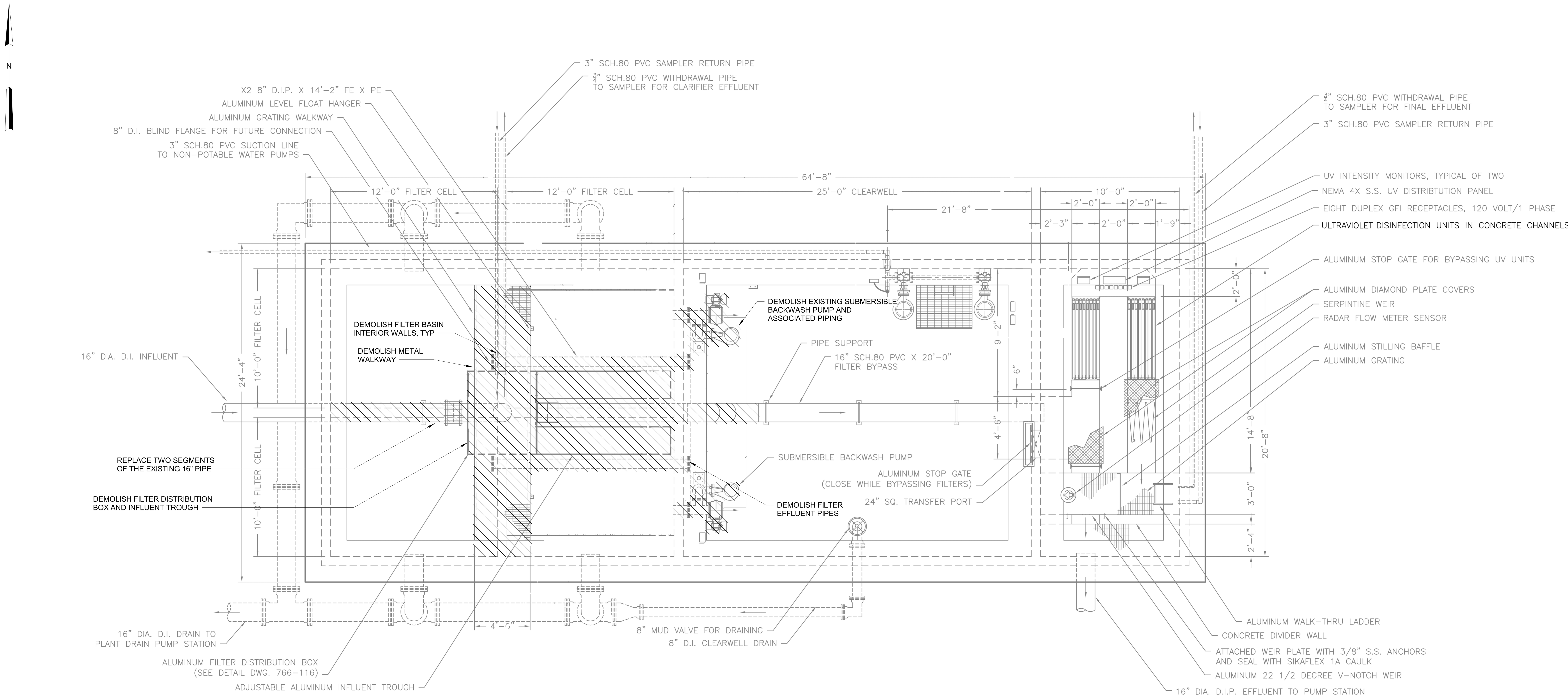


DEMOLITION PLAN

NOT TO SCALE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: A. GAO
DRAWN BY: P. VANGORDEN
CHECKED BY: P. MACCLELLAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

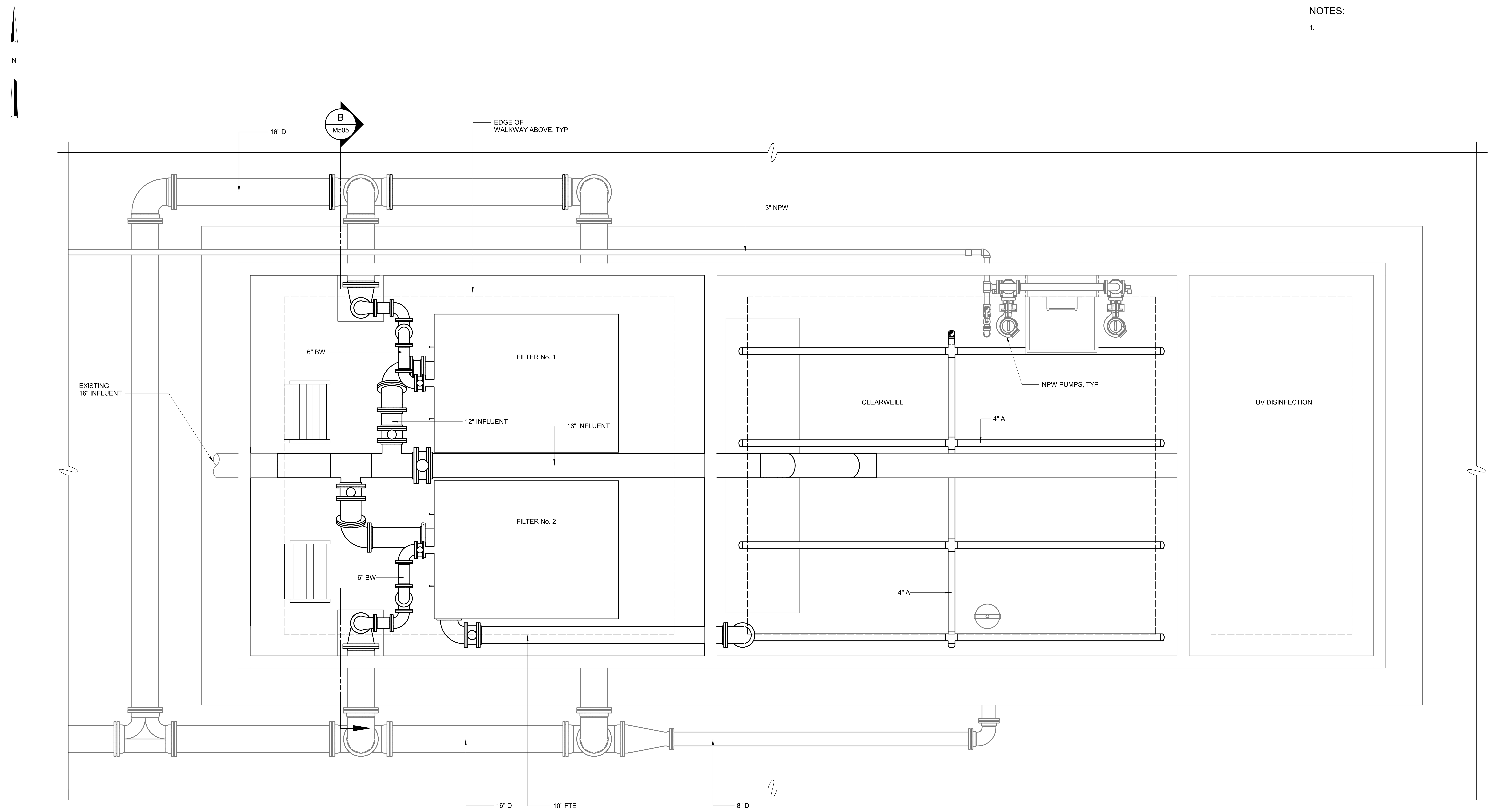
NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

FILTER BUILDING
MECHANICAL
DEMOLITION PLAN

DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: M501

NOTES:

1. --



BOTTOM PLAN

3/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS

DESIGNED BY: A. GAO

DRAWN BY: P. VANGORDEN

CHECKED BY: P. MACCLELLAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

30% DRAWING
DO NOT USE FOR
CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

FILTER BUILDING
MECHANICAL
BOTTOM PLAN

DATE: OCTOBER 2022

HAZEN NO.: 50098-010

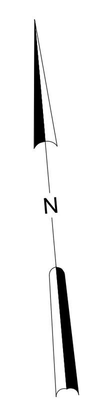
CONTRACT NO.: 1

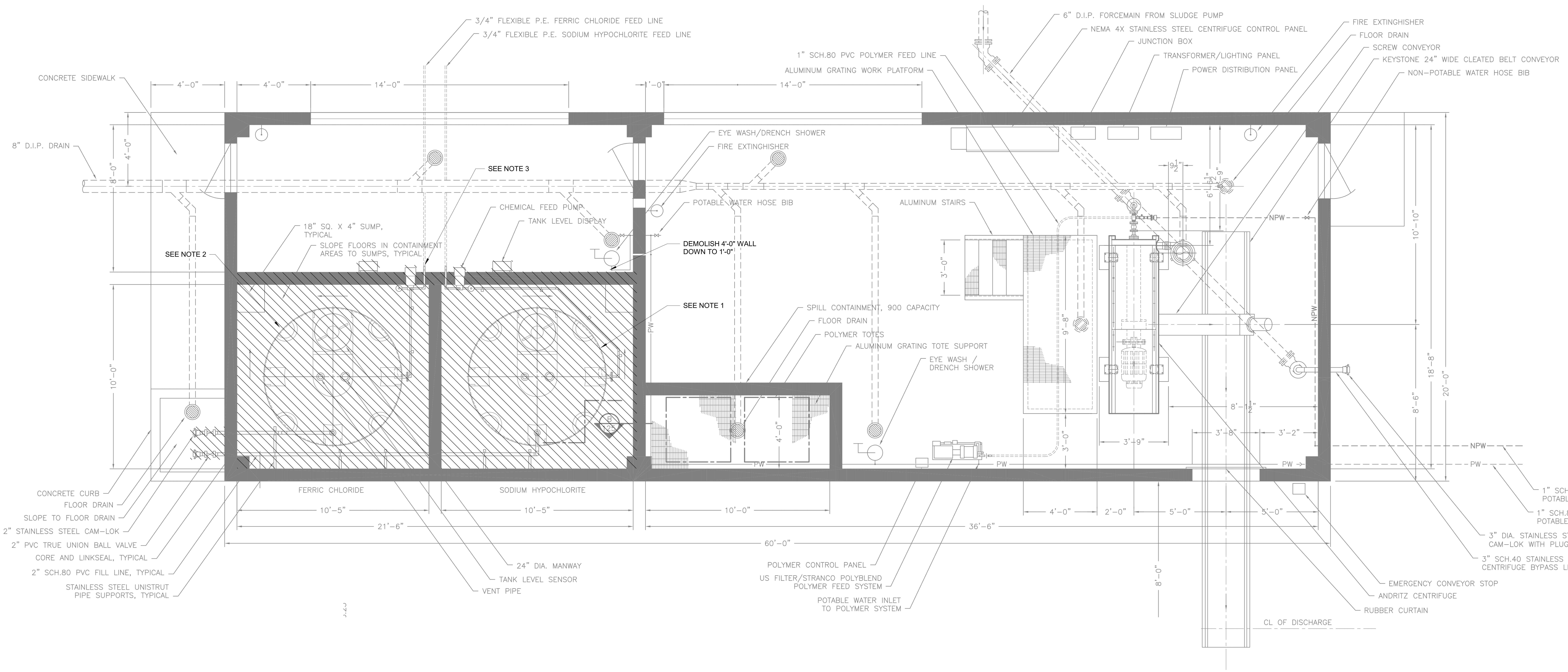
DRAWING NUMBER: M502

Autodesk Docs://50098-010_Northstar WRF Upgrades/50098-010-500-FLT-M.rvt
11/2/2022 2:58:38 PM

NOTES:

1. DEMOLISH EXISTING SODIUM HYPOCHLORITE BULK TANK, FEED PUMP, AND ANY INSTRUMENTATIONS ASSOCIATED WITH THE CHEMICAL SYSTEM AND EXPOSED PIPING.
2. DEMOLISH EXISTING FERRIC CHLORIDE BULK TANK, FEED PUMP, AND ANY INSTRUMENTATIONS ASSOCIATED WITH THE CHEMICAL SYSTEM AND EXPOSED PIPING.
3. NEW ALUM FEED PIPE CONNECT TO EXISTING FERRIC CHLORIDE PIPE.





DEMOLITION PLAN
3/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS
DESIGNED BY: Designer
DRAWN BY: Author
CHECKED BY: Checker
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

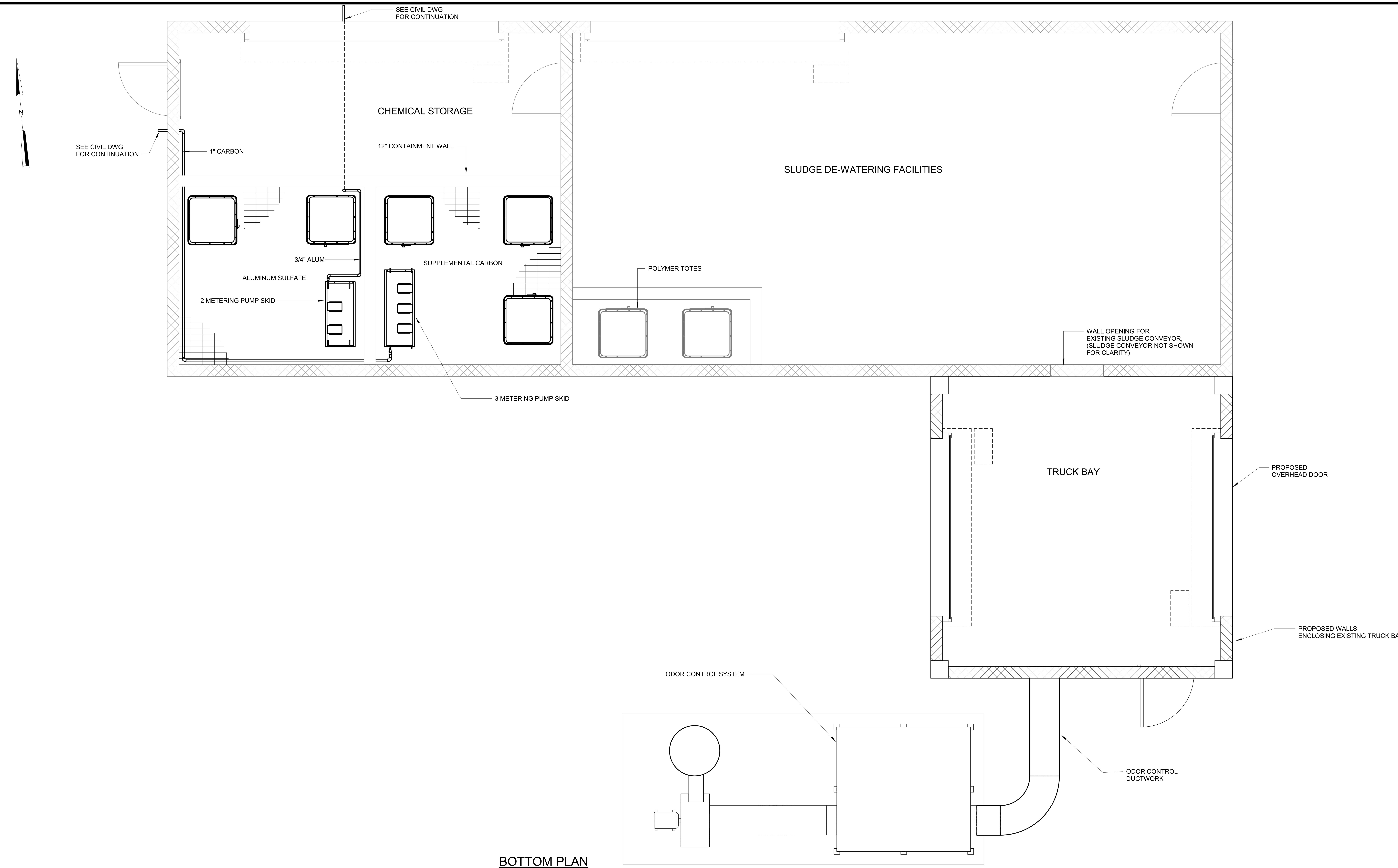
Hazen
HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

OVERALL DEMOLITION PLAN

DATE: OCTOBER 2022
HAZEN NO.: 50098-010
CONTRACT NO.: 1
DRAWING NUMBER: M900



BOTTOM PLAN

3/8" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: S. PHIPPS

DESIGNED BY: H&S

DRAWN BY: P. VANGORDEN

CHECKED BY: H&S

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

30% DRAWING
DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
150 E. CAMPUS VIEW BLVD, SUITE 200
COLUMBUS, OHIO 43235

DELAWARE COUNTY
REGIONAL SEWER DISTRICT

NORTHSTAR
WATER RECLAMATION FACILITY
UPGRADES

DEWATERING BUILDING
MECHANICAL
BOTTOM PLAN

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Appendix B: Project Manual Table of Contents

SECTION 00 01 10

TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 – GENERAL REQUIREMENTS

08-02-2022

DIVISION 02 – EXISTING CONDITIONS

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

Section	Title
04 01 20	Masonry and Stone Work Restoration and Cleaning
04 05 13	Mortar and Masonry Grout
04 05 23	Masonry Accessories
04 20 00	Unit Masonry

DIVISION 05 – METALS

Section	Title
05 05 13	Galvanizing
05 05 23	Metal Fastening
05 10 00	Metal Materials
05 12 00	Structural Steel
05 13 00	Stainless Steel
05 14 00	Structural Aluminum
05 50 00	Metal Fabrications
05 51 33	Ladders
05 52 00	Guards and Railings
05 53 00	Gratings, Checkered Floor Plates, and Access Doors
05 56 00	Castings
05 59 00	Bearing Devices and Anchoring

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

Section	Title
06 10 00	Rough Carpentry

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Section	Title
07 90 00	Joint Fillers, Sealants and Caulking

DIVISION 08 – OPENINGS

Section	Title
08 11 13	Steel Doors and Frames
08 33 23	Roll-up Doors
08 71 00	Finish Hardware
08 80 00	Glass and Glazing
08 90 00	Louvers and Dampers

DIVISION 09 – FINISHES

Section	Title
09 90 00	Painting
09 97 00	Special Coatings

DIVISION 12 – FURNISHINGS

Section	Title
12 20 00	Window Treatment

DIVISION 22 – PLUMBING

Section	Title
22 05 00	Common Results for Plumbing
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 16	Expansion Fittings and Loops for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 48	Vibration and Seismic Controls for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 08 00	Commissioning of Plumbing
22 11 13	Facility Water Distribution Piping
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties

22 13 23	Sanitary Waste Interceptors
22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

Section	Title
23 00 00	Basic HVAC Requirements
23 05 48	Vibration and Seismic Controls for HVAC
23 05 93	HVAC Testing, Adjusting, and Balancing
23 07 00	HVAC Insulation
23 08 00	Commissioning of HVAC System
23 09 00	HVAC Automatic Temperature Controls (Relay Logic)
23 09 13.33	Control Valves
23 31 13	Metal Ducts and Duct Accessories
23 31 16	Nonmetal Ducts and Duct Accessories
23 31 19	Fiberglass Reinforced Plastic Stacks and Accessories
23 34 00	HVAC Fans
23 34 23	HVAC Power Ventilators

DIVISION 26 – ELECTRICAL

Section	Title
26 05 00	Basic Electrical Requirements
26 05 13	Medium Voltage Cables
26 05 19	Low-Voltage Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 26.13	Impedance Grounding Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33.13	Conduit for Electrical Systems
26 05 33.16	Boxes for Electrical Systems
26 05 36	Cable Trays for Electrical Systems
26 05 43.13	Trench Duct Systems
26 05 53	Identification for Electrical Systems

26 05 60	Low-Voltage Electric Motors
26 05 61	Medium Voltage Electric Motors
26 09 16	Electric Controls and Relays
26 12 19	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers
26 13 13	Medium-Voltage Circuit Breaker Switchgear
26 13 16	Medium-Voltage Fuse Interrupter Switchgear
26 15 13	Medium-Voltage Busways
26 18 39	Medium-Voltage Motor Controllers
26 19 13	Medium Voltage Termination Cabinets
26 22 00	Low-Voltage Transformers
26 23 00	Low Voltage Switchgear
26 24 13	Low Voltage Switchboards
26 24 16	Panelboards
26 24 19	Low Voltage Motor Control Centers
26 25 13	Low-Voltage Busways
26 27 26	Wiring Devices
26 28 16.13	Enclosed Circuit Breakers
26 28 16.16	Enclosed Switches
26 29 13.13	Low-Voltage Enclosed Motor Controllers-Full Voltage
26 29 13.16	Low-Voltage Enclosed Motor Controllers-Reduced Voltage
26 29 23	Low Voltage Variable Frequency Motor Controllers
26 35 33.16	Low-Voltage Power Factor Correction Equipment
26 36 23	Automatic Transfer Switches
26 41 00	Facility Lightning Protection
26 43 13	Surge Protective Devices
26 50 00	Lighting

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section	**Title**
28 31 11	Intrusion Detection System

DIVISION 31 – EARTHWORK

Section	Title
31 00 01	Earthwork
31 05 16	Aggregate Materials
31 05 19	Geotextiles
31 10 00	Clearing, Grubbing, and Site Preparation
31 13 20	Wood for Streamwork
31 13 21	Invasive Plant Suppression
31 23 19	Dewatering
31 25 00	Erosion and Sedimentation Control
31 32 40	Geotextile for Streamwork
31 37 20	Stone for Streamwork
31 52 00	Stream Diversion and Cofferdams

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section	Title
32 01 92	Watering for Streamwork
32 10 00	Paving and Surfacing
32 11 00	Surface Restoration
32 31 13	Steel Fencing
32 90 00	Final Grading and Landscaping
32 90 22	Topsoil for Streamwork
32 91 24	Streamwork Plant Installation

DIVISION 33 – UTILITIES

Section	Title
33 05 61	Utility Structures
33 71 19	Underground Electrical

DIVISION 40 – PROCESS INTERCONNECTIONS

40 61 21.73	Final Acceptance Test
40 61 22	Tools, Supplies, and Spare Parts, General
40 61 23	Signal Coordination Requirements
40 61 24	Quality Assurance
40 61 26	Process Control System Training
40 61 90	Schedules and Control Descriptions, General
40 61 91	Process Control System Instrument List
40 61 93	Process Control System Input/Output List
40 61 96	Process Control Descriptions
40 63 43	Programmable Logic Controllers
40 66 00	Network and Communication Equipment
40 67 00	Control System Equipment Panels and Racks
40 67 23	Control System Consoles
40 67 63	Uninterruptible Power Systems
40 68 00.13	Process Control Software (Modify)
40 70 00	Instrumentation for Process Systems
40 71 13.13	Inline Magnetic Flow Meters
40 71 79.13	Flow Switches (Vane)
40 72 13	Ultrasonic Level Meters
40 72 23	Radar Level Meters
40 72 46	Bubbler Systems
40 72 46.13	Packaged Bubbler Systems
40 72 76.13	Multiple Point Level Switches
40 72 76.26	Level Switches (Floats)
40 72 76.39	Electrode/Conductance Level Switches
40 73 13	Pressure and Differential Pressure Gauges
40 73 20	Pressure Transmitters
40 73 29.13	Submersible Level (Pressure) Sensors
40 73 36	Pressure and Differential Pressure Switches
40 74 63	Temperature Transmitters
40 74 66	Temperature Switches

DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

DIVISION 44 – POLLUTION AND WASTE CONTROL MANAGEMENT

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT