FINAL

SAN ELIJO WATER RECLAMATION FACILITY SLUDGE DEWATERING FACILITIES UPGRADES

Preliminary Design Report

B&V PROJECT NO. 407556
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PREPARED FOR

San Elijo Joint Powers Authority

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Abbreviations and Acronyms

A list of abbreviations used in this PDR is presented below.

AC	Air Conditioning
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing and Materials
AWP	Advanced Water Purification
BAS	Building Automation System
BFP	Belt Filter Press
btuh	British Thermal Units Per Hour
BV	Black & Veatch
CBC	California Building Code
CEBC	California Existing Building Code
CEC	California Energy Code
CFC	California Fire Code
cfm	Cubic Feet Per Minute
CMC	California Mechanical Code
CMU	Concrete Masonry Unit
CPC	California Plumbing Code
cy	Cubic Yards
DAF	Dissolved Air Floatation
DAFT	Dissolved Air Floatation Thickener
EBRT	Empty Bed Residence Time
FEB	Flow Equalization Basins
FRP	Fiberglass Reinforced Plastic

GFCI	Ground Fault Circuit Interrupting
gpm	Gallons Per Minute
gal	Gallons
HVAC	Heating, Ventilation, and Air Conditioning
hrs	Hours
I&C	Instrumentation and Control
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEBC	International Existing Building Code
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
ISA	Instrument Society of America
lbs	Pounds
LCP	Local Control Panel
MCC	Motor Control Center
MERV	Minimum Efficiency Reporting Value
mgd	Million Gallons Per Day
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
ORF	Odor Reduction Facility
OSHA	Occupational Safety and Health Act
PDR	Preliminary Design Report
psi	Pounds Per Square Inch
S1	One second Period Spectral Acceleration
SDAPCD	San Diego Air Pollution Control District

SDG&E	San Diego Gas & Electric
SEJPA	San Elijo Joint Powers Authority
SEWRF	San Elijo Water Reclamation Facility
SMACNA	Sheet Metal and Air Conditioning Contractor National Association
Ss	Short Speed Spectral Acceleration
TS	Thickening Sludge
UL	Underwriters' Laboratories
VFD	Variable Frequency Drive
WK	Week

1.0 Introduction

1.1 Background and Report Purpose

The San Elijo Joint Powers Authority (SEJPA) owns and operates the San Elijo Water Reclamation Facility (SEWRF). The SEWRF was first put into service in 1966 with a capacity of 2 million gallons per day (mgd) of primary treatment. In 1981, the plant capacity was increased to 2.87 mgd, and increased again in 1992 to 5.25 mgd with the addition of secondary treatment facilities. The existing Sludge Dewatering Building which houses two belt filter presses (BFPs), a polymer room, an electrical room, an odor reduction facility, and dewatered cake conveyance equipment, feeds a truck loading facility, all of which were constructed in 1994. In 2000, the SEWRF was upgraded to include a 2.48 mgd tertiary treatment system for Title 22 recycled water treatment and distribution. In 2013, the 0.5 mgd Advanced Water Purification (AWP) facility was added for enhanced Title 22 treatment. The current average daily wastewater influent flow is approximately 2.7 mgd. A key map of the existing SEWRF is presented on Figure 1-1.

As an industry leader, SEJPA routinely challenges the organization to review optimization strategies that will enhance service reliability and efficiency.

In 2020, Black & Veatch (BV) completed a Project Definition Report for the solids handling facilities improvements at SEWRF to estimate current and future solids quantities, review and screen technology alternatives for needed improvements, and develop a business case analysis for future improvements.

The Project Definition Report provided recommendations for system upgrades that will enable SEJPA to achieve the following goals:

- Meet a level of service reliability consistent with Board and industry expectations,
- Meet current and anticipated future regulatory requirements,
- Enhance operational efficiency and reduce operations and maintenance costs.

The improvements to the existing dissolved air floatation (DAF) thickening, dewatering, polymer storage and feed facilities were identified to be most critical and recommended for immediate implementation (i.e. begin design within 1 year). As such, SEJPA retained Black & Veatch to provide engineering services for preliminary design of the dewatering, polymer storage and feed facilities upgrades.

The improvements to the DAF and its ancillary facilities will be completed by SEJPA as part of internally completed repair and replacement projects.

This Preliminary Design Report (PDR) provides a summary of the evaluations and studies performed to date, as well as an overview of the existing facilities, proposed improvements, design criteria, and estimated construction costs for the sludge dewatering facilities upgrades (Project). The primary purpose of this PDR is to establish the criteria that will be used as the basis of detailed design. The document is organized to provide context on the existing facilities, the current deficiencies, evaluations of alternatives where applicable, and the basis of design criteria that will serve as the basis for the Project.

1.2 Report Organization

This PDR is organized as follows:

Table 1-1 Report Organization

Section	Title	Description
1	Introduction	Provides a summary of the Project purpose, background, and report contents.
2	Existing Facilities and Proposed Improvements	Provides a summary of the existing facilities and proposed improvements, categorized by facility/process area.
3	Design Criteria	Provides a summary of discipline design criteria.
4	General Sequencing and Temporary Facilities	Provides a summary of preliminary construction sequencing and requirements for temporary facilities.
5	Opinion of Probable Construction Cost	Provides a summary of the estimated capital costs for the proposed facility upgrades.

2.0 Existing Facility Overview and Proposed Improvements

A series of workshops and meetings (participants included SEJPA and Black & Veatch staff) were held as part of the preliminary design effort to review the existing dewatering and associated facilities, discuss and refine the recommendations from the Project Definition Report, and evaluate alternatives where applicable, in order to determine the scope of proposed improvements. Agenda, minutes, and presentation materials from the workshops and meetings are included in Appendix A.

A brief overview of each facility or area being upgraded and the proposed improvements based on the outcome of the workshops are described in the following subsections.

Preliminary drawings of the proposed improvements are presented in Appendix B.

2.1 Dewatering Equipment

The two existing BFPs, 1.5-meter Winklepress 84 (2-belt unit), are near the end of their useful life, and a decision was made during the Project Definition phase to replace them with new dewatering equipment. Three dewatering technology options, (1) BFPs, (2) centrifuges, and (3) screw presses, were considered in the Project Definition Report, but SEJPA subsequently narrowed down to the BFP and centrifuge options based on projected performance, costs, track record in the municipal industry, and compatibility with existing facilities.

As part of the preliminary design effort, extensive analysis was performed to decide on the most appropriate dewatering technology for the SEWRF.

A preliminary life cycle cost analysis was performed for the BFP (both 2-belt and 3-belt systems) and centrifuge options to determine if there were any significant economic advantages between the two options. As summarized in Table 2-1, the life cycle costs were found to be relatively equal. Additional information on the life cycle cost analysis is included in Appendix C.

Table 2-1 Summary of Life-Cycle Cost Analysis

Technology Alternative	Manufacturer / Model	Capital Cost[1] ($)	Annual O&M Cost[2] ($)	Life Cycle Cost[2] ($)
BFP	BDP / 2VP (2 belt) 1.5 m	$2,545,000	$443,000	$8,066,000
	BDP / 3DP (3 belt) 1.0 m	$2,423,000	$444,000	$7,956,000
	BDP / 3DP (3 belt) 1.5 m	$2,696,000	$424,000	$7,980,000
Centrifuge	Centrisys / CS18	$2,660,000	$431,000 - $437,000	$8,031,000 - $8,106,000
	Centrisys / CS18	$2,807,000	$425,000 - $436,000	$8,103,000 - $8,241,000
	Alfa Laval / Aldec 75	$2,417,000	$427,000 - $432,000	$7,738,000 - $7,801,000

Notes:

1. Includes demolition of the existing BFPs, installation of new dewatering equipment (total of 2 units), access platform with a monorail assembly (for the centrifuge options only), sludge feed pumps, polymer feeder blenders, receiving screw conveyors, and associated electrical and I&C improvements. See Appendix A for additional information. Costs of downstream equipment (main screw conveyor, live bottom bin, and truck scale), piping, or architectural improvements not included (same costs for all dewatering equipment alternatives). Only includes structural costs related to dewatering equipment installation (i.e. concrete pedestals and washwater curb). Other structural costs related to building

improvements (i.e. demolition of the mezzanine level, rehabilitation of steel components, door framing modifications, etc.) not included.

2. The lower and upper range represents the estimated cost for 1.5% TS feed and 2.0% TS feed conditions, respectively. The variability in feed concentrations primarily affected the operation period for centrifuges due to hydraulic loading limitations. BFP loadings were controlled by solids load limits.

Since the life cycle costs were similar between the two options, other, noneconomic criteria was used to make a sound selection. As shown in Table 2-2, the majority of the categories listed are better or far better for the centrifuge than the BFP. There is only one category that is worse for the centrifuge than the BFP, and that is related to the cost for electrical upgrades, which does not substantially change the overall first cost.

Table 2-2 Dewatering Technology Alternative Analysis Summary

Category	BFP		Centrifuge	
First Cost	About Equal	🟡	About Equal	🟡
Life Cycle Costs	About Equal	🟡	About Equal	🟡
Building Environment	Improved with turtle shell enclosure, but still harsh	🟡	Significantly improved	🟢
Wash water Requirements	High, about the same as existing	🟡	Much less than BFP	🟢
Odor Control Provisions	Similar to existing	🔴	Much improved	🟢
Future Flexibility	Limited	🔴	Significant improvement	🟢
Electrical Upgrades	Limited	🟢	More (~$15K) than BFP	🟡
Operator Time Requirements	Significant	🔴	Limited	🟡

Legend: 🔴 = worse 🟡 = the same 🟢 = better

Based on the outcome of the economic and non-economic analyses, SEJPA decided to proceed with the centrifuge option for the dewatering equipment. Two centrifuge units will be installed, and each unit will be provided with an elevated operating platform to allow for installation of an inclined screw conveyor below the cake discharge chute, as further described in Section 2.3. Foul air from each centrifuge unit will be routed to the existing Odor Reduction Facility (ORF) No. 2. Each unit will also be equipped with a monorail system for removal of the rotating assembly for maintenance and repair. A new double door will be installed directly in front of each centrifuge unit to facilitate equipment removal and maintenance access, as described in Section 2.7.

Preliminary plan and sections of the proposed centrifuges are shown on Drawings M-001 and M-002. While Centrisys Model 21-4 units are shown on the preliminary drawings, other manufacturers/models are also considered and will be included in the specifications during detailed design. Equipment dimensions vary amongst different models of centrifuges, but general configuration will be similar.

Design criteria for the centrifuges are presented in Section 3.1.1.

2.2 Dewatering Feed Pumps

There are three existing dewatering feed pumps located adjacent to the digesters. At the time of the condition assessment performed by BV in 2017, all three pumps were the original pumps installed in

1994, and the overall condition of the pumps was found to be good. The original pumps were equipped with Reeves adjustable speed drives. During the assessment, discussions with plant Operations indicated that the operation of the drives was no longer reliable and that the pumps were operated at a single speed as a result. Subsequently, one of the three pumps was replaced with a new pump with a VFD. Based on review of the pump curve for the newly installed pump, the rated flow and total dynamic head of the pump is 160 gpm at 60 psi.

Based on the range of hydraulic loading rates proposed for the centrifuges (See Tables 3-2 and 3-3 in Section 3.1.1), the required pumping capacity to feed the centrifuges is anticipated to be within the operating range of the newly installed pump. The other two pumps will be replaced by SEJPA prior to construction of this Project.

2.3 Screw Conveyor

The existing shaftless screw conveyor that conveys dewatered sludge cake from the BFPs to the existing hopper was installed in 2015. Although the conveyor is fairly new, there has been multiple failure incidents, as some components were not appropriately sized. As such, the existing screw conveyor will be replaced with a new shaftless conveyor as part of this Project.

In addition to the main screw conveyor that runs in the east-west direction from the Sludge Dewatering Building to the Truck Loading Area (Main Screw Conveyor), two Inclined Screw Conveyors and a Distribution Screw Conveyor will also be installed to convey dewatered sludge cake from the centrifuges to the Main Screw Conveyor, as shown in Drawings M-001 through M-003.

The Intermediate Screw Conveyor and the Main Screw Conveyor were identified as the single points of failure. The following potential risk mitigation measures have been discussed at the workshops and will be further considered by SEJPA during the detailed design phase.

- For the Intermediate Screw Conveyor, provide spare parts, (see below).
- For the Main Screw Conveyor, provide spare parts and/or install a redundant screw conveyor that conveys dewatered sludge cake to an area outside of the building to facilitate hauling of cake off-site (Standby Screw Conveyor, as shown on Drawings M-001 through M-003).

Recommended spare parts include:

- Screw flight
- Drive shaft and coupling plate
- Packing gland sets
- Trough liner

Design criteria for the screw conveyors are presented in Section 3.1.2.

2.4 Sludge Hopper / Bin

The existing two-cell sludge hopper is supported by a steel truck loading structure. The existing structure is in good shape, with minor areas of corrosion where the coatings have been worn. Significant corrosion (quarter-size holes penetrating through the steel wall) has been observed on the hopper, especially near the vibrating equipment. Due to the geometry of the hopper (i.e. all four sides are sloped), the two existing chutes with knife gates are located next to each other, which limits the ability to distribute sludge along the truck bed without moving the truck.

To address this limitation, a new live bottom bin, equipped with a screw conveyor at the bottom of the bin, will be installed. Two cake discharge chutes (each provided with a knife gate) will be located approximately 10 feet apart to improve distribution of sludge across the truck bed. The existing truck loading structure will be reused to the extent practical with modifications required to support the new bin.

Preliminary plan and sections of the proposed live bottom bin are shown on Drawings M-003 and M-004.

Design criteria for the live bottom bin are presented in Section 3.1.3.

2.5 Truck Scale

The existing truck scale is a portable-type, low-profile, axle scale (one for left wheels, one for right wheels, approximately 10 feet long), which is mounted on top of the concrete slab, near the north end of the truck loading area. Only the rear or front wheels of the trailer can be on the scale at a time, and it is challenging to accurately measure the weight of the sludge on the trailer. The current configuration does not allow for continuously monitoring of the weight while the truck position changes to distribute the sludge along the truck bed.

A longer above-grade truck scale that can accommodate the entire truck, while the trailer position is adjusted during sludge loading, is proposed to be installed to allow for continuous weight monitoring. The existing concrete slab will need to be extended to accommodate the longer scale and the approach ramps. The existing area washdown and associated trench drain system will need to be modified to accommodate the new scale.

Preliminary plan and sections of the proposed truck scale are shown on Drawings M-003 and M-004.

Design criteria for the truck scale is presented in Section 3.1.4.

2.6 Polymer Storage and Feed

The existing polymer storage area is located outdoor on the west side of the Sludge Dewatering Building. Polymer is delivered as an emulsion and the totes are swapped out when the operation unit is empty. The secondary containment was originally designed for a bulk tank and was not intended for a tote system. The original containment wall was partially cut out to accommodate forklift access, but the forklift approach area is sloped and unsafe to park, while loading or unloading the tote.

Currently, thickening and dewatering processes utilize the same type of polymer. SEJPA may consider use of two different types of polymer for thickening and dewatering to optimize performance. However, the existing containment area is not large enough to accommodate more than one tote.

The existing polymer feed equipment (for both thickening and dewatering), which is a mix of old and new equipment with minimal control, is located in the Polymer Feed Room with no secondary containment.

In order to provide safe forklift access for tote replacement, consolidate containment of the storage and feed equipment, and to provide flexibility to add a second tote in the future, a new slab-on-grade polymer storage and feed area will be constructed with the following features:

- Polymer totes (2 total or reserve space for a second tote),
- PLC based feeder blenders (2 for thickening, 2 for dewatering)
- Portable mixer with a wall mounted hanger
- Emergency eyewash and shower
- Concrete slab to be sloped away from the building and sloped down towards containment trenches along the western and southern edges
- Metal canopy for sunshade and partial weather protection

Preliminary plan and sections of the proposed Polymer Storage and Feed Facility are shown on Drawings M-003 and M-004.

Design criteria for the proposed Polymer Storage and Feed Facility are presented in Section 3.1.4.

2.7 Sludge Dewatering Building Structural and Architectural Components

The existing BFP room has a mezzanine level for access to the gravity table portion of the BFPs. With replacement of the BFPs with centrifuges, the mezzanine level and associated stairs and handrails will no longer be required and will need to be demolished.

The existing concrete pedestals and washwater curbs associated with the BFPs will be demolished, and equipment supports for the centrifuges, associated operating platforms, monorail system, and screw conveyors will be provided.

As described in Section 2.1, a new double door will be installed directly in front of each centrifuge unit on the south wall to facilitate equipment removal and maintenance access. A forklift (the existing one that SEJPA owns or similar) or a similar-size utility vehicle will be utilized to transport the rotating assembly and other components in and out of the building for routine maintenance. Based on review of the dimensions of the forklift currently utilized on-site, 6’-0” wide x 8’-10” height double doors (6’-4” wide x 9’-0” height opening) will be large enough to accommodate the forklift/vehicle, while minimizing structural impacts. As discussed at the workshops and illustrated on Drawing M-002, the rotating assembly will be pulled out of the centrifuge unit and transported to the area directly in front of the door with use of the monorail system. As such, the cabin of the forklift could remain outside, while the rotating assembly is loaded onto the forklift attachment. The existing double door will be removed, and the opening will be filled with reinforced CMU. The proposed door modifications on the south wall are illustrated on Drawing S-001.

Other structural and architectural improvements that are proposed to support the upgrades to the dewatering facilities are further described in Sections 3.3 and 3.4.

2.8 Foul Air Collection and Control

The existing Odor Reduction Facility No. 2 (ORF No. 2) currently draws foul air from the Sludge Dewatering Building, DAF thickeners, and the flow equalization basins (FEBs). While the airflow contribution from each source should be verified during detailed design, Table 2-3 provides a summary of the assumed exhaust rate from each source.

Table 2-3 Exhaust Rate Per Source

Source	Exhaust Rate (cfm)[1,2]
Sludge Dewatering Building	7,100
DAF Thickeners	300[3]
FEBs	600 (300 each)
FEB Diversion Structure	200
TOTAL	**8,200**

Notes:

1. Existing capacity of fans and flow balancing to be verified upon testing to be performed by SEJPA.
2. Source of information is July 1999 as-built drawing.
3. DAF thickeners operate as duty/standby with 300 cfm per unit.

The odor control system, shown in Figure 2-1, is comprised of a primary foul air fan, two booster fans, and a packed tower scrubber with recirculation pumps. The chemical facilities associated with the scrubber are no longer operational; rather the system operates with non-potable water supply with the sump solution recirculated through the spray nozzles at the top of the scrubber. While some components of the system have aged and show signs of corrosion, the system operates as intended and allows SEJPA to meet their permit limit of 1 part per million of hydrogen sulfide (H_2S) in the exhaust. Thus, no changes are proposed for the odor control system equipment and modifications are limited to new ductwork and foul air duct connections from the new centrifuges to the existing odor control system, as shown on Drawings M-001 and M-002.

3.0 Design Criteria

3.1 Process Mechanical Design Criteria

3.1.1 Dewatering Equipment

As described in Section 2.1, two new centrifuge units will be installed. Based on the design loading rates and target operating conditions, as summarized in Table 3-1, recommendations on equipment models were provided by two equipment manufacturers (Centrisys and Alfa-Laval). The preliminary selection of centrifuge models and the projected operating conditions for 1.5% TS feed and 2.0% TS feed are summarized in Table 3-2 and 3-3, respectively.

It should be noted that additional manufactures and models will be considered and further evaluated for inclusion in the specifications during detailed design.

Table 3-1 Design Loading Rates, Target Operating Conditions, and System Throughput

Parameters	Value	Units
Maximum Month Digested Sludge Solids[1]	6,580	lbs/day, dry solids
Maximum Month Digested Sludge Flow[1]	52,600 @ 1.5% TS, 39,600 @ 2.0% TS	gpd
Target Operating Conditions	5 days/wk, 7 hrs/day	-
Target System Solids Throughput	1,316	lbs/hr, dry solids
Target System Hydraulic Throughput	175 @ 1.5% TS, 132 @ 2.0% TS	gpm

Notes:
1. Calculated based on the solids production data from 2016 (4,770 lbs/day of digested sludge produced based on the annual average influent flow of 2.34 mgd), the design annual influent flow rate of 3.0 mgd, and the maximum month to annual average ratio of 1.1. Although the rated plant capacity of SEWRF is 5.25 mgd, the influent flow rate is not anticipated to exceed 3.0 mgd in the foreseeable future.

Table 3-2 Projected Operating Conditions – 1.5% TS

MFR / Model	MFR Maximum Rated Capacity Per Unit1	Design Throughput Per Unit2	Operating Days/Week Hours/Day3		No. Of Units Operating	% Cake Solids	Polymer Use (Active lbs/Ton)	Washwater Use (Gal/Week)
Centrisys CS18	751 lbs/hr	563 lbs/hr	5	9	2	~22-24	15-30	30,000
	100 gpm	75 gpm	7	12	1			
Centrisys CS21	1,314 lbs/hr	985 lbs/hr	5	5	2	~22-24	15-30	52,500
	175 gpm	131 gpm	6	8	1			
Alfa Laval Aldec 75	976 lbs/hr	732 lbs/hr	5	7	2	~22-24	15-30	39,000
	130 gpm	98 gpm	7	9	1			

Table 3-3 Projected Operating Conditions – 2.0% TS

MFR / Model	MFR Maximum Rated Capacity Per Unit1	Design Throughput Per Unit2	Operating Days/Week Hours/Day3		No. OF Units Operating	% Cake Solids	Polymer Use (Active lbs/Ton)	Washwater Use (Gal/Week)
Centrisys CS18	1,001 lbs/hr	751 lbs/hr	5	7	2	~22-24	15-30	30,000
	100 gpm	75 gpm	7	9	1			
Centrisys CS21	1,751 lbs/hr	1,314 lbs/hr	5	4	2	~22-24	15-30	52,500
	175 gpm	131 gpm	5	8	1			
Alfa Laval Aldec 75	1,301 lbs/hr	976 lbs/hr	5	5	2	~22-24	15-30	39,000
	130 gpm	98 gpm	6	8	1			

Notes (applicable to both Table 3-1 and 3-2):

1. The maximum rated capacity per unit based on the information provided by the manufacturer. This value is not intended to be a design loading rate.
2. The basis of design capacity assumption and the recommended design throughput for centrifuges to optimize performance are 75% of the manufacturer's rated capacity based on BV's experience to optimize performance (all are hydraulically limited @ 1.5% to 2.0% TS).
3. Green values denote that the target operating condition (5 days per week, 7 hours per day) being met. Target operating conditions were developed with SEJPA staff.

3.1.2 Screw Conveyors

As described in Section 2.3, the conveyor system utilizes a series of screw conveyors for directing sludge cake from the centrifuges to the dewatered cake storage bin.

The following provides a description of each of the conveyors in the system.

- Inclined Conveyors – One inclined conveyor will be provided on the discharge of each centrifuge unit to either direct start-up slop from the centrifuge to the centrate system or to direct dewatered sludge cake to the Intermediate Conveyor. Upon start-up of the centrifuge, and prior to the centrifuge making seal where the sludge cake is produced through the unit at acceptable cake dryness, the centrifuge will produce a sloppy sludge/water mix. The inclined conveyor is initially operated in reverse to direct this slop to the centrate line, and when the centrifuge starts to create sludge cake, the conveyor is run in the forward direction to direct the sludge cake to the Intermediate Conveyor.
- Intermediate Conveyor – One horizontal Intermediate Conveyor, would be provided to collect dewatered sludge cake from both inclined conveyors and convey it to the Main Conveyor during normal operation. The distribution shall also convey to the Standby Conveyor if implemented when the truck loadout facility is not operational.
- Main Conveyor – One main inclined conveyor will transfer the cake to the truck loading bin. The conveyor will have one discharge point in the center of the truck loading bin.

- Standby Conveyor – One standby inclined conveyor will transfer the cake from the Intermediate Conveyor to the cake hauling station located outside the building on grade when the Main Conveyor and/or the truck loading facilities are out of service.

Table 3-4 summarizes the various screw conveyor design criteria.

Table 3-4 Screw Conveyor Criteria

Parameter	Value
Inclined Conveyors	
Drive Unit, hp	2
Number of units	2
Incline, degrees	25
Screw diameter, inch	12
Approximant length, feet	12
Intermediate Conveyor	
Drive Unit, hp	2
Number of units	1
Incline, degrees	0
Screw diameter, inch	12
Approximant length, feet	11
Main Conveyor	
Drive Unit, hp	3
Number of units	1
Incline, degrees	22
Screw diameter, inch	14
Approximate length, feet	67
Standby Screw Conveyor	
Drive Unit, hp	2
Number of units	1
Incline, degrees	7
Screw diameter, inch	14
Approximant length, feet	42

3.1.3 Sludge Hopper / Bin

As described in Section 2.4, the existing structure for the truck loading will be reused to support the new live bottom bin. The new bin will have a similar capacity to the existing bin of approximately 16 cubic yards (cy). The truck loading bin will have 2 sides sloped at 30 degrees from vertical to a shaftless screw. The screw will feed two discharge chutes, one at each end. This will minimize the number of times the truck needs to be relocated during filling.

3.1.4 Truck Scale

A new truck scale to accommodate the full trailer length and its movement will be installed, as described in Section 2.5.

Design criteria for the truck scale are summarized in Table 3-5.

Table 3-5 Truck Scale Design Criteria

Parameters	Value
Scale Length x Width	80 feet x 10 feet
Scale Height	16 inches (total height with load cells and steel deck)
Capacity	90,000 lbs

3.1.5 Polymer Storage and Feed

3.1.5.1 Dewatering Polymer Feed System

As described in Section 2.6, a new dewatering polymer feed system will be provided as part of this Project. The new system will be located outdoors under a canopy adjacent to the western wall of the Sludge Dewatering Building. The system will consist of a polymer tote, polymer feeder/blender units, and dilution water. This system will feed 0.25% to 0.5% polymer to each centrifuge. Neat polymer will be delivered in totes and stored in the Polymer Storage and Feed Facility. Two polymer feeder/blender units will be provided, one for each of the new centrifuges. The polymer will be delivered to the dewatering units without aging to meet minimum and peak flow conditions. Table 3-6 presents a summary of the design criteria.

Table 3-6 Dewatering Polymer Feed System

Description	Value
Chemical	Polymer
Delivered Chemical	Emulsion Polymer
Concentration	35% active polymer
Specific Gravity	1.02
Fed Chemical	Polymer
Concentration	0.5%

Description	Value
Specific Gravity	1
Feed Points	Centrifuge No. 1 Centrifuge No. 2
Dewatering Equipment - Centrifuge	
Capacity, pph	1,314
Polymer Dose, lbs/dry ton	15 to 30
Chemical Dosage as 100% polymer	
Minimum, lbs/dry ton	15
Average, lbs/dry ton	N/A
Maximum, lbs/dry ton	30
Sludge Flow	
Minimum, dry ton/hr	N/A
Average, dry ton/hr	N/A
Maximum, dry ton/hr	0.66
Chemical Feed Flow as 35% active polymer	
Minimum, gph	3.3
Average, gph	N/A
Maximum, gph	6.7
Feeder/Blender Equipment	
Quantity	2 (2-duty)
Neat Polymer Pump	
Pump Type	Progressive Cavity
Pump Quantity	2 (1 per feeder/blender unit)
Pump Capacity Range, gph per pump[1, 2]	0.67 to 6.7
Turndown Ratio, per pump	10:1
Pump Control	Automatic and manual start/stop. Automatic and manual speed control with local override.
Primary Dilution Water Capacity, gpm	45
Secondary Dilution Water Capacity, gpm[3]	45

Description	Value
Piping and Valves	
Pipe Material	PVC
Valve Type	Ball

Notes:
1. Designed for one Centrifuge unit running at full design throughput capacity.
2. Minimum pump flow is based on pump turndown.
3. Secondary dilution provided to dilute polymer solution to 0.25%.

3.1.5.2 Thickening Polymer Feed System

A new thickening polymer feed system will also be provided as part of this Project and will be located adjacent to the dewatering polymer feed system. The system will consist of a polymer tote, polymer feeder/blenders units, and dilution water. This system will feed 0.25% to 0.5% polymer to each existing DAF unit. Neat polymer will be delivered in totes and stored in the Polymer Storage and Feed Facility. Two polymer feeder/blender units will be provided, one for each of the existing DAF units. The polymer will be delivered to the thickening units without aging to meet minimum and peak flow conditions. Table 3-7 presents a summary of the design criteria.

Table 3-7 Thickening Polymer Feed System

Description	Value
Chemical	Polymer
Delivered Chemical	Emulsion Polymer
Concentration	35% active polymer
Specific Gravity	1.02
Fed Chemical	Polymer
Concentration	0.5%
Specific Gravity	1
Feed Points	DAF No. 1 DAF No. 2
Thickening Equipment - DAF	
Capacity, ppd	4,400
Polymer Dose, lbs/dry ton	5 to 7
Chemical Dosage as 100% polymer	
Minimum, lbs/dry ton	5
Average, lbs/dry ton	N/A
Maximum, lbs/dry ton	7

Description	Value
Sludge Feed	
Minimum, dry ton/hr	N/A
Average, dry ton/hr	N/A
Maximum, dry ton/hr	0.092
Chemical Feed Flow as 35% active polymer	
Minimum, gph	0.16
Average, gph	N/A
Maximum, gph	0.22
Feeder/Blender Equipment	
Quantity	2 (2-duty)
Neat Polymer Pump	
Pump Type	Progressive Cavity
Pump Quantity	2 (1 per feeder/blender unit)
Pump Capacity Range, gph per pump[1, 2]	0.02 to 0.22
Turndown Ratio, per pump	10:1
Pump Control	Automatic and manual start/stop. Automatic and manual speed control with local override.
Primary Dilution Water Capacity, gpm	7.3
Secondary Dilution Water Capacity, gpm[3]	7.3
Piping and Valves	
Pipe Material	PVC
Valve Type	Ball

Notes:

1. Designed for one DAF unit running at full capacity.
2. Minimum pump flow is based on pump turndown.
3. Secondary dilution provided to dilute polymer solution to 0.25%.

3.1.6 Foul Air Collection and Control

With the presumption that the existing odor control system would continue to be utilized, multiple dewatering equipment containment and ventilation strategies were assessed and presented in the Odor Control Workshop in March 2021. Based on workshop discussions, centrifuges were selected for dewatering, with both centrifuge and Sludge Dewatering Building exhausts directed to the existing odor control system, ORF No. 2. Additional information on the assessment can be found in the workshop materials included in Appendix A.

New fiberglass reinforced plastic (FRP) ductwork will be provided to draw foul air from both the solids chute and liquid chute of each centrifuge. The ducts will then combine to a single line that is then conveyed to the existing odor control system via a new connection to the existing ductwork. It is anticipated that a single penetration through the Sludge Dewatering Building CMU wall will be required.

The anticipated airflow contribution from each centrifuge is approximately 70 cubic feet per minute (cfm), for a total addition of 140 cfm to the system. ORF No. 2 will continue to draw air from the existing sources and the minor airflow contribution from the centrifuges will provide a negligible offset to the exhaust volume for the Sludge Dewatering Building. Furthermore, the building air will provide the benefit of dilution to the more concentrated airstream drawn from centrifuges.

Table 3-8 provides a summary of the existing odor control system and modification design criteria.

Table 3-8 Odor Control System Design Features

Parameters	Value
Technology	Packed Tower Scrubber[1]
Exhaust Rate (Total), cfm	8,200[2]
Centrifuge Exhaust Rate, cfm per centrifuge	70[3]
Diameter, ft	5
Packing Depth, ft	10
Packing Type	Plastic, random pack
Empty Bed Residence Time (EBRT), sec	1.8
Makeup Water Type	Non-potable
Makeup Water Rate, gpm	Unknown[4]
New Duct Material (from Centrifuge)	FRP
New Duct Diameter (from Centrifuge), inches	4

Notes:

1. Scrubber is operated with non-potable water; no chemicals are added.
2. Assumed system capacity based on previous odor control upgrades to add foul air contribution from DAFs and FEBs. Original odor control system design capacity was 6,600 cfm to draw from the Sludge Dewatering Building only. Final airflow and flow balancing to be verified upon testing to be performed by SEJPA.
3. Quantity of two centrifuges for a total airflow contribution of 140 cfm.
4. Makeup water rate to be verified by SEJPA during detailed design.

The proposed odor control modifications for inclusion of centrifuge foul air as a source to ORF No. 2 will be coordinated with the San Diego Air Pollution Control District (SDAPCD) during the design phase. Permit modification may be required due to the new dewatering technology and to update for the actual exhaust rate once verified by SEJPA.

3.2 Building Mechanical System Design Criteria

3.2.1 General

This section presents the criteria and basis of building mechanical design associated with the plumbing, heating, ventilating, and air conditioning (HVAC) and fire protection systems. The intent of this section is to define the design criteria, establish the minimum design requirements, and describe the mechanical systems. The selection of the systems will be based on operating performance, system efficiency, life safety considerations, long-term durability, redundancy, local representation/service, ease of operation as well as site and specific requirements identified by the Project team or SEJPA as described herein.

3.2.2 Applicable Codes and Standards

The mechanical building systems design will conform to the referenced versions of the following building codes:

- California Mechanical Code (CMC), 2019
- California Plumbing Code (CPC), 2019
- California Fire Code (CFC), 2019
- California Energy Code (CEC), 2019

In addition to the applicable building codes and standards identified above, the system designs will also be based on but not limited to the following publications and standards:

- American Society of Plumbing Engineers (ASPE) Handbooks.
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbooks and Standards.
- Sheet Metal and Air Conditioning Contractor National Association (SMACNA) Handbooks.
- National Fire Protection Association Recommended Practices (NFPA) and Manuals.
- Recommended Standards for Sewage Works - Great Lakes - Upper Mississippi River Board of Sanitary Engineers (10 States Standards).
- Occupational Safety and Health Act (OSHA) Standards Manual.

3.2.3 Location and Meteorological Design Criteria

Table 3-9 describes the design criteria that will be used for the building mechanical.

Table 3-9 Location and Meteorological Design Criteria

Criteria	Value
Site Elevation, above sea level, ft	40.0
Site Location (1)	San Diego-Lindbergh
North Latitude, degrees	32.7

Criteria	Value
West Longitude, degrees	117.2
Ambient Design Temperatures (2)	
Winter, design dry bulb, F	44
Summer, design dry bulb/mean coincident wet bulb, F	83/69
Climate Zone	7

Notes

1. The site location is for determining representative weather data for the project site but is not necessarily the specific project location.
2. The winter and summer design temperatures are based on the CEC Title 24 frequency levels 0.60 percent and 0.50 percent, respectively.

3.2.4 Materials

Materials will be selected giving preference to those materials that require the least maintenance and have the longest life. These are summarized in Table 3-10.

Table 3-10 Mechanical Systems Materials

System	Materials
Water Systems	Copper
Plumbing Fixtures	Vitreous China, Cast Iron, Enameled Steel, Stainless Steel, or Composites
Ductwork	Aluminum

3.2.5 Seismic

The seismic design will comply with the "Seismic Design Requirements for Nonstructural Components" of the latest edition of American Society of Civil Engineers Standard ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures" as described in Section 3.3.

3.2.6 Plumbing Design Requirements

3.2.6.1 Water Piping Systems

The existing potable water line at the Sludge Dewatering Building will supply water to the new emergency shower/eyewash fixture at the new Polymer Storage and Feed Facility, located outdoors. The existing emergency shower/eyewash fixture in the Polymer Feed Room will be demolished, and its potable water supply line connection will be removed and capped. The water pressure is anticipated to be sufficient, therefore water pressure boosting equipment will not be required. Pressure reducing stations are not anticipated to be required. All new potable water supply piping will be located above grade, and piping material will be type K hard drawn copper tubing with solder joint fittings.

All materials in contact with the potable water will comply with the Safe Drinking Water Act of 1986 as amended by the Reduction of Lead in Drinking Water Act of 2011. All plumbing fittings and fixtures intended to convey or dispense water for human consumption will comply with the requirements of NSF/ANSI 61 and NSF/ANSI 372 for low lead.

Protection of the potable water system will be in accordance with local codes or standards. Reduced pressure principle backflow preventers will be provided on the water supply to nonpotable water systems.

The existing emergency fixtures at the Sludge Dewatering Building are currently supplied by a cold water system without a water heater. It is recommended that a water heater and blending valve be provided in the cold water supply to the emergency shower/eyewash fixtures to permit tepid water temperatures (60°F to 90°F) to be supplied to the fixtures to meet the OSHA requirements per ANSI Z358.1. Any new water heater located downstream from a backflow prevention device will be protected by use of an expansion tank.

Existing hose faucets and 1-1/2-inch hose valves will be relocated as required based on new equipment layouts.

The polymer system and the centrifuge washwater will be supplied by the existing nonpotable water system. As the washwater requirements for centrifuges will be significantly less than the current requirements for the BFPs, and the requirements for the polymer feed system will not significantly change from the existing conditions, it is anticipated that the existing nonpotable water system has sufficient capacity to support the new equipment.

3.2.6.2 Plumbing Fixtures

A new emergency shower and eyewash station will be located in the Polymer Storage and Feed Facility. The emergency fixtures will be located in a well lit, highly visible, accessible locations on the same level as the hazard with an obstruction free travel path. The station will be plumbed to a tepid water supply to provide minimum 15 minutes of flow as described above. A floor drain will be located under the emergency shower if possible. The emergency shower and eyewash station will have an alarm device for local and remote alarms. The local alarm will consist of an audible and visible alarm light.

3.2.7 Heating, Ventilation, and Air Conditioning Design Requirements

3.2.7.1 Indoor Design Conditions

Table 3-11 describes the indoor design conditions that will be used for the design of the HVAC system.

Table 3-11 Indoor Design Conditions

Area	Design Temperatures (F) (1)			Ventilation Requirements	Ventilation Notes
	Summer	Winter			
	Design	Design	Setpoint		
Sludge Dewatering Building					
Centrifuge Room	90	---	---	6 AC/hr (C)	1
Electrical Room	90	---	---	Air Conditioned	2
Chlorination Building					
Electrical Room (MS-2 SWGR)	90	---	---	Air Conditioned	2

Area	Design Temperatures (F) [1]			Ventilation Requirements	Ventilation Notes
	Summer	Winter			
	Design	Design	Setpoint		
[1] Indoor conditions reflect operating temperatures for personnel comfort, code/standard recommendations, or equipment protection. AC/HR - designates air changes per hour. (C) - designates the ventilation system operates continuously. (I) - designates the ventilation system operates intermittently.					

Notes:

1. The ventilation system will be sized on the more restrictive of the AC/HR listed or the airflow required to maintain the indoor design temperature based on the summer outside design temperature.
2. The ventilation rate will be based on the exhaust requirements or as required by ASHRAE 62, whichever is more stringent.

3.2.7.2 HVAC General Requirements

3.2.7.2.1 Intakes

Outdoor air intakes will be designed to manage rain entrainment in accordance with the latest ASHRAE standards. Louvers will be selected to limit water penetration to a maximum of 0.01 oz/ft^2 of louver free area at the maximum intake velocity. Corrosion resistant screens will cover the openings with openings of 1/2 inch. Rain hoods will be sized for no more than 500 fpm face velocity with a downward-facing intake such that all air passes vertically upward through a horizontal plan before entering the system.

3.2.7.2.2 Air Filtration

Outdoor air will be filtered for all areas. Filtration will consist of 2 inch disposable pleated media filters with a minimum efficiency reporting value (MERV) based on ASHRAE 52.2 guidelines of at least 6.

3.2.7.2.3 Internal Load Factors

Heating and cooling loads will be calculated in accordance with ASHRAE Standard 183-2007. Internal heat gains will be included in the calculations based on the following:

- Lighting: 1.3 watts/sq ft (unless otherwise indicated)
- People: 230 btuh/person sensible and 190 btuh/person latent (seated, light work)
- Equipment: Equipment heat loss from equipment anticipated to operate simultaneously

3.2.7.2.4 Ductwork

Ductwork will be sized for 0.08 inch water column per 100 feet for a friction loss. Ductwork will be insulated for air conditioning systems, outside air, and heating systems. Insulation will consist of duct liner tested to be resistant to mold growth and erosion under a standardized test method. Insulated plenums will be externally insulated and include drain provisions for removal of any moisture that may carryover through the outside air louver.

3.2.7.2.5 Outside Air

Air conditioning and ventilation will be provided in the Electrical Room in accordance with ASHRAE Standards 55 and 62 for areas that are ventilated per person.

3.2.7.3 Heating Systems

Space heating is not anticipated for any area.

3.2.7.4 Ventilation Systems

In the Centrifuge Room of the Sludge Dewatering Building, the ventilation system will consist of a continuous filtered supply fan unit and exhaust will be through the existing odor control system at the ORF No. 2. The filtered supply fan unit will be controlled by a local "ON-OFF-AUTO" selector switch and interlocked with the odor control system. The system will be designed to maintain a negative pressure in the space compared to the adjacent rooms to minimize air transfer to those adjacent spaces.

3.2.7.5 Air Conditioning Systems

The air conditioning system for the Dewatering Building Electrical Room will be replaced due to age and sized according to the current expected load due to the change in process equipment. The air conditioning system for the Sludge Dewatering Room, Electrical Room, and the Chlorination Building Electrical Room will be a split system consisting of an air cooled condensing unit and a refrigerant coil installed in an air handling unit. An air cooled condensing unit will be used to reject heat from the refrigerant coil to ambient for the air conditioning system. The condensing unit will be located outdoors. Redundancy will not be provided.

3.2.7.6 Building Control Systems

The HVAC controls will consist of automatic industrial grade electromechanical and electronic controls. Control component enclosures will be selected based on the environment where they are installed. Typical controls will consist of the following:

- Differential pressure indication across supply and exhaust fans designed to operate continuously to indicated fan flow or failure. Where insufficient differential pressure occurs due to limited ductwork, motor current switches will be used.
- Duct mounted smoke detectors where systems have airflows greater than 2000 cfm and are capable of spreading smoke beyond the enclosing walls, floors and ceilings of the room or space in which the smoke is generated.
- Differential pressure gauge and differential pressure switch with alarm across air filters.
- Programmable electric thermostats for control of packaged/split system air conditioning systems.

A microprocessor-based standalone system or building automation system (BAS) is not anticipated for the facilities due to the environment and simplicity of the HVAC systems. However, if deemed preferable by SEJPA, a BAS system can be incorporated to replace the electric and electronic controls and provide central monitoring, operation, and management of the HVAC systems.

3.2.8 Fire Protection

There is no existing fire protection system associated with the dewatering facilities, and no new systems are anticipated to be required.

3.3 Structural Design Criteria

3.3.1 General

These structural design criteria establish the minimum design requirements for buildings, environmental and liquid containing structures, yard structures, miscellaneous equipment foundations, non-structural components, piping supports, and other miscellaneous items requiring structural design.

The project primary goal is to replace and upgrade the existing dewatering processing and sludge conveyance equipment at the plant.

Table 3-12 summarizes the modifications to various structures.

3.3.2 Existing Structures to be Upgraded

Table 3-12 Upgraded Structures Summary

Structure	Structural Modifications
Sludge Dewatering Building	Demolish existing BFP equipment, supports and mezzanine. Close off existing double door and cut new door openings at South Wall. Install steel strongback frames at new openings. Design new supports for new centrifuge equipment. Design new conveyor system support within building.
Sludge Conveyor	Demolish and replace existing sludge conveyors with new conveyors and supports.
Truck Loadout Structure	Modify sludge hopper to increase flow efficiency. Check and recommend modifications to existing steel support to carry new loading.

3.3.3 Codes and Standards

The codes, standards, and references listed below will serve as the basis for structural design.

- California Building Code (CBC) 2019 Edition; International Building Code (IBC), 2018 Edition.
- California Existing Building Code (CEBC) 2019 Edition; International Existing Building Code (IEBC), 2018 Edition.
- ASCE 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- Geotechnical Investigation Report (future).
- ACI 318-14: Building Code Requirements for Structural Concrete.
- ACI 350-06: Code Requirements for Environmental Engineering Concrete Structures and Commentary ACI 350R-06.
- ACI 350.3-06: Seismic Design of Liquid Containing Structures and Commentary ACI 350.3R-06.
- TMS 402/602-16: Building Code Requirements and Specification for Masonry Structures.
- Aluminum Design Manual, 2015 Edition.
- AISC Manual of Steel Construction, 15th Edition.

- AISC 360: Specification for Structural Steel Buildings, 2016.

3.3.4 Structural Materials and Properties

3.3.4.1 Concrete

- Cast-in-Place Structural Concrete
    - Flatwork, foundations: f'c= 4,000 psi
    - Environmental structures: f'c= 4,500 psi
    - Other: f'c= 4,500 psi
- Precast Structural Concrete: f'c= 5,000 psi
- Nonstructural Concrete (Concrete fill, duct banks): f'c= 3,00 psi

3.3.4.2 Concrete & Masonry Reinforcement

- Reinforcing Bars (ASTM A615 or ASTM A706): fy = 60,000 psi
- Welded Wire Mesh (ASTM A1064): fy = 70,000 psi
- Masonry unit assembly (Match Existing): f'm = 1,500 psi

3.3.4.3 Structural Steel

- W and WT shapes (ASTM A992, Grade 50): fy = 50,000 psi
- M, S, C and MC shapes (ASTM A36): fy = 36,000 psi
- Angles, bars, plates, and other structural
- shapes (ASTM A36): fy = 36,000 psi
- HP shapes (ASTM A572, Grade 50): fy = 50,000 psi
- Pipe sections (ASTM A53, Type E or S, Grade B): fy = 35,000 psi
- Round Structural Tube sections
- (ASTM A500, Grade C): fy = 46,000 psi
- Square and Rectangular Tube sections
- (ASTM A500, Grade C): fy = 50,000 psi
- Weld materials (ANSI/AWS D1.1, Table 3.1), using
- E70XX filler metal with minimum tensile strength: Fw = 70 ksi
- High strength bolts (ASTM F3125, Grade A325,
- Type 1 or Grade F1852 Twist-Off/TC, Type 1)
- Tensile strength: Fu = 120 ksi

3.3.4.4 Aluminum

- Aluminum Association standard shapes (ASTM B308, Alloy 6061-T6)
- Sheet and Plate (ASTM B209, Alloy 6061-T6)
- Material strengths for all aluminum materials:

- Tensile yield strength: Fty = 35,000 psi
- Compressive yield strength: Fcy = 35,000 psi
- Shear yield strength: Fsy = 20,000 psi

3.3.5 Loading Criteria

3.3.5.1 Dead Loads

Dead load will include the weight of all permanent construction including roofs, walls, floors, partitions, interior finishes, fixed equipment, tanks and bins including contents, equipment bases, pipes, HVAC ducting, and electrical lighting. Dead load criteria are indicated in Table 3-13.

Table 3-13 Dead Load Criteria

Description	Value
Equipment, tanks, piping	Actual weights
Pipe, 12-inch diameter and smaller	25 psf over full member length
Pipe, 14-inch diameter and larger	Actual weights
Concrete (normal weight)	150 pcf
Roofing and rigid insulation board	Actual, 15 psf (minimum)
HVAC ductwork (general)	5 psf
Lighting (general)	3 psf

3.3.5.2 Live Loads (Floor and Roof)

A minimum floor live load of 150 psf will be applicable to all operating floors. For large equipment areas, the combined weight of equipment and concrete pad plus an additional live load of 50 psf over the base area may be used as the live load. The equipment weight may be assumed distributed over an area 3 feet all around beyond the concrete pad perimeter. Additional live load criteria are indicated in Table 3-14.

Table 3-14 Live Load Criteria

Description	Value
Operating floors	150 psf
Walkways, stairs and landings	100 psf
Elevated equipment platforms (non-egress)	60 psf
Storage, general	250 psf
Control room floors	250 psf
Ordinary roof live load	20 psf minimum (no reduction taken)

3.3.5.3 Wind Loads

Wind loads will be determined for primary frames and components of structures in accordance with IBC Section 1609 in conjunction with ASCE 7, Chapter 26. ASCE7, Chapter 28 (Wind Loads on Buildings – MWFRS) will be used for low-rise buildings meeting the scope requirements of Section 28.1.1. For other structures, ASCE 7, Chapter 29 (Wind Loads on Other Structures and Building Appurtenances – MWFRS) will apply. ASCE 7, Chapter 30 will be applied to components and cladding. Basic wind load parameters are given in Table 3-15.

Table 3-15 Wind Load Criteria

Parameter	Value
Risk Category	III
Basic (Ultimate) Design Wind Speed	102 mph
Ground Elevation Factor, Ke	1.0
Exposure Category	Exposure C

3.3.5.4 Seismic Load

Seismic loads will be determined for primary frames and components of new building structures in accordance with IBC Section 1613 in conjunction with ASCE 7, Chapter 11. ASCE 7, Chapter 12 will be the basis of design for new buildings and similar structures. Non-structural components will be designed for the seismic loads indicated in ASCE 7, Chapter 13. Non-building structures will be designed for the seismic loads indicated in ASCE 7, Chapter 15. Liquid-containing concrete structures will be designed for the seismic loads indicated in ACI 350.3. Interior walls and partitions will be designed for a minimum of 10 psf lateral pressure (strength-level). Basic seismic load parameters are given in Table 3-16.

Existing buildings and non-structural components shall be review in accordance with IEBC design and seismic provisions.

Table 3-16 Seismic Load Criteria

Parameter	Value
Short period spectral acceleration, (Ss)	01.193
One second period spectral acceleration, (S1)	0.425
Risk Category	III
Seismic Design Category	D
Structural System Response Coefficient	ASCE 7, Chapter 12
Total Seismic Dead Loads, W	Actual
Site Soil Classification	D, in the absence of a geotechnical report.

3.3.5.5 Impact Loads

Structural systems will be designed for impact loads from machinery and other moving items. Impact loads will be determined in accordance with ACI 350.4R and IBC Section 1607.9 for machinery. Weight of machinery and moving loads will be increased as indicated in Table 3-17.

Table 3-17 Impact Load Criteria

System	Increase
Conveyor loads, and machinery	100%
Light Machinery, Shaft or Motor Driven	20%
Reciprocating Machinery or Power Driven Units	50%

3.3.6 Design Procedures and Methodologies

3.3.6.1 Reinforced Concrete Design

Liquid-containing structures or below grade structures in contact with groundwater in normal conditions, and chemical storage structures will be designed in accordance with ACI 350 to address durability, serviceability and environmental exposure issues for these structures. Other concrete structures will be designed by IBC Chapter 19 and ACI 318. Concrete design shall be based on 4,000 psi strength with 4,500 psi to be specified on the contract documents. The 500 psi strength differential between the design value and specified value is to be consistent with ACI allowable tolerance (-500 psi) for concrete test sample results and remain in compliance with the code requirements.

3.3.6.2 Reinforced Masonry Design

Concrete masonry will be designed in accordance with IBC Chapter 21 and TMS 402.

3.3.6.3 Structural Steel Design

Structural steel will be designed in accordance with IBC Chapter 22, AISC Manual of Steel Construction, and AISC 360.

3.3.6.4 Aluminum Design

Aluminum will be designed in accordance with IBC Chapter 20, and the Aluminum Design Manual.

3.3.7 South Door Modifications

The existing single-story, CMU Sludge Dewatering Building currently houses two belt press units with an intermediate level mezzanine that are to be demolished and replaced with two new centrifuge units. Proposed structural modifications to accommodate upgrade work are summarized in Table 3-12. The detail information relevant to the proposed equipment upgrades can be found in Section 3.1 of this report.

Structural alterations to the existing Sludge Dewatering Building are required to accommodate the new centrifuge units. In addition to the demolition of the existing equipment and supports, new supports for centrifuges and conveyors will be provided. The new centrifuge units will be supported directly on the existing 24-inch thick concrete slab. It is assumed that the interior conveyor system from each centrifuge will be floor supported and provide redundant sludge delivery paths to the main exterior sludge conveyor. Existing wall opening for sludge conveyor at West wall is assumed to be sufficient for new conveyor design. Further structural evaluation would be necessary if a new opening or modification to existing opening is required.

Building access for the installation and maintenance of centrifuge units requires two new double doors (6’-4” wide x 9’-0” height) to be cut into the existing South wall. The new wall openings will be strengthened with steel strongback frames connected to the interior face of the CMU walls around the openings.

The existing double door at South wall will be closed off with reinforced CMU to match the current masonry construction and provide shear wall strength to resist lateral earthquake loads on the building. The contractor may choose to remove the skylights should the large roof openings provide better access during construction. During removal of existing skylights, contractor shall exercise care to not damage the existing support curbs and roofing. Installation of new skylights will require the contractor to field measure and coordinate existing conditions to ensure proper support and weather tight details are provided for the new skylights.

3.3.8 Truck Loading Structure

The Truck Loading Structure is an open steel frame facility and assumed to be adequate to support the additional loading that results from modifications to the sludge hopper and the addition of the horizontal screw with two discharge chutes. Existing structural drawings for the Truck Loading Structure are not available, making it difficult to perform a comprehensive structural evaluation with a high level of precision. Building code standard of practice allows a maximum 10% increase of load on an existing structure and still deem it as safe. Should the actual modifications to the sludge hopper exceed this design load limitation, further field investigation and survey of the structure will be required to generate dimensional and material details that can serve as a basis for structural modelling and analyses to verify capacities.

3.4 Architectural Design Criteria

3.4.1 General

This section describes the basis of architectural design for the SEWRF existing Sludge Dewatering Building. The architectural design scope will be limited to new doors on the South wall, replacement of all existing doors, painting updates, louvered window replacement, and skylight replacement.

3.4.2 Codes and Standards

The architectural design will conform to the following codes:

- 2019 California Building Code
- 2019 California Existing Building Code
- 2019 California Fire Code

The existing Sludge Dewatering Building will conform to the following requirements from the 2019 California Building Code and the 2019 California Existing Building Code:

Table 3-18 Code Classification Table

Sludge Dewatering Building	
Occupancy	Group F-1 (existing)
Type of Construction	II-B (existing)
Allowable Building Area	15,500 sf per story
Actual Building Area	2,184 sf (existing)
Allowable Building Height	2 stories (55 ft)
Actual Building Height	1 story (22.17 ft) (existing)
Design Occupant Loads	100 sf/person (industrial) 300 sf/person (electrical & mechanical equipment rooms)
Design Occupant Load	20 (existing)
Means of Egress	2 minimum or 1 with maximum 75 ft travel distance
Accessibility	Not required (CBC 11B-203.5 Machinery Spaces)
Fire Separation	Not required.
Fire Sprinklers	Not required.

3.4.3 Doors

Two new FRP double doors will be installed on the south façade of the Sludge Dewatering Building to allow for future equipment removal and installation. The existing personnel door on the south façade will be infilled with masonry to match existing.

All other existing personnel doors and frames will be replaced with new FRP doors and frames as requested by the Client during the Structural and Architectural Workshop on April 13, 2021.

3.4.4 Skylights

The two existing skylights will be demolished and replaced with new insulated skylights that are rated for fall protection. The new skylights will be provided with lifting eye bolts to facilitate future removal.

3.4.5 Louvers / Windows

All eight existing operable louvered windows will be demolished, and the masonry/concrete sills will be repaired where necessary. The four openings at the current mezzanine level will be infilled with fixed windows. Three of the four lower openings will be infilled with operable windows and the fourth opening will provide the necessary duct access for new HVAC equipment.

3.4.6 Painting

All existing wall, ceiling, and structural steel framing components that are currently painted will be appropriately cleaned and prepared for new epoxy paint coating. Painting of walls includes both interior and exterior masonry wall surfaces. Replacing and repairing joint sealants/caulking is included in the surface preparation of walls/ceilings.

3.4.7 Roof Access Ladder

The existing roof access ladder begins at the mezzanine level which is scheduled to be demolished and therefore, the ladder will also be demolished. A new ladder will be provided on the building exterior, providing access to the North low roof over the existing parapet wall. A security shield will be provided over the base of the ladder to prevent unauthorized access. Final location of the new ladder will be determined during detailed design.

3.4.8 Roofing

The existing roof is a built-up roof system with a gravel aggregate top coating. Based on review of photos of the roofing provided by SEJPA and a visual inspection performed by BV's structural engineer in May 2021, the existing roof system appears to be in good condition and does not require immediate repair or replacement. As such, the current project scope does not include replacement of the existing roof membrane system. However, it is difficult to inspect this type of roof system to completely evaluate the condition of the waterproofing top membrane. As the roof system is near the end of its useful life, periodic inspections of the roof system are recommended to identify the need for replacement in the future prior to failure.

3.5 Civil Site Design Criteria

This section describes the civil site design criteria.

Construction of the proposed Polymer Storage and Feed Facility will require the following civil site modifications, as shown on Drawing C-001:

- Demolish the existing retaining wall, located between the western wall of the Sludge Dewatering Building and the Truck Loading Area.
- Construct a higher retaining wall to replace the retaining wall and further extend the wall to the north (top of the wall to match the top of the slab elevation of the proposed Polymer Storage and Feed Facility. The northern end of the retaining wall will be sloped or stepped down to follow the sloping of the new pavement between the forklift access/parking area and the adjacent access road.
- The new paving will match the adjacent existing pavement plus one-inch of additional pavement thickness.
- The existing plant perimeter gates and fencing will not be modified as part of this Project.
- The existing concrete slab in the Truck Loading Area will be extended to support the new truck scale and to provide approach aprons.

3.6 Electrical Design Criteria

3.6.1 General

This section presents the criteria for the design of the electrical systems which are to be provided as part of the SEWRF sludge dewatering facilities upgrades project.

3.6.2 Codes and Standards

The electrical design will conform to the latest version of the following codes and standards unless otherwise specified:

- National Electrical Code (NEC – NFPA 70)
- Life Safety Code (NFPA-101)

The standards and codes of the following organizations will also govern, where applicable:

- American National Standards Institute (ANSI)
- Illuminating Engineering Society (IES)
- Instrument Society of America (ISA)
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)
- Occupational Safety and Health Act (OSHA)
- American Society for Testing and Materials (ASTM)
- Underwriters' Laboratories (UL)

3.6.3 Power Distribution System

The electric utility that currently serves the WRF is San Diego Gas & Electric (SDG&E). Currently, the plant receives power from SDG&E at 480V through two utility-owned, 12.47 kV-480 V, pad-mount transformers. The secondary of these transformers then each feed 480 V switchboard/switchgear lineups (MS-1 and MS-2, respectively) that each contain a utility section with SDG&E metering equipment. These two lineups are each tied to individual standby engine-generator units that provide backup power to the facility upon loss of utility power. These two lineups also feed a multitude of motor control centers (MCCs) located across the site that power all the plant's electrical processes and loads.

Existing switchgear MS-2 and downstream MCC-H are at the end of their useful life, and it is difficult to find replacement parts for them. They both have visible signs of exterior corrosion and will be replaced under this project. Any potential damage or corrosion of the bus structure of switchgear MS-2 and MCC-H is unknown since the recommended electrical testing is no longer required given the full replacement decision. New MCC-H will be installed in the same location as the existing one while new switchgear MS-2 will be installed in an existing storage room on the opposite end of the chlorination building that will be converted to an electrical room.

Due to increased loading from the sludge dewatering facilities upgrades, the ampacity of the feeder conductors to MCC-H must be increased to support all new and existing loads. Currently, the existing MCC-H comprises a double-bus main-tie-main configuration with one 3-inch conduit and associated conductors feeding each main breaker and bus from switchgear MS-2. However, the larger feeder conductors to each main breaker are too large to fit into the existing 3-inch conduits.

In addition, both MCC-H feeders from existing switchgear MS-2 originate from a common bus (which also represents a single-point-of-failure) thereby eliminating any real redundancy beyond the double-bus separate circuits (i.e., a single cable fault can be bypassed). Given this fact and the desire to avoid the complexity and cost of building a new parallel concrete-encased duct bank from MS-2 to MCC-H, the decision has been made to provide a single feeder to MCC-H utilizing parallel sets of conductors in the two existing 3-inch conduits to provide power to all MCC-H loads. Thus, new MCC-H will become a single bus configuration with only one main breaker and no bus-tie breaker.

The existing duct bank utility feeder from the SDG&E transformer T-2 will be intercepted near the building and rerouted to the edge of the building before conduits turn up out of the ground and route up the side of the building to a new junction box. From that point, conduits will penetrate the wall into the building and be routed indoors overhead to the new MS-2 switchgear. The existing feed from the generator switchgear comes through the wall at an existing outdoor junction box. These conduits that enter the building will also be intercepted and routed overhead to new switchgear MS-2. For all existing downstream circuits fed from switchgear MS-2, conduits will be routed overhead indoors back to the existing MS-2 switchgear room where they will intercept existing conduits that punch through the wall into an existing junction box that then routes down the outside of the wall and into duct bank before routing over to existing underground pull box PB-P5. This pull box provides access to existing conduits that route to all downstream MCCs.

The construction of these new distribution lineups will be sequenced to minimize process downtime. During detailed design, Black & Veatch will work with SEJPA to determine which loads are critical for powering through the shutdown during work involving the replacement of switchgear MS-2 and MCC-H.

3.6.4 Electrical Power Equipment

The following distribution and equipment utilization voltages and ratings will generally be used. Depending on specific equipment requirements determined in design, there could be some exceptions.

- Site service — 12,470 volts, three-phase
- Facility distribution — 480 volts, three-phase
- Motors, ½ hp and larger — 460 volts, three-phase
- Motors, less than ½ hp — 115 volts, single-phase
- Motor control — 120 volts, single-phase
- Lighting — 120 volts, single-phase
- Convenience outlets — 120 volts, single-phase
- Instrumentation and Control — 120 volts, single-phase

The electrical design will conform to Black & Veatch standards and will generally consist of the following:

- Except for packaged equipment, motor starters will be in an MCC and have a green indicating light for off, red indicating light for on and amber indicating light for alarm or failure. All indicating lights will be 120 volt rated LED type.
- All electrical systems will be grounded in accordance with the National Electrical Code.
- Where required, receptacles will be ground fault circuit interrupting (GFCI) type.
- Cable for power and controls in low voltage circuits will be rated for 600 volts and will have XHHW-2 insulation. Cable for lighting and receptacle circuits will be single conductor with THHN/THWN insulation.

- Specific types of raceways will be chosen for use in various locations in the facility based on moisture, temperature and exposure to damage, corrosion, voltage and cost.

3.6.5 Lighting Requirements

LED lighting systems will be used for all areas to the extent possible. Illumination levels will conform to the recommended levels suggested in the Illuminating Engineering Society (IES) handbook for the space and tasks being performed. Lighting fixture types will be suitable for the environments where they are installed and will be located (serviceable and accessible) for routine maintenance. All lighting fixtures will be UL listed.

Exit signs, emergency egress lighting, and emergency lighting power supply will conform to the requirements of the local code authority.

All luminaires will be LED type unless otherwise dictated by operational or process requirements. No fixtures will be provided with less than 70 lumens per watt. All fixtures will have an LM70 or greater. All fixtures will be provided with a 0-10 V dimming driver, where required.

Interior fixtures will be specification grade fixtures. All fixtures will be painted after fabrication. Lay-in type fixtures and linear pendants will be acceptable.

Exterior fixtures will conform to the San Diego County Light Pollution Code, also known as the Dark Sky Ordinance. In general, such exterior fixtures will be full cut-off type to avoid glare, and with limited lumens in order to avoid illuminating the night sky.

All process areas will have marine grade fixtures.

In general, the following suggested foot-candle levels will be used for preliminary design. Actual levels provided will be further evaluated during detailed design.

Table 3-19 summarizes the suggested foot candle levels.

Table 3-19 Foot Candle Levels

Area	
Break room	40
Electrical rooms	35
Control rooms	30
Battery rooms	30
General site	1
Outdoor building entrances	5
Maintenance areas	50
Office	70

Area	
Process, inside	30
Process, outside	5
Storage, inside	15
Walkway	5

3.6.6 Improvements for NEC Compliance

Existing panel VC-2 is located on the wall in front of existing MCC-H and does not currently allow for the required code clearance needed in front of the MCC. This panel will be relocated to the right in order to ensure proper code clearance once new MCC-H is installed. Cable and conduit to and from this panel will be rerouted to the panel’s new location.

3.7 Instrumentation and Control Design Criteria

The instrumentation and control (I&C) system design will provide a reliable means to monitor and control the new and existing equipment and processes for the SEWRF sludge dewatering facilities. All I&C work will be in accordance with local codes, the criteria outlined in this memorandum, Black & Veatch standards, client standards, and other requirements applicable to the I&C design for water reclamation facilities. The P&IDs indicating process and instrumentation features for the major processes are included as Appendix B.

3.7.1 General

Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

3.7.2 Codes and Standards

All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters' Laboratories.

3.7.3 SCADA and PLC

The existing Bio Solids PLC (Allen-Bradley SLC505) will be used for new equipment control where possible and, if required, the addition of an Allen-Bradley Compact Logix PLC will be used to expand the Bio Solids control capabilities. The increased quantity of I/O required for the new equipment in particular is expected to drive the addition of the new Allen-Bradley Compact Logix PLC.

The centrifuges will be supplied with their own Centrifuge Control Panel, PLC, and Starter Panel.

The existing Bio Solids PLC is connected to the plant network via a fiber connection which will remain in place as the datalink between the SCADA and Bio Solids controls.

3.7.4 Instrumentation

Instrumentation will be provided to support the monitoring and control of the new equipment and processes associated with this project. Instruments will be provided as inputs to alarm abnormal system operation, pending problems, or safety hazards. Standard analog signals from the instrumentation will be 4-20 mA. Instruments will meet the requirements of the SEJPA's standard specification with additional requirements as recommended by Black & Veatch.

3.7.5 Preliminary Control Description

In general, the below process control strategies shown in Table 3-20 will be provided. More detailed descriptions will be defined during the detailed design.

Table 3-20 Recommended Control Philosophies

Process	Control Philosophy
Sludge/Dewatering Feed Pumps	<u>Local Manual Control:</u> When the pump Local-Off-Remote switch is selected to be in Local at the VFD, the operator will control the pump using Start/Stop push buttons and control speed using the VFD controller. <u>Local Automatic Control:</u> None. <u>Plant Control System Alarm & Status Monitoring:</u> Yes. <u>Remote Manual Control:</u> When the pump Local-Off-Remote switch is selected to be in Remote at the VFD and the pump is selected to be in Manual control mode at the HMI, the pump shall be controlled by the operator through the HMI. The operator shall have the ability to start and stop the pump, enter a speed setpoint, and place the pump In or Out of Service. <u>Remote Automatic Control:</u> When the pump Local-Off-Remote switch is selected to be in Remote at the VFD and the pump is selected to be in Auto control mode at the HMI, the pump shall be controlled by the Bio-Solids PLC in coordination with the centrifuges.
Dewatering Feed Grinders	<u>Local Manual Control:</u> When the grinder Local-Off-Remote switch is selected to be in Local at the local control panel (LCP), the operator will operate the grinder using a Forward-Reverse selector switch. <u>Local Automatic Control:</u> None. <u>Plant Control System Alarm & Status Monitoring:</u> Yes. <u>Remote Manual Control:</u> When the grinder Local-Off-Remote switch is selected to be in Remote at the LCP and the grinder is selected to be in Manual control mode at the HMI, the grinder shall be controlled by the operator through the HMI. The operator shall have the ability to start and stop the grinder and place the grinder In or Out of Service. <u>Remote Automatic Control:</u> When the grinder Local-Off-Remote switch is selected to be in Remote at the LCP and the grinder is selected to be in Auto control mode at the HMI, the grinder shall be controlled by the Bio-Solids PLC in coordination with the centrifuges. The grinder will automatically attempt to clear jams by alternating forward and reverse running directions. If a jam is not cleared after a set number of alternations, a fault will be generated.

Process	Control Philosophy
Polymer Storage Totes & Mixers	Local Manual Control: When the mixer On-Off-Auto switch is selected to be in the On position at the LCP, the mixer will start. Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: When the mixer On-Off-Auto switch is selected to be in Auto at the LCP and the mixer is selected to be in Manual control mode at the HMI, the operator shall have the ability to start and stop the mixer. Remote Automatic Control: When the mixer On-Off-Auto switch is selected to be in Auto at the LCP and the mixer is selected to be in Auto control mode at the HMI, the mixer will run at intervals determined by the Bio-Solids PLC in coordination with the centrifuges.
Polymer Feeder/Blender Pumps	Local Manual Control: When the pump Local-Off-Remote switch is selected to be in Local at the LCP, the operator shall have the ability to start the pump, stop the pump, and control the pump speed using the LCP. Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: When the pump Local-Off-Remote switch is selected to be in Remote at the LCP and the pump is selected to be in Manual control mode at the HMI, the operator shall have the ability to send a run permissive, set the feed rate, or place a pump Out of Service. When the pump is Out of Service, the Run Permissive shall be removed. Remote Automatic Control: When the pump Local-Off-Remote switch is selected to be in Remote at the LCP and the pump is selected to be in Auto control mode at the HMI, the pump will run at a feed rate as determined by the Bio-Solids PLC in coordination with the centrifuges.
Dewatering Centrifuges System	Local Manual Control: When the Dewatering Centrifuge system is selected to be in Manual at the LCP, the Dewatering Centrifuge can be fully operated in manual from the Centrifuge Control Panel. Each centrifuge will also have a starter panel that contains the centrifuge VFDs and power monitoring. Local Automatic Control: When the Dewatering Centrifuge system is selected to be in Automatic at the LCP, the centrifuge shall be controlled by the Centrifuge PLC. The Centrifuge PLC shall continually monitor all interlocks and fault conditions from the SCADA. If a pump, grinder, or conveyor alarm is generated by the Dewatering Centrifuge Feed System, Dewatering Polymer Feed System, the Dewatering Conveyor, or the Distribution Conveyors, an Idle Mode command shall be generated by the SCADA and sent to the Centrifuge PLC. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: None. Remote Automatic Control: None.
Centrifuge Screw Conveyors	Local Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Local at the LCP, the operator will control the conveyor using Forward/Reverse selector switch.

Process	Control Philosophy
	Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Manual control mode at the HMI, the conveyor shall be controlled by the operator through the HMI. The operator shall have the ability to run the conveyor in the forward or reverse direction, stop the conveyor, or place the conveyor In or Out of Service. Remote Automatic Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Auto control mode at the HMI, the conveyor shall be controlled by the Centrifuge PLC in coordination with the centrifuges.
Intermediate Screw Conveyor	Local Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Local at the LCP, the operator will control the conveyor using a Forward/Reverse selector switch. Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Manual control mode at the HMI, the conveyor shall be controlled by the operator through the HMI. The operator shall have the ability to run the conveyor forward, in reverse, or place the conveyor In or Out of Service. Remote Automatic Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Auto control mode at the HMI, the conveyor shall be controlled by the Bio-Solids PLC in coordination with the centrifuges.
Main Screw Conveyor	Local Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Local at the LCP, the operator will control the conveyor using a Forward/Reverse selector switch. Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Manual control mode at the HMI, the conveyor shall be controlled by the operator through the HMI. The operator shall have the ability to run the conveyor forward, in reverse, or place the conveyor In or Out of Service. Remote Automatic Control: When the conveyor Local-Off-Remote switch is selected to be in Remote at the LCP and the conveyor is selected to be in Auto control mode at the HMI, the conveyor shall be controlled by the Bio-Solids PLC in coordination with the centrifuges.

Process	Control Philosophy
Live Bottom Bin and Truck Scales	Local Manual Control: The operator will control the Live Bottom Bin using Start/Stop switches and Open/Close push buttons. Selector switches shall allow the operator to select which gates will be opened when filling the truck. Local Automatic Control: None. Plant Control System Alarm & Status Monitoring: Yes. Remote Manual Control: None. Remote Automatic Control: When the Live Bottom Bin level or weight in the falls below a low-low setpoint, the Bio-Solids PLC shall stop and prevent from starting the Dewatering Centrifuge Feed System, Dewatering Polymer Feed System, the Dewatering Conveyor, & the Distribution Conveyors. When weight in the Live Bottom Bin rises above a High-High level, the Bio-Solids PLC shall shut down the Main Screw Conveyor.

3.7.6 System Integration

System integration will be completed by SEJPA. This will include the installation and programming of any PLCs, HMIs, network equipment, and appurtenances. SEJPA will be responsible for arranging and obtaining all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

4.0 Summary of Proposed Improvements

A summary of the existing facilities and proposed improvements that were presented in Sections 2 and 3 are summarized in Table 4-1. The proposed improvements to address code compliance are noted in green.

Table 4-1 Summary of Existing Facilities and Proposed Improvements

Facility/Scope Item	Existing Facility/Conditions/Challenges	Proposed Improvements
Dewatering Equipment	• Two BFPs near the end of useful life.	• Demolish existing BFPs. • Install two new centrifuges, operating platforms and monorail systems for maintenance.
Dewatering Feed Pumps	• Three sludge feed pumps (two original pumps with Reeves adjustable speed drive, and one recently replaced with a variable frequency drive). • Drives for the two older pumps no longer reliable. Pumps operated at a single speed without flow adjustment capability. • The rated flow and head of the recently replaced pump (160 gpm, 60 psi) is sufficient for the centrifuges (up to 135 gpm, <60 psi).	• SEJPA to replace the two original pumps with new pumps with VFD (outside of this Project, to be completed prior to construction of this Project).
Sludge Screw Conveyor	• Conveyor undersized, resulting in frequent failure. • Single point of failure (challenging to haul dewatered cake out of the building when the conveyor is out of service).	• Demolish existing screw conveyor. • Install a new Inclined Conveyor for each centrifuge unit for slop management. • Install a new Distribution Conveyor to receive dewatered sludge from each centrifuge unit and convey to the Main Conveyor. • Install a new Main Conveyor. • Consider installing an Emergency Conveyor (a redundant conveyor that can be used when the Main Conveyor is out of service to convey sludge to the cake hauling station to be located outside of the building).
Sludge Hopper / Bin	• Significant corrosion (quarter-size holes penetrating through the steel wall) observed on the hopper, especially near the vibrating equipment.	• Demolish existing hopper, chutes, and knife gate valves. • Install a new live bottom bin (equipped with a screw conveyor at the bottom of the bin), which allows for the two cake discharge chutes to be located further apart

Facility/Scope Item	Existing Facility/Conditions/Challenges	Proposed Improvements
	• Limited ability to distribute sludge along the truck bed without moving the truck.	to improve distribution of sludge across the truck bed.
Truck Scale	• A portable-type, low-profile, axle scale (one for left wheels, one for right wheels, approximately 10' long), mounted on top of the concrete slab, near the north end of the truck loading area. • Only the rear or front wheels of the trailer to be on the scale at a time. Challenging to accurately measure the weight of the sludge on the trailer. • Unable to continuously monitor weight with truck movement.	• Demolish existing truck scale. • Install a longer low-profile truck scale that can accommodate the entire trailer to stay on the scale, while the trailer position is adjusted during sludge loading, to allow for continuous weight monitoring. • Extend concrete slab to accommodate the longer scale and approach ramps. • Modify the washdown area and the trench drain system to accommodate the new scale.
Polymer Storage and Feed	• The current storage area was not intended for containment of a tote system and not appropriate for its required containment volume or forklift access (i.e. the wall is too tall). • The forklift approach area is sloped and unsafe to park, while loading or unloading the tote. • Containment area is not large enough to accommodate more than one tote. SEJPA may consider use of two different types of polymer for thickening and dewatering to optimize performance. • The feed equipment is a mix of old and new equipment with minimal control. The feed pumps are located in a room with no secondary containment.	• Demolish the existing polymer storage area. • Construct a new slab-on-grade polymer storage and feed area (2 totes, 4 PLC based feeder blenders, a portable mixer, and an emergency eyewash and shower) located to the south of the existing containment. The area to be sloped away from the building and towards containment trenches along the western and southern edges. Provide a metal canopy for sunshade. • Provide safe forklift access (i.e. flat area in front of the totes for approach/parking)
Structural and Architectural Components	• Mezzanine level and stairs provided for access to the gravity table portion of the BFPs. • Main equipment maintenance access through the 6'-4" wide 7'-4" H double door on the South Wall. • Significant corrosion of metal building components and undesirable working environment due to odor caused by the open system (without an enclosure).	• Demolish existing BPF supports, washwater curbs, mezzanine level, and stairs. • Remove access ladder from the mezzanine level to the upper roof. Install an exterior ladder from the grade level to the lower roof. • Provide supports for new centrifuges and associated operating platforms and monorail system.

Facility/Scope Item	Existing Facility/Conditions/Challenges	Proposed Improvements
	• Two skylights (non-removable type) near the end of useful life. • Protective coating and painting worn out at many locations.	• Provide supports for the new sludge conveyors. • Remove the existing double door, close-off existing opening, cut two new door openings at South Wall, install steel strongback frames at new door openings, and install two new 6'-4" wide 8'-10" H double doors. • Replace all other existing doors with new doors. • Replace-in-place existing skylights with new, removable type. • Remove existing protective coating and painting, clean, resurface, recoat, and repaint both interior and exterior of the building.
Odor Control and Ventilation	• Building exhaust routed to Existing ORF No. 2, equipped with a scrubber operated with recycled water. • Low H_2S levels measured above BFPs - compliance with APCD permit requirements achievable with the existing system. • Ventilation of building exhaust without treatment is not allowed according to APCD. • Existing exhaust fans (EF-2 and EF-3) on the roof disabled. • Scrubber fan recently rebuilt and in good shape. • Recirculation pumps in fair condition with some corrosion. • Air supply to the building is passive through the existing louvers/screened openings. • AC unit for the Electrical Room near the end of useful life. • There is no AC unit for the existing storage room, where installation of the new SWGR MS-2 is proposed.	• Demolish existing exhaust fans (EF-2 and EF-3) and close roof opening. • Continue treating foul air from the Sludge Dewatering Building with the existing scrubber at ORF No. 2. • Route foul air from the centrifuge units to the existing scrubber at ORF No. 2. • Maintain the existing scrubber system components in service, including the scrubber fan and recirculation pumps. • Install an AHU to meet the NFPA 820 requirement to provide forced mechanical air supply to Sludge Dewatering Building. • Replace-in-place existing AC unit with new • Install a new AC unit for the new SWGR MS-2 Room.
Electrical	• MCC-H (located in the Electrical Room within Sludge Dewatering Building) near the end of useful life with visible signs of corrosion on exterior enclosures.	• Replace-in-place MCC-H with new single bus MCC. • Demolish existing SWGR MS-2 and install new SWGR MS-2 in the

Facility/Scope Item	Existing Facility/Conditions/Challenges	Proposed Improvements
	• SWGR MS-2 (located in MS-2 SWGR Room at the north end of the Chlorination Building) near the end of useful life with visible signs of corrosion on exterior enclosures. • Two 3-inch conduits from MS-2 to MCC-H via PB-P5 and PB-P2. • Clearance between the front of MCC-H and side of Control Panel VC-2 is 38 inches. • Existing light fixtures, light switches, duplex receptables, exposed electrical conduits near the end of useful life.	existing storage room at the south end of the Chlorination Building. • Use existing 2-3" conduits for parallel circuits to the new single bus MCC. • Remove the existing VFDs for BFPs and their blue enclosures (located adjacent to VC-2) and relocate VC-2 to achieve 42" minimum clearance from the front of new MCC-H to side of VC-2 for NEC compliance. • Replace light fixtures, light switches, duplex receptables, exposed electrical conduits, and associated electrical equipment within the Sludge Dewatering Building with new.
Instrumentation and Control	• Limited communication between the vendor supplied control panels associated with dewatering facility equipment and SCADA. • Desirable to increase the level of automation for the dewatering sludge conveyance facilities.	• The existing Bio Solids PLC (Allen-Bradley SLC505) to be used for new equipment control where possible and, if required, the addition of an Allen-Bradley Compact Logix PLC to be used to expand the Bio Solids control capabilities. • The centrifuges to be supplied with their own Centrifuge Control Panel, PLC, and Starter Panel. • The existing fiber connection between the Bio Solids PLC and the plant network to remain in place as the datalink between the SCADA and Bio Solids controls.

5.0 Construction Sequencing and Temporary Facilities

Construction sequencing plans will be developed during detailed design to provide the Contractor an understanding of general sequencing requirements for the work to be performed and related constraints such that the facilities will be maintained operational throughout the construction period and interruption to normal operation of the SEWRF is minimized.

Based on the preliminary design information developed thus far, it is generally recommended that the proposed improvements associated with the power distribution system for the dewatering facilities be completed prior to installation of the new mechanical equipment to minimize the electrical load to be supported by temporary facilities and to optimize the construction sequencing.

It is anticipated that key temporary facilities that will be required during construction of this Project will include:

- Temporary electrical facilities to power critical dewatering facility equipment during demolition of the existing MCC-H and installation of new MCC-H
- Temporary electrical facilities to feed power to MCCs that are connected to SWGR MS-2 during the cutover from the existing to new SWGR MS-2
- Temporary, outdoor sludge dewatering facility and load out facilities during demolition of the existing BFPs and other equipment and installation of new equipment
- Temporary relocation of the existing polymer tote to allow for demolition of the existing containment area and construction of the new polymer storage and feed facility

Construction sequencing and requirements for temporary facilities will be further developed during detailed design.

6.0 Opinion of Probable Construction Cost

A preliminary design level Opinion of Probable Construction Cost (OPCC) was developed by BV's subconsultant, Cumming Management Group, Inc. and summarized in Figure 6-1. The cost basis includes historical cost data from similar projects, current bid prices in San Diego, California, and vendor quotes for critical pieces of equipment. OPCC details are included in Appendix D.

The OPCC will continue to be updated upon completion of the 70% and 100% design.

SUMMARY - SLUDGE DEWATERING FACILITY UPGRADES

Element	Subtotal	Total
A) Shell (1-5)		**$214,350**
1 Foundations	$36,600	
2 Vertical Structure	N/A	
3 Floor & Roof Structures	$57,200	
4 Exterior Cladding	$60,550	
5 Roofing and Waterproofing	$60,000	
B) Interiors (6-7)		**$45,800**
6 Interior Partitions, Doors and Glazing	$17,500	
7 Floor, Wall and Ceiling Finishes	$28,300	
C) Equipment and Vertical Transportation (8-9)		**$2,200,780**
8 Function Equipment and Specialties	$2,200,780	
9 Stairs and Vertical Transportation	N/A	
D) Mechanical and Electrical (10-13)		**$757,707**
10 Plumbing Systems	$42,574	
11 Heating, Ventilation and Air Conditioning	$186,078	
12 Electrical Lighting, Power and Communications	$529,055	
13 Fire Protection Systems	N/A	
E) Site Construction (14-16)		**$343,370**
14 Site Preparation and Demolition	$209,835	
15 Site Paving, Structures & Landscaping	$118,535	
16 Utilities on Site	$15,000	
Subtotal		$3,562,007
General Conditions	12.00%	$427,441
Subtotal		$3,989,447
General Requirements	2.50%	$99,736
Subtotal		$4,089,183
Bonds & Insurance	1.50%	$61,338
Subtotal		$4,150,521
Contractor's Fee	7.00%	$290,536
Subtotal		$4,441,058
Design & Construction Contingency	30.00%	$1,332,317
Subtotal		$5,773,375
Escalation to MOC, 07/02/23	8.44%	$487,268
TOTAL ESTIMATED CONSTRUCTION COST		**$6,260,643**

Figure 6-1 Summary of Preliminary Design Level OPCC

Appendix A – Workshop and Meeting Materials

MEETING MINUTES

San Elijo Joint Power Authority (SEJPA) — B&V Project 407556
San Elijo Water Reclamation Facility — B&V File 14.1200
Dewatering Facilities Upgrades — Meeting held on: 1/13/2021
Kick-off Meeting — Minutes issued on: 1/21/2021

To: Michael Thornton, PE
Chris Trees, PE

From: John Bekmanis, PE
Rika Evans, PE

Meeting Purpose

A kick-off meeting was held virtually on January 13, 2021, to initiate work on the preliminary design for the San Elijo Water Reclamation Facility (SEWRF) Dewatering Facilities Upgrades project. The key objectives / outcome of the meeting were to:

- Review and confirm project scope, drivers, and goals based on work performed during the project definition phase and subsequent discussions
- Discuss project execution approach including collaborative decision making through workshops and meetings
- Discuss key design elements by confirming existing conditions and understanding of improvement objectives
- Obtain SEJPA input/preferences, review list of initial design questions and discuss additional information needs
- Review and confirm schedule

Recorded by: Rika Evans

Attendees: See attached Sign-in Sheet

Handouts: Agenda, Information Request List

Summary of Key Items Discussed

Key items discussed in the meeting and action items are summarized below. See page 4 for a list of action items. A copy of the .ppt slides presented during the meeting is attached to the minutes.

1. Notes on SEJPA Project Team
    - Mike Thornton, General Manager, will be involved throughout this project.
    - Chris Trees, Director of Operations, will be the point of contact for SEJPA.
    - Mike Konicke's involvement in this project during preliminary design will likely be limited. He is a Capital Improvement Project Manager and will be more involved, as the project moves towards construction.

- Mike Henke, Mechanical Systems Supervisor, will provide input on equipment selection, operations, and maintenance.
- Casey Larsen, SCADA Manager, will provide input on electrical and I&C elements of the project.
- Dale Kreinbring, Chief Plant Operator, will also provide input on the facility design.

2. Project Scope, Drivers & Goals
   - Project budget is more restricted. It is important to be cost effective on all fronts, including design activities, project scope, equipment selection, etc., and design towards the budget. Each decision will need to be carefully made by assessing cost impacts on related items (i.e., avoid domino effects).
   - Capital cost is currently a key focus in decision-making (more than life-cycle costs).
3. Key Design Elements
   a. Process
      - The current inflow rate is approximately 2.7 mgd, and the flow is not anticipated to increase in the foreseeable future, unless SEJPA acquires new services areas. Influent flow has actually been stagnant or dropped, even with the addition of some new service areas.
      - SEJPA typically operates both BFP units for ~7 hrs/day, Monday through Saturday, and on Sundays, only one unit is usually operated.
      - During COVID-19, the operation hours/shifts have been adjusted to longer shifts of 12 hours.
      - It is desirable to potentially eliminate the weekend operations. However, potential cost impacts of reducing operating hours should be considered.
      - The group generally agreed that optimizing the dewatering facilities around ~3 mgd, while assessing impacts on operating hours and redundancy upon potential future flow increase (up to the plant capacity of 5.25 mgd) will likely be a viable approach for sizing the facilities. Maximizing flexibility, while managing cost impacts, is important in developing the design criteria. The project team will present dewatering equipment sizing options for BFPs and centrifuges at the mechanical basis of design workshop. Impacts of feed solids concentrations (1.5% without Primary Sludge Thickening vs. 2% with potential future Primary Sludge Thickening) on equipment sizing will be assessed.
      - SEJPA may consider accepting food wastes in the future. When comparing the two dewatering technologies, if there are differences in their ability to handle food wastes, they should be considered in the evaluation.
      - Multiple manufacturers will be considered in developing equipment layouts. For example, dimensions/configuration of BFPs by BDP Industries is different from others (i.e., may not require a mezzanine level).
      - Cover options for the BFPs will be presented at the mechanical basis of design workshop, considering various factors such as odor control, corrosion control, costs and ease of operations (i.e., ability to see the cake, maintenance access, etc.).

   b. Process Mechanical
      - The single point(s) of failure in the system (e.g., screw conveyor) should be identified, and provisions to minimize the associated risks should be described in the preliminary design report (PDR).

- Sludge Feed Pumps - The seal water system for the sludge feed pumps is operated with recycled water. It was noted that a chlorine resistant rubber material should be specified. While this will likely be a low-cost impact item, it will be noted in the PDR as a detailed design consideration.
- Polymer - One type of polymer is currently used for both thickening and dewatering. The current annual polymer budget is approximately $75,000. SEJPA will be issuing an RFP (likely in the next several months) to polymer vendors to optimize polymer use. SEJPA is open to using different types of polymer for the two processes to optimize the overall performance, both financially and operationally. While the proposals in response to the RFP may not be available prior to completion of the PDR, the project team can incorporate flexibility into preliminary design by reserving space for a second tote for the possible configuration to use two polymer types.

c. Structural/Architectural
- SEJPA confirmed that it is desirable to convert the south double doors to a roll-up door. BV will start performing the structural analysis for the conversion.

d. Electrical
- NETA testing of MS-2 and MCC-H has not been performed yet. SEJPA has had difficulty identifying a contractor that can provide the testing services. BV will provide a list of recommended firms.
- Poor NETA testing results (e.g., insulation resistance compromised, corroded buses, etc.) would dictate the need for replacement of the tested equipment.
- It was noted that typical life expectancy of MCCs is approximately 30 years. Therefore, the existing equipment is at its typical life expectancy.
- It was clarified that if the MCC is to be replaced, all components of the MCC will be replaced.
- A preliminary load study will be prepared for both BFP and centrifuge options to identify required improvements. For the centrifuge option, MCC-H will likely require an upsized bus-tie and main breakers.
- It was noted that the size of the existing conduit from MS-2 to MCC-H is not shown on the record drawing set reviewed. SEJPA will investigate the two existing pull boxes along the duct bank route and provide the information. If the existing conduits are not large enough to house larger cables that may be required for the centrifuge option, the need for a new duct bank would likely result in significant cost impacts. A preliminary calculation reveals that a 4-inch conduit would be required to accommodate what is estimated to be the larger cables.
- It was noted that replacement of the MCC in place will be challenging during construction and but could be accomplished with well-planned sequencing and temporary equipment.
- SEJPA will provide a copy of the arc flash study, which was recently performed (a PDF copy was subsequently provided to BV).
- The rough order of magnitude (ROM) cost (equipment only without installation) for MCC-H and MS-2 may be in the range of $80,000 and $170,000, respectively.
- Benefits of what is known in the industry as a smart MCC include the ability to remotely start and stop process equipment and to monitor/collect operational data (such as current, voltage, etc.) via SCADA. The NEC clearance violations that currently exist at

both ends of MCC-H (i.e., sections 1 and 8) could also be mitigated by the new replacement MCC since fewer that eight vertical sections would be required.

e. I&C
- SEJPA indicated that Wonderware System Platform is the SCADA software currently used at SEWRF.
- SEJPA will provide the requested information (as noted in the attached information request).
- It was noted that it is desirable to receive more critical data points communicated between equipment local control panels and SCADA. BV will provide recommendations upon review of proposed equipment with local control panels.

4. Next Steps
- The project team will perform an analysis on dewatering equipment sizing based on the input received on flow rates, operating hours, redundancy, and other factors discussed. Recommended design criteria will be presented at the basis of design workshop.
- BV will coordinate with SEJPA to schedule bi-weekly meetings and the basis of design workshops. It was generally agreed that the team will attempt to schedule the first workshop (process/process mechanical) during the week of 2/1. SEJPA will provide a list of available time/dates to BV.
- BV will set up a file-sharing site for storage of information provided by SEJPA and to facilitate review of information to be developed by BV.

Action Items

Following are Action Items developed during the discussions:

No.	Description of Action	Responsible Party	Due Date
1.	Provide a list of recommended NETA testing contractors.	BV	as soon as practical
2.	Provide requested information.	SEJPA	In progress. Some information provided on 1/14. List updated with the status on each item in red. Additional items requested by BV indicated in blue.
3.	Schedule bi-weekly meetings.	BV	as soon as practical
4.	Schedule basis of design workshops.	BV	as soon as practical
5.	Set up a file-sharing site for storage of information provided by SEJPA and to facilitate review of information to be developed by BV.	BV	Completed. MS Teams site set up on 1/14.

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
1/13/2021
Kick-off Meeting

Meeting Purpose

The key objectives / outcome of this kick-off meeting are to:

- Review and confirm project scope, drivers, and goals based on work performed during the project definition phase and subsequent discussions
- Discuss project execution approach including collaborative decision making through workshops and meetings
- Discuss key design elements by confirming existing conditions and understanding of improvement objectives
- Obtain SEJPA input/preferences, review list of initial design questions and discuss additional information needs
- Review and confirm schedule

Agenda

1. Introductions / Project Team
2. Meeting Objectives
3. Project Scope, Drivers & Goals
4. Project Execution Approach
5. Key Design Elements
6. Schedule
7. Next Steps
8. Open Discussion
9. Recap of Action Items

BLACK & VEATCH

SEWRF Sludge Dewatering Facilities Upgrades

Preliminary Design Services

Kickoff Meeting
January 13, 2021

San Elijo Joint Powers Authority

SAN ELIJO | JOINT POWERS AUTHORITY

Agenda

- Introductions / Project Team
- Meeting Objectives
- Project Scope, Drivers & Goals
- Project Execution Approach
- Key Design Elements
- Schedule
- Next Steps
- Open Discussion
- Recap of Action Items

Introductions / Project Team

BV Project Team

- **Kevin Davis – Project Director**
- **John Bekmanis – Project Manager**
- **Rika Evans – Engineering Manager**
- **Scott Carr – Lead Process Engineer**
- **Keene Matsuda – Lead Electrical**
- **Andrew Franklin – Lead I&C**
- Mark Lowe – Lead Structural
- Phil Rishel – Lead Architect
- Lori Overhaug – Lead Process Mech
- Randy Cantrell – Lead Bldg. Mech
- Jervon Bond – Lead Chem Feed
- Shirley Edmondson – Lead Odor Control
- Lizzy Knox – Staff Engineer

SEJPA Project Team

- Mike Thornton – General Manager
- Chris Trees – Director of Operations
- Mike Konicke – Sr. Project Manager
- Mike Henke – Mechanical Systems Supervisor
- Casey Larsen – SCADA Manager

Black & Veatch 5

Meeting Objectives

Black & Veatch 6

Meeting Objectives

- Review and confirm project scope, drivers, and goals based on work performed during the project definition phase and subsequent discussions
- Discuss project execution approach including collaborative decision making through workshops and meetings
- Discuss key design elements by confirming existing conditions and understanding of improvement objectives
- Obtain SEJPA input/preferences, review list of initial design questions and discuss additional information needs
- Review and confirm schedule

Black & Veatch 7

Project Scope, Drivers, and Goals

Black & Veatch 8

Project Drivers

- Enable SEJPA to meet a level of service reliability consistent with Board and industry expectations
- Meet current and anticipated future regulatory requirements
- Improve operational efficiency and reduce operating costs

Black & Veatch 9

Project Scope

- Replacement of the exiting belt filter presses (BFPs) with new dewatering equipment (new BFPs or centrifuges)
- Installation of piping and appurtenances associated with new dewatering equipment

Black & Veatch 10

Project Scope (Continued)

- Rehabilitation and improvements to the existing Dewatering Building, including:
  - Resurfacing and recoating of steel framing and other metal components (including the outdoor hopper area)
  - Improvements to the ventilation and odor control systems
  - Architectural/structural improvements associated with installation/O&M of the new equipment

Project Scope (Continued)

- Replacement of the existing screw conveyor and associated hopper with new screw conveyor and new or rehabilitated hopper
- Modifications to the truck loading area structure, if required, to accommodate the improved dewatered cake conveyance and storage system
- Integrate new weight scale into the truck loading area

Project Scope (Continued)

- Installation of new dewatering feed pumps (to replace the existing pumps feeding the BFPs)

Project Scope (Continued)

- Upgrades to the existing polymer feed and storage facilities, including:
  - A new outdoor polymer storage area with configuration suitable for a tote and safe fork lift access and integration of the feed pump area within the containment
  - Replacement of the existing feeder blenders (for both thickening and dewatering processes) with a PLC based system

Project Scope (Continued)

- Building mechanical, electrical, instrumentation and control improvements associated with the upgrades
- Mechanical and electrical testing of MS-2 and MCC-H to be completed by SEJPA

Black & Veatch 15

Project Goals / Deliverables

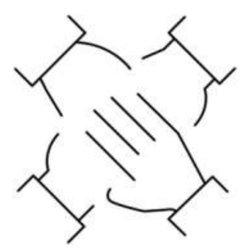
- Develop the basis of design collaboratively through workshops
- Document decisions (scope of improvements, assumptions, equipment recommendations, design criteria, general layouts, etc.) in a preliminary design report (PDR)
  - Introduction and Background
  - Existing Facilities, Scope of Improvements, Design Criteria, and Layout Drawings
  - Air Permitting and Title 22 Requirements
  - Preliminary Cost Estimate (Subconsultant, Cumming)

Black & Veatch 16

Project Execution Approach

Collaborative Approach

- Maintain communication and make decisions collaboratively. Meetings include:
  - Kickoff meeting (today)
  - Discipline focused workshops (3)
    - Process / mechanical
    - Structural / architectural
    - Electrical / I&C
  - PDR comment review meeting
  - Progress meetings (2)
  - Bi-weekly progress conference calls
- Project schedule to be updated as needed
- Monthly invoices and progress reports



Key Design Elements

Process – Key Criteria for Sizing

- Solids load
  - Near Future – 3.0 MGD Influent
  - Design Capacity – 5.25 MGD Influent
- Solids concentration
  - Affected by feed concentration to digestion. Historic data shows approximately 1.5% TS
    - ≥2% results in solids load controlling
    - <2% TS hydraulic load typically controls
  - Study assumed primary sludge thickening would be in place, resulting in >2% TS
- Hours of operation each week
- Redundancy requirements

Process - Design Criteria for Dewatering Equipment

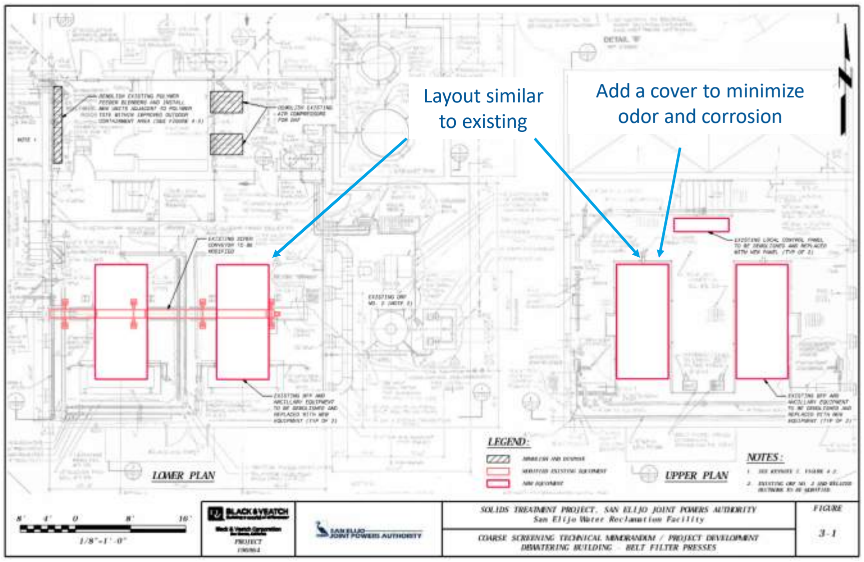
Design Condition	Average Annual		Max Month	
	(lb/day)	(gpd)*	(lb/day)	(gpd)*
3.0 MGD Influent Flow	5,980	47,800	6,580	52,600
5.25 MGD Influent Flow	10,450	83,500	11,495	91,900

*Based on historic average TS concentration of 1.5%

Process - Dewatering Technologies (BFPs and Centrifuges)

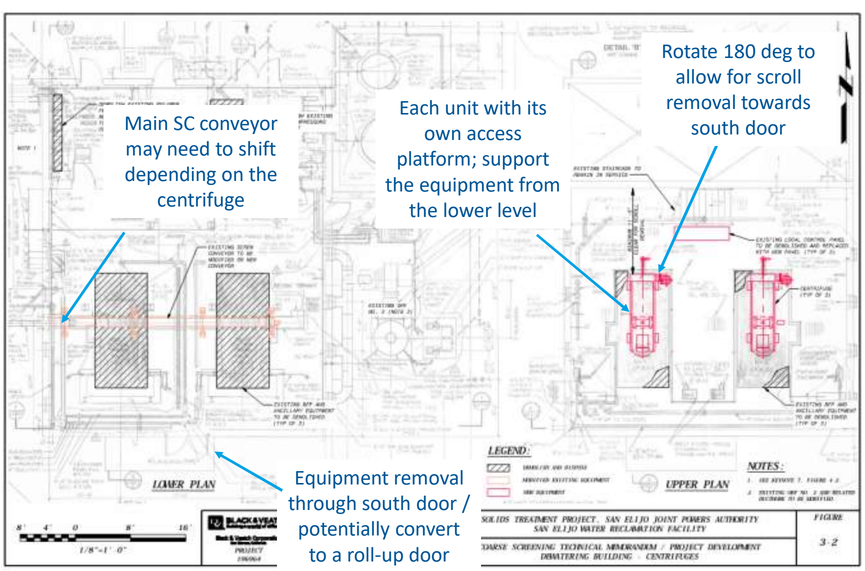
- Two options are to be evaluated in the PDR by comparing:
  - Capacity and hours of operation
  - Level of redundancy provided
  - Equipment layout - assess required improvements for equipment maintenance/removal
  - Capital and O&M costs
  - Preliminary electrical load study (higher loads for centrifuges) - assess required improvements
- Design criteria to be developed for each option (i.e. preliminary equipment sizing, list of ancillary equipment, etc.)

Process Mechanical – BFP Layout



- Manufacturer preference, if any
- Size
- Roller removal / O&M access
- Major equipment removal through the skylight opening

Process Mechanical – Centrifuge Layout



- Manufacturer preference, if any
  - Centrisys pilot testing performed in 2019
- Size / quantity
- Scroll removal / O&M access
- Equipment support / mezzanine configuration

Process Mechanical – Screw Conveyor, Hopper, and Platform

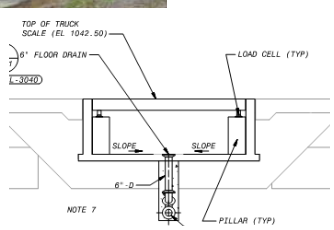
- Screw conveyor
  - Replace existing conveyor
  - May need to modify penetration location for the centrifuge option
- Hopper
  - New hopper recommended
- Re-use the truck loading structure to the greatest extent practical with minimum structural mods

Black & Veatch 25

Process Mechanical / Civil – Truck Scale

- Assess feasibility of integrating into the existing loading area
- 10’ of level concrete approach pad required at entrance and exit

Above-grade



Pit

Black & Veatch 26

Process Mechanical – Sludge Pumps

- Would SEJPA consider keeping the existing pumps if the design point works with the new equipment and add a gear reduction or belt drive with a VFD and inverter duty motor?
- Manufacturer preference for new PC pumps, if any
- Seal water system

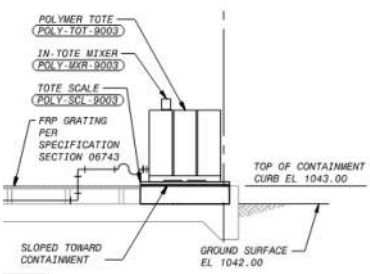
Black & Veatch 27

Process Mechanical - Odor Control

- Treat foul air directly from the equipment
  - Centrifuge – enclosed
  - BFP – "turtle shell" cover recommended
- Modifications to the existing equipment, ductwork to be identified
- Existing scrubber vessel to be reused

Black & Veatch 28

Process Mechanical – Polymer Storage and Feed



- Same polymer (Clarifloc WE-007) currently used for both thickening and dewatering (~300 to 580 gallons/month total)
- Tote quantity – currently one but may want to consider multiple, especially, if a different type polymer will be used for centrifuges
- Containment volume / depth
- Manufacturer preference for the feeder-blenders, if any
  - BV spec lists UGSI, Prominent or Velodyne

Building Mechanical – HVAC and Plumbing

- Ventilation improvements for the Dewatering Building
- Plumbing modifications are anticipated to be minimal
- A new emergency fixture likely required for the new outdoor polymer storage/feed area
- Confirm that the building retrofit will not trigger a requirement for a fire protection system

Structural

- Assess required improvements to allow for installation of new dewatering equipment (e.g. support of the new equipment loads, modifications to the mezzanine level, re-configuration or removal of the staircase and handrails, etc.)
- Seismic review for the existing Dewatering Building to assess the impacts of the potential improvements (e.g. enlargement of a door opening and/or relocation of the existing screw conveyor wall penetration)
- Confirm that minimal structural modifications will be required for the truck loading structure

Architectural

- Re-location, re-configuration, or removal of the staircase associated with the new dewatering equipment, if required
- Potential improvements to the existing doors (e.g. replacement of a double door with a roll-up door) to facilitate installation and maintenance of new dewatering equipment
- Potential louver modifications, if required, associated with the ventilation and odor control system upgrades
- Replacement of the existing doors, louvers, windows and screens, as necessary, due to age, wear, corrosion, and aesthetics
- Assumed that the existing skylights may be replaced with a removable type, but re-configuration or relocation of the skylights will not be required

Electrical

- Need results of full NETA electrical testing of MCC-H and MS-2 (feeder breaker to MCC-H) prior to developing the basis of design
- Preliminary load study to be prepared for the centrifuge option to identify required improvements to the existing electrical system
  - MCC-H does have electrical capacity (bus) and physical space (buckets) for new centrifuge loads
  - Centrifuge VFDs likely in separate local control panel
  - MCC-H will need upsized bus-tie and main breakers
  - Investigate cables/conduit from MS-2 to MCC-H

Black & Veatch 33

Electrical (Continued)

- Assumed that existing light fixtures, light switches, duplex receptacles, exposed electrical conduits, and associated electrical equipment within the Dewatering Building will be replaced
- Existing panel VC-2 (located directly in front of Section 8 of MCC-H) to be re-located to achieve the required minimum clearance in front of MCC-H in accordance with the NEC

Black & Veatch 34

Instrumentation and Controls

Scope:

- Preliminary design level P&IDs and control system block diagram to be developed
- Preliminary control descriptions to be developed

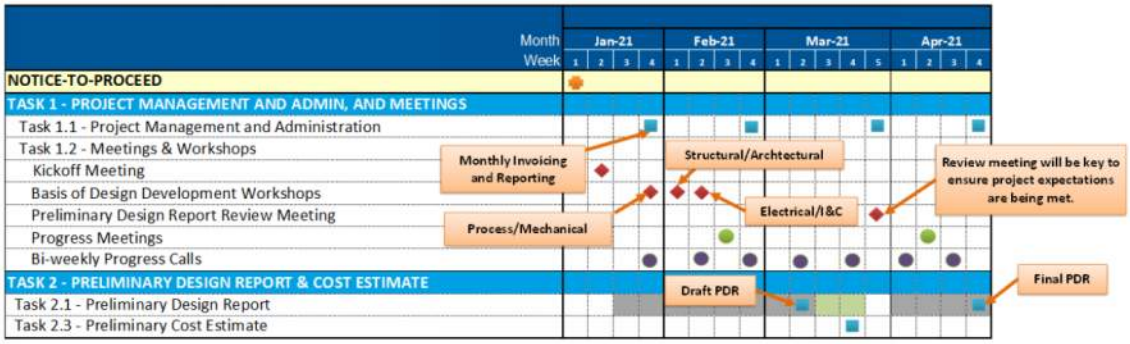
Requesting Information:

- Latest SCADA/PLC/Instrumentation standards and/or preferences
- Existing network architecture diagram
- Existing PLC schematics and IO lists
- Existing control strategies
- Existing instrument index
- 1994 P&ID Legend and Abbreviations sheet

Other

- Existing yard piping between the dewatering feed pumps and the Dewatering Building to be re-utilized (to be confirmed upon review of pipe size and flow rates)
- No land surveying
- Temporary facilities/measures required to maintain operations of the dewatering facilities during construction to be assessed
  - SEJPA initial thoughts on location

Schedule



LEGEND
- Notice-to-Proceed
- Meetings
- Deliverable
- Progress Meetings
- Bi-weekly Progress Calls
- Black & Veatch Work
- SEJPA Review

NOTES:
1) Project duration of 4 months is assumed.

Next Steps

Initial Coordination Items / Actions / Next Steps

- B&V
  - Send information request to SEJPA (initial request sent 1/8/2021)
  - Review information provided by SEJPA
  - Schedule basis of design workshops and bi-weekly meetings

- SEJPA
  - Mechanical and electrical testing of MS-2 and MCC-H
  - Provide information requested
  - Safety related forms / COVID-19 protocol for site visits?

Discussion.

SEWRF DEWATERING FACILITIES UPGRADES
PRELIMINARY DESIGN
MEETING SIGN IN SHEET

Meeting Date: 1/13/2021
Meeting Time: 2:00 PM – 4:00 PM
Meeting Location: MS Teams
Meeting Topic: Kick-off Meeting

SEJPA Attendees:

Name	Email	Phone	Attendance
Mike Thornton	thornton@sejpa.org	+17607536203 X72	x
Chris Trees	treesc@sejpa.org	+17607536203 X70	x

Black & Veatch Attendees:

Name	Email	Phone	Attendance
John Bekmanis	BekmanisJT@bv.com	+17606218421	x
Scott Carr	CarrJS@bv.com	+19134584240	x
Rika Evans	EvansR@bv.com	+17606218533	x
Andrew Franklin	FranklinAC@bv.com	+19134583288	x
Keene Matsuda	MatsudaKM@bv.com	+19497884291	x

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MEETING MINUTES

San Elijo Joint Power Authority (SEJPA)	B&V Project 407556
San Elijo Water Reclamation Facility	B&V File 14.1200
Dewatering Facilities Upgrades	Meeting held on: 2/9/2021
Process Mechanical Workshop	

To: Michael Thornton, PE
Chris Trees, PE

From: John Bekmanis, PE
Rika Evans, PE

Meeting Purpose

The Process Mechanical Workshop was held virtually on February 9, 2021 to discuss process and mechanical design elements of the preliminary design for the San Elijo Water Reclamation Facility (SEWRF) Dewatering Facilities Upgrades project. The key objectives / outcome of the meeting were to:

- Discuss key process and mechanical design elements
- Obtain SEJPA input / preferences on equipment options, design criteria, and other key items
- Identify follow-up assessments needed, if any, to make decisions on the basis of design

Recorded by: Rika Evans

Attendees: See attached Sign-in Sheet

Handouts: Agenda

Summary of Key Items Discussed

Key items discussed in the meeting and action items are summarized below. See page 4 for a list of action items. A copy of the .ppt slides presented during the meeting is attached to the minutes.

1. Dewatering Technology Options
    - SEJPA requested information on how the belt replacement cost compares between the 2-belt and 3-belt systems. BV will obtain the requested information from the vendors.
    - SEJPA noted that the target operating condition (system throughput for the 5 day/wk, 7 hrs/day operation) should be shown on the BFP options, centrifuge options, and the comparisons tables to facilitate the understanding of how the calculated operating time compares with the target. The tables should also clearly identify which dewatering units can meet the target operating schedule. BV will update the tables.
    - SEJPA requested life cycle cost comparison of different BFP and centrifuge options for coarse screening. BV will provide the information.

- It was noted that washwater usage is a key factor, as it impacts the sale of recycled water. BV will provide information on washwater usage for the BFP and centrifuge options.

2. Screw Conveyors
   - SEJPA requested the cost of a parallel main screw conveyor to evaluate potential cost of avoiding a single point of failure. It was noted that the cost of the existing system was approximately $250K (including installation). If a single point of failure is possible, then a contingency plan should also be developed for a scenario when the unit fails or is down for maintenance in the future.
3. Sludge Feed Pumps
   - SEJPA noted that the sludge pump that is currently being replaced is equipped with VFD.
4. Truck Scale
   - SEJPA indicated that the scale will need to be located below the hopper to monitor truck loading of the sludge. Currently, SEJPA staff has to move the truck to weigh. It is desirable to install an above-grade scale similar to the existing one but longer or in two segments (front and back) to minimize impacts on the tower foundation.
5. Polymer Storage and Feed
   - BV will provide information on the maximum allowable distance between the polymer storage and feed facility and feed points (i.e. DAF and dewatering units). SEJPA will identify potential alternative locations for the polymer storage facility.
   - It was agreed that a mixing system will be provided for continuous tote mixing to prevent oil/liquid separation and formation of fish-eyes.
6. Next Steps
   - BV will coordinate with SEJPA to schedule a site visit to review the existing odor control system and discuss potential improvement options.

Action Items

Following are Action Items developed during the discussions:

No.	Description of Action	Responsible Party	Due Date
1.	Provide belt replacement cost comparison between the 2-belt and 3-belt systems.	BV	To be provided with the life cycle cost comparison
2.	Provide updated summary tables for BFP and centrifuge options.	BV	Provided on 2/16/2021
3.	Provide life cycle cost comparison of different BFP and centrifuge options for coarse screening.	BV	2/25/2021

No.	Description of Action	Responsible Party	Due Date
4.	Provide washwater usage comparison for the BFP and centrifuge options.	BV	To be provided with the life cycle cost comparison
5.	Provide the cost of a parallel main screw conveyor.	BV	To be provided with the life cycle cost comparison
6.	Provide information on the maximum allowable distance between the polymer storage and feed facility and feed points.	BV	2/19/2021
7.	Schedule a site visit to review the existing odor control system and discuss potential improvement options.	BV	Scheduled for 2/25 at 9:30 am.

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
2/9/2021
Process Mechanical Workshop

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Discuss key process and mechanical design elements
- Obtain SEJPA input / preferences on equipment options, design criteria, and other key items
- Identify follow-up assessments needed, if any, to make decisions on the basis of design

Agenda

1. Meeting Agenda / Objectives
2. Dewatering Equipment
   a. Capacity assessment
   b. Belt filter presses (2-belt and 3-belt systems)
   c. Centrifuges
   d. Equipment maintenance / access
3. Screw Conveyor(s)
   a. Main conveyor to the hopper (type, key design criteria, location, etc.)
   b. Inclined screw conveyor for each centrifuge unit for slop management
4. Hopper
   a. Recommended type / configuration for a new hopper
   b. Benefits of a new hopper vs. rehabilitation
5. Sludge Feed Pumps
   a. Design point of the existing pumps vs. the range of design points being considered
6. Truck Scale
   a. Scale size
   b. Above grade vs. pit
   c. Location
7. Polymer Feed
   a. Location and general configuration
8. Open Discussion
9. Recap of Action Items

SEWRF DEWATERING FACILITIES UPGRADES
PRELIMINARY DESIGN
MEETING SIGN IN SHEET

Meeting Date: 2/9/2021
Meeting Time: 12:00 PM – 2:00 PM
Meeting Location: MS Teams
Meeting Topic: Process Mechanical Workshop

SEJPA Attendees:

Name	Email	Phone	Attendance
Mike Thornton	thornton@sejpa.org	+17607536203 X72	x
Chris Trees	treesc@sejpa.org	+17607536203 X70	x

Black & Veatch Attendees:

Name	Email	Phone	Attendance
John Bekmanis	BekmanisJT@bv.com	+17606218421	x
Jervon Bond	BondJ@bv.com	+19134581508	x
Scott Carr	CarrJS@bv.com	+19134584240	x
Kevin Davis	DavisKN@bv.com	+17606218419	x
Rika Evans	EvansR@bv.com	+17606218533	x
Lori Overhaug	OverhaugL@bv.com	+19134583048	x

SEWRF Sludge Dewatering Facilities Upgrades

Preliminary Design Services

Process / Mechanical Workshop
February 9, 2021

San Elijo Joint Powers Authority

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1

Agenda

- Introductions
- Meeting Agenda / Objectives
- Dewatering Equipment (Capacity, Options, etc.)
- Screw Conveyor(s)
- Hopper
- Sludge Feed Pumps
- Truck Scale
- Polymer Feed
- Open Discussion
- Recap of Action Items

Black & Veatch 2

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Introductions / Project Team

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On the Phone Today

- John Bekmanis – Project Manager
- Rika Evans – Engineering Manager
- Scott Carr – Lead Process Engineer
- Lori Overhaug – Lead Process Mech
- Jervon Bond – Lead Chem Feed
- Lizzy Knox – Staff Engineer

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Meeting Objectives

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Meeting Objectives

- Discuss key process and mechanical design elements
- Obtain SEJPA input / preferences on equipment options, design criteria, and other key items
- Identify follow-up assessments needed, if any, to make decisions on the basis of design

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Key Design Elements

Loading Rate Requirements (3.0 MGD Influent)

Max Month (MM) Loading

- 6,580 lb/day
- 52,600 gal/day

Average Annual (AA) Loading

- 5,980 lb/day
- 47,000 gal/day

Days/Wk	Hrs/Day	MM Throughput			AA Throughput		
		(gpm)		(lb/hr)	(gpm)		(lb/hr)
		1.5% TS	2.0% TS		1.5% TS	2.0% TS	
5	7	175	132	1,316	157	120	1,200
5	11	112	84	838	100	76	761
6	7	146	110	1,100	131	100	1,000
6	11	93	70	700	83	64	634

Dewatering Technologies Considered

Belt Filter Presses

- BDP
  - 2VP (standard 2-belt unit)
  - 3DP unit (3 belt unit)
- Alfa Laval
  - Winklepress 84 (standard 2-belt unit)
    1.5 m unit no longer available
  - Klampress (3 belt unit)

Centrifuges

- Centrisys
  - CS21
  - CS18
- Alfa Laval
  - Aldec 115
  - Aldec 75

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BFP Options – Max Month Operating Conditions

Mfr	Model	Manufacturer Rated Capacity per Unit	Unit Design Throughput*	Operating Time		Units Operating	Equip. Cost ($)	% Cake Solids	Polymer Use (active lb/ton)
				days/wk	hrs/day				
BFPs									
BDP	2VP (2 belt) 1.5m	1,125 lb/hr 180 gpm	845 lb/hr 113 gpm	5 5	6 11	2 1	$827,000	~20-22 %	15 – 25
BDP	2VP (2 belt) 2.0m	1,500 lb/hr 240 gpm	1,126 lb/hr 150 gpm	5 5	4 8	2 1	$948,000	~20-22 %	15 – 25
BDP	3DP (3-belt) 1.0m	2,000 lb/hr 300 gpm	638 lb/hr 85 gpm	5 5	8 15	2 1	$777,000	~21-23 %	15 – 25
BDP	3DP (3-belt) 1.5m	3,000 lb/hr 450 gpm	950 lb/hr 127 gpm	5 5	5 10	2 1	$888,000	~21-23 %	15 - 25
Alfa Laval	KPZ (3-belt) 1.5 m	1,275 lb/hr 175 gpm	950 lb/hr 127 gpm	5 5	5 10	2 1	$700,000	~21-23 %	15 - 25

*Basis of design capacity assumption for BFPs (based on feed solids concentration of 1.5%)
2-belt units = 750 lb/hr/m (563 lb/hr/m @ 75% loading used)
3-belt units = 850 lb/hr/m (638 lb/hr/m @ 75% loading used)

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Centrifuge Options - Max Month Operating Conditions

Mfr	Model	Manufacturer Rated Capacity per Unit	Design Throughput*	Operating Time days/wk	Operating Time hrs/day	Units Operating	Equip. Cost ($)	% Cake Solids	Polymer Use (active lb/ton)
Centrifuges									
Centrisys	CS18	1,485 lb/hr 100 gpm	560 lb/hr 75 gpm	5 6	9 14	2 1	$667,000	~22-24 %	15 – 30
Centrisys	CS21	2,430 lb/hr 175 gpm	975 lb/hr 130 gpm	5 6	5 8	2 1	$722,000	~22-24 %	15 - 30
Alfa Laval	Aldec 75	863 lb/hr 115 gpm	645 lb/hr 86 gpm	5 6	8 12	2 1	$550,000	~22–24 %	15 - 30
Alfa Laval	Aldec 115	1,726 lb/hr 230 gpm	1,310 lb/hr 175 gpm	5	7	1	$900,000	~22–24 %	15 - 30

*Basis of design capacity assumption for centrifuges is based on 75% of manufacturer's max throughput (hydraulics loading controls @ 1.5 % TS)

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Comparisons – Max Month Operating Conditions

Mfr	Model	Rated Capacity per Unit	Design Throughput	Operating Time days/wk	Operating Time hrs/day	Units Operating	Equip. Cost ($)	% Cake Solids	Polymer Use (active lb/ton)
Centrifuges									
Centrisys	CS18	1,485 lb/hr 100 gpm	560 lb/hr 75 gpm	5 6	9 14	2 1	$667,000	~22-24 %	15 – 30
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BFPs									
BDP	2VP (2 belt) 1.5m	1,125 lb/hr 180 gpm	845 lb/hr 113 gpm	5 5	6 11	2 1	$827,000	~20-22 %	15 – 25
BDP	3DP (3-belt) 1.0m	2,000 lb/hr 300 gpm	638 lb/hr 85 gpm	5 5	8 15	2 1	$777,000	~21-23 %	15 – 25
BDP	3DP (3-belt) 1.5m	3,000 lb/hr 450 gpm	950 lb/hr 127 gpm	5 5	5 10	2 1	$888,000	~21-23 %	15 - 25

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Comparisons – Electrical

Mfr	Model	Drive / Hydraulic Power Unit / Booster Pump HP per Unit	Total (HP)
Centrifuges			
Centrisys	CS18	Main Drive – 40 HP Back Drive – 10 HP	100
Centrisys	CS21	Main Drive – 60 HP Back Drive – 15 HP	150
Alfa Laval	Aldec 75	Main Drive – 50 HP Back Drive – 7.5 HP	115
BFPs			
Alfa Laval Existing Units	WP84 (2 belt) 1.5m	Hydraulic Power Unit - 3 HP Wash Water Booster Pump - 5 HP BFP Drives - 3 HP, 2 per unit	28
BDP	2VP (2 belt) 1.5m	Hydraulic Power Unit - 2 HP Wash Water Booster Pump – 7.5 HP	19
BDP	3DP (3-belt) 1.0m	Hydraulic Power Unit - 2 HP Wash Water Booster Pump – 7.5 HP	19
BDP	3DP (3-belt) 1.5m	Hydraulic Unit - 2 HP Wash Water Booster Pump - 10 HP	24

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Equipment Maintenance

- BFP
  - GBT section is at low operator height
  - Jib crane and a 4-step rolling ladder could be used for roller maintenance
  - Mezzanine not required

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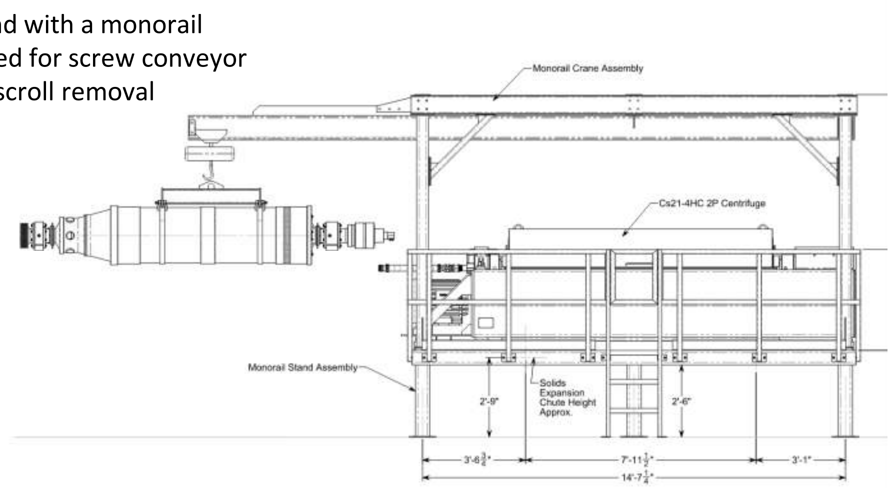
Equipment Maintenance

- Centrifuge
  - An elevated stand with a monorail assembly required for screw conveyor installation and scroll removal



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Screw Conveyor – Main Conveyor

- Lower maintenance than pumps
- One main conveyor can connect to multiple inclined conveyors
- A scissor lift is typically used to maintain/replace liner
- One unit to be provided
  - Single point of failure
  - System temporarily down during maintenance (e.g. liner replacement)

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Screw Conveyor – Slop Management

- Inclined Screw Conveyor
  - Reversing screw during startup
  - Ease of operation
- Diverter Gates
  - Requires lots of vertical height for proper operation
  - Valves need to time to open/close

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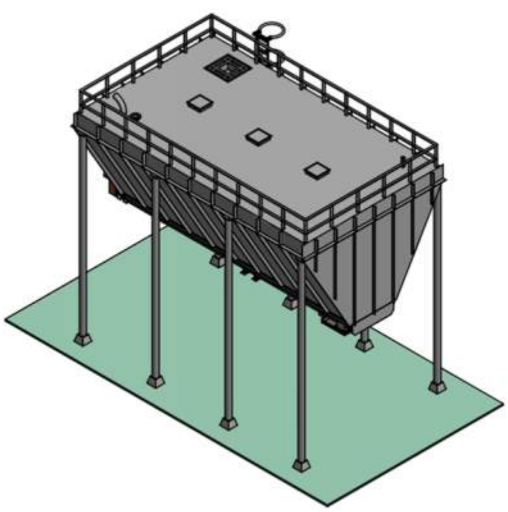
Hopper



- Live Bottom Bin
  - Screw in the bottom of the bin
  - Multiple discharge points
  - More storage

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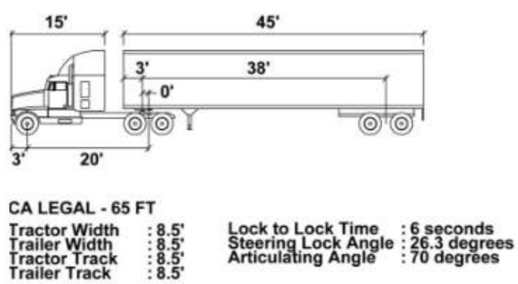
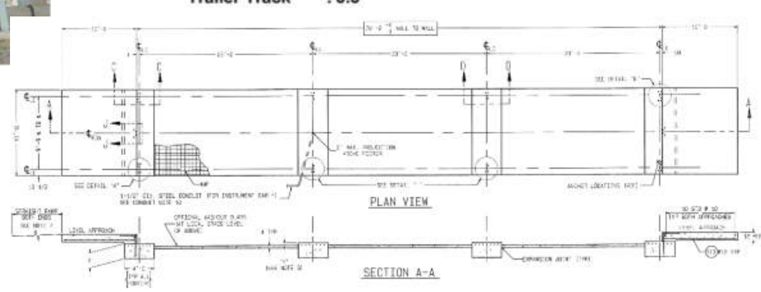
Sludge Feed Pumps

- Sludge feed pumps
  - Currently in the process of replacing 1 of 3 existing pumps
  - 160 gpm at 60 psi (per recent submittal)
  - Proposed design 75 to 130 gpm
  - Potentially reuse the existing pumps (especially the one being replaced)
  - Operation of the existing Reeves adjustable speed drives not reliable
  - Replacement of the existing drive with a new gear reduction or belt drive system with VFD recommended
  - Replace older pumps and provide a new drive and VFD
- Reuse existing 4” digested sludge feed piping (2 piping in parallel)

Truck Scale – Size

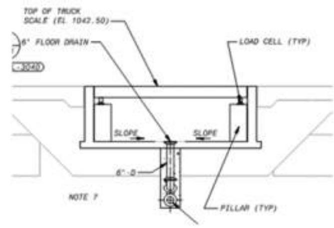




Truck Scale – Above-grade or Pit

Above-grade

Pit



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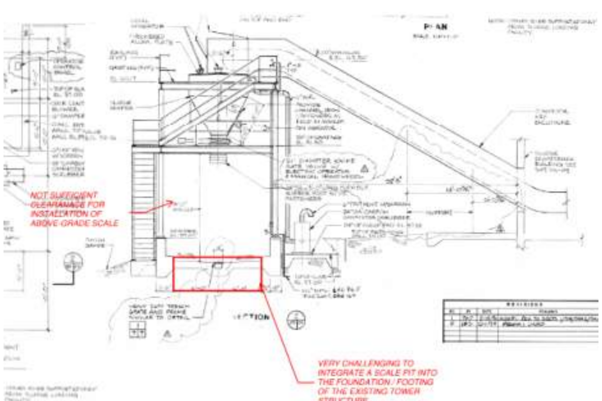
Truck Scale - Location



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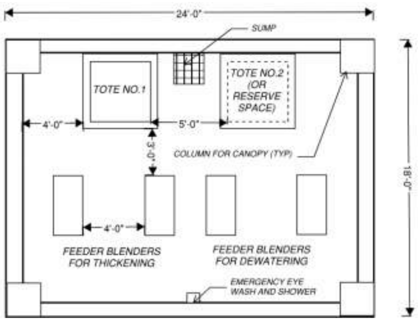
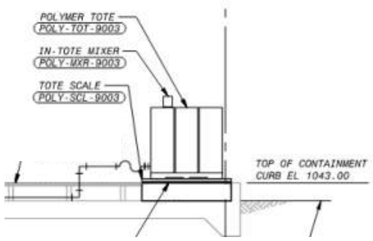
Polymer Storage and Feed – General Requirements





- Possibly use two types of polymer for thickening and dewatering
- At minimum leave space for a second tote
- Tote system components
  - In-tote mixer
  - Tote scale
- Feeder blenders (2 for thickening, 2 for dewatering)
  - Progressive cavity pumps
  - Secondary dilution panel?

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Polymer Storage and Feed – General Requirements

- Single polymer tote replacement frequency
  - Approx. 100 Active ppd of polymer usage
  - Approx. 8 days of storage per tote
- Tote mixer handling method
  - Manual
    - Requires two operators
  - Forklift
  - Allocate space for mounting mixer bracket when mixer is not in use
    - Wall Mount
    - Free Standing

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Polymer Storage and Feed - Location

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Next Steps

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Next Steps

- B&V
  - Odor control site visit
  - Odor control / HVAC meeting
  - Structural / Architectural Workshop
- SEJPA
  - NETA testing
  - Additional input on information provided today

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Discussion.

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SAN ELIJO | JOINT POWERS AUTHORITY

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades
Odor Control Meeting

B&V Project 407556
B&V File 14.1200
Meeting held on: 3/10/2021
Minutes issued on: 3/19/2021

To: Michael Thornton, PE
Chris Trees, PE

From: John Bekmanis, PE
Rika Evans, PE

Meeting Purpose

The Odor Control Meeting was held virtually on March 10, 2021. The key objectives / outcome of this meeting were to:

- Review existing odor control system and operations
- Define impact of dewatering technologies on odor control
- Discuss options for dewatering equipment containment of foul air
- Present options for odor control improvements
- Address potential impacts to SDAPCD permit

Recorded by: Rika Evans and Shirley Edmondson

Attendees: See attached Sign-in Sheet

Handouts: Agenda

Summary of Key Items Discussed

Key items discussed in the meeting and action items are summarized below. See pages 2 and 3 for a list of action items. A copy of the .ppt slides presented during the meeting is attached to the minutes.

1. Existing odor control system
    a. Based on the review of daily logs recording inlet and outlet hydrogen sulfide (H_2S) concentrations from December 2020 through February 2021, the H_2S removal efficiency of the existing packed tower scrubber averaged 0%. While the system is not providing treatment under current operation, the inlet and outlet H_2S concentrations for the scrubber are lower than the permit limit of 1 ppm.
    b. Based on the record drawings, the existing odor control system was initially designed to treat 6,600 cfm from the dewatering building. Additional sources (i.e. dissolved air flotation thickeners and flow equalization basins) with dedicated in-line fans were later added with the San Diego Air Pollution Control District (SDAPCD) permit noting an

approximate airflow of 5,200 cfm from the building. The actual air flow rate from each source is presently unknown.

c. The existing odor control system operates in recirculation mode with non-potable water; the chemical feed and storage facilities have been abandoned or demolished. The system is functional and in fair condition. Some corrosion and delamination is present, but no major rehabilitation is needed to continue the current mode of operation.

d. SEJPA noted that ferric chloride is periodically added at the digesters to control H_2S.

2. Odor control considerations for dewatering equipment alternatives

    a. Out of the odor containment options presented for belt filter presses (BFPs), it was generally agreed that the gravity deck enclosure (i.e. turtle shell) would be the most desirable option for SEJPA, as it provides better equipment access compared to the full enclosure option, while containing emissions. Ventilating at a high air exchange rate helps prevent fugitive emissions when access hatches are opened.

    b. Compared to the full containment that centrifuges provide, the building environment is anticipated to be significantly less desirable with BFPs even with the gravity deck or full enclosure options.

    c. BV will verify the design air flow rate for each centrifuge model being considered.

    d. An overview of ventilation and containment strategies were presented for BFPs and centrifuges. These strategies accounted for the following scenarios: building treatment only; combing building and contained process air for treatment; and contained process air treatment with separate building ventilation.

    e. Even with the full enclosure options (BFPs with full enclosure or centrifuges), SEJPA's preference is to treat the building space with the scrubber. It was also noted that the odor control approach that minimizes modifications to the existing scrubber system is generally preferred.

3. Odor control options

    a. Odor control options considered exhaust volume and level of treatment. The following three options were assessed:

        i. Similar airflow to odor control system while continuing to operate as a water scrubber (with minimal to no H_2S treatment expected).

        ii. Reduced airflow to odor control system while continuing to operate as a water scrubber.

        iii. Reduced airflow to odor control system while making modifications to operate as a biological scrubber. Based on SEJPA's input above (2.e), this option will not be further evaluated.

    b. Regardless of dewatering technology selected, the odor control option for similar airflow to the odor control system is preferred.

4. Next steps
    a. BV will incorporate the discussions/outcome of this meeting into the dewatering technology comparison summary and facilitate the decision making.
5. Other items
    a. Door/access options to facilitate scroll removal for centrifuges were discussed. It was agreed that the following two options will be assessed:
        i. Replace the existing double door with a 12’ wide, 13’ tall roll up door (to be located in between the two centrifuges) and add a man-door
        ii. Add a standard double door directly in front of each centrifuge (to replace the existing double door). Utilize a forklift extension or low profile/narrow receiving bed of a small utility cart/vehicle to pick up the scroll (while the cab stays outside)

Action Items

Following are Action Items developed during the discussions:

No.	Description of Action	Responsible Party	Due Date
1.	Verify design foul air treatment flow rate for the centrifuge models being considered.	BV	3/16/21
2.	Incorporate the discussions/outcome of this meeting into the dewatering technology comparison summary and facilitate the decision making.	BV	3/16/21

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SAN ELIJO | JOINT POWERS AUTHORITY

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
3/10/2021
Odor Control Meeting

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Review existing odor control system and operations
- Define impact of dewatering technologies on odor control
- Discuss options for dewatering equipment containment of foul air
- Present options for odor control improvements
- Address potential impacts to SDAPCD permit

Agenda

1. Introductions
2. Overview of existing odor control system
3. Key elements of odor control design
4. Odor control considerations for dewatering equipment alternatives
5. Odor control options
6. San Diego Air Pollution Control District (SDAPCD) permit considerations
7. Next steps
8. Open discussion
9. Recap of action items

SEWRF DEWATERING FACILITIES UPGRADES
PRELIMINARY DESIGN
MEETING SIGN IN SHEET

Meeting Date: 3/10/2021
Meeting Time: 1:00 PM – 2:00 PM
Meeting Location: MS Teams
Meeting Topic: Odor Control Meeting

SEJPA Attendees:

Name	Email	Phone	Attendance
Mike Thornton	thornton@sejpa.org	+17607536203 X72	x
Chris Trees	treesc@sejpa.org	+17607536203 X70	x

Black & Veatch Attendees:

Name	Email	Phone	Attendance
John Bekmanis	BekmanisJT@bv.com	+17606218421	x
Kevin Davis	DavisKN@bv.com	+17606218419	x
Shirley Edmondson	EdmondsonS@bv.com	+17606218506	x
Rika Evans	EvansR@bv.com	+17606218533	x
Lynne Moss	MossLH@bv.com	+15122716244	x

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SEWRF Sludge Dewatering Facilities Upgrades

Preliminary Design Services

Odor Control Workshop
March 10, 2021

San Elijo Joint Powers Authority

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Agenda

- Introductions
- Overview of existing odor control system
- Key elements of odor control design
- Odor control considerations for dewatering equipment alternatives
- Odor control options
- San Diego Air Pollution Control District (SDAPCD) permit considerations
- Next steps
- Open discussion
- Recap of action items

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Introductions

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B&V Staff On the Phone Today

- Kevin Davis – Client Director
- John Bekmanis – Project Manager
- Rika Evans – Engineering Manager
- Shirley Edmondson – Lead Odor Control Process Engineer
- Lynne Moss – Residuals and Odor Control Practice Leader

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Meeting Objectives

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Meeting Objectives

- Review existing odor control system and operations
- Define impact of dewatering technologies on odor control
- Discuss options for dewatering equipment containment of foul air
- Present options for odor control improvements
- Address potential impacts to SDAPCD permit

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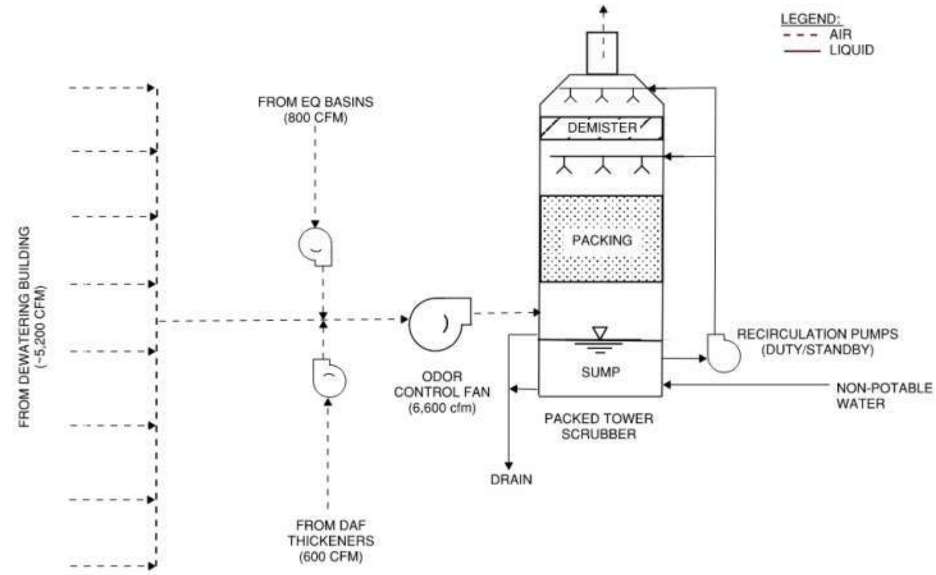
Existing Odor Control System

Summary of Existing Scrubber

Parameter	Value
Technology	Packed tower scrubber
Exhaust Rate, cfm	6,600
Diameter, ft	5
Packing Depth, ft	10
Packing Type	Plastic, random pack
EBRT, sec	1.8
Water Supply	Non-potable
Inlet H_2S Concentration, ppm*	Average: 0.2 ppm Peak: 0.7 ppm
H_2S Removal Efficiency*	0%

** Based on daily logs from November 2020 through February 2021*

Existing Odor Control System Schematic



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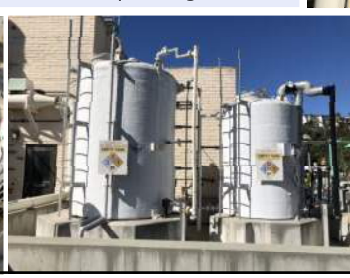
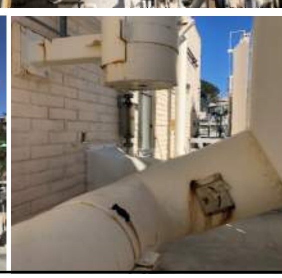
Existing System Condition

Component	Condition
Scrubber Vessel	Good
Main Odor Control Fan	Good; recently rebuilt after failure
Recirculation Pumps	Visible Corrosion
Chem Storage and Feed System	Non-operational
Foul Air Duct	Good; some delamination present
Internal Elements	Unknown; consider inspecting





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Key Elements of Odor Control Design

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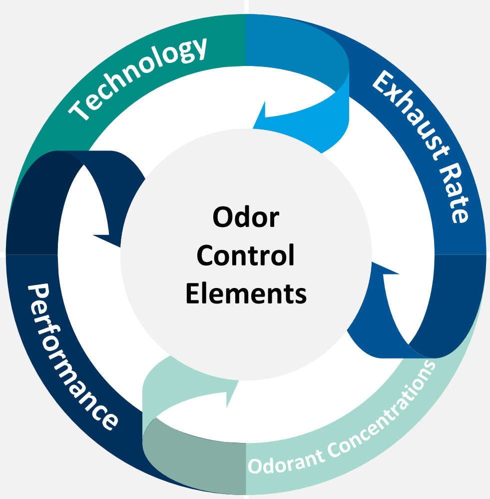
Odor Control Design Criteria

Technology
- Initial design: chemical scrubber
- Current operation: non-potable water scrubber

Exhaust Rate
- Dependent upon sources to be treated and dewatering equipment/containment selected
- Often guided by NFPA 820



Performance
- Typical odor control systems offer >99.5% H_2S or <0.5 ppm at the outlet
- Permit limit = 1 ppm at odor control exhaust

Odorant Concentrations
- Focus on H_2S
- Odor threshold = 0.0005 ppm
- Inlet H_2S concentration = 0.2 ppm average/ 0.7 ppm peak
- No discernable difference when measured directly above BFP gravity deck

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Exhaust Rate Determination

- NFPA 820 – stipulates electrical classification based on air exchange rate
  - 6 ac/hr → unclassified
  - < 6 ac/hr → Class I Div 2
- WEF Manual of Practice No. 25 – guidance for worker accessible spaces
  - Worker accessible spaces → 12 ac/hr

Preliminary Recommendation for Dewatering Building:

- Belt filter press: 12 ac/hr for worker safety and to reduce corrosion potential
- Centrifuge: minimum 6 ac/hr to allow for unclassified space
- Process exhaust rate will vary upon equipment and containment type

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Odor Control Considerations For Dewatering Equipment Alternatives

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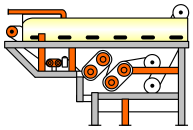
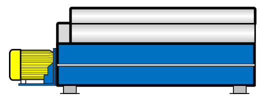
Key Consideration: Containment

Belt Filter Presses



Centrifuges



	Belt Filter Press Alternative	Centrifuge Alternative
Enclosed	No	Yes
Odor concerns	Emissions from gravity deck • Room environment • Escape from building	Minimal
Containment options	• None • Hoods • Curtains • Gravity deck enclosure • Full enclosure	None needed

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BFP Containment Options – No Containment

- Current operation has no containment
- Advantage
  - Best access
  - No modification to current airflow rates
- Disadvantages
  - Poor control of worker environment
  - Large volume of generally low strength exhausts to treatment = $$$

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BFP Containment Options - Hoods

- Typically
  - Provided 2’ to 4’ above gravity deck
  - Extend across BFP footprint (usually)
  - Use hood to exhaust building
- Poor capture a concern
  - Capture rate of 200 fpm or more needed, often impractical
  - Fugitive emissions are common
  - Open doors etc. further reduce effectiveness
- Added costs for structural supports

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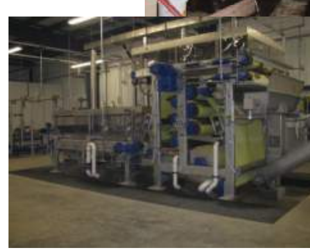
BFP Containment Options - Curtains

- Provide plastic strips around BFP
  - Ventilate at high rate (15 ac/hr+) within containment
- Advantages
  - Typically exclude operator workspace
  - Easily removable/replaceable
  - Low cost
- Disadvantages
  - Visibility over time
  - Messy
  - Access somewhat limited



Courtesy: BDP

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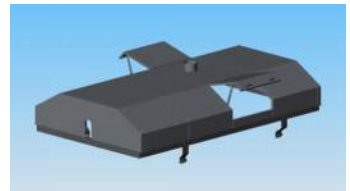
BFP Containment Options – Gravity Deck Enclosures

- Cover to contain gravity deck emissions
  - Ventilate at high rate (18 ac/hr+), still a low exhaust volume
- Compared to full enclosure
  - Better access
  - Lower cost
  - Less effective fugitive control below gravity deck



Courtesy: Alfa Laval

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BFP Containment Options – Full Enclosures

- Typically vendor supplied
  - Gravity deck cover and side panels
  - Access doors for ops and maintenance
  - Minimizes exhaust volume
- Access for cleaning can be difficult
  - Side panels key issue
- Operator modifications that reduce efficiency:
  - Remove/modify access doors
  - Hatches open

Courtesy: BDP

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Centrifuge Odor Management

- Enclosed system provides good odor containment
- Allows for odor treatment of equipment exhaust only
  - More concentrated airstream at reduced airflow
  - Combining with exhaust from dewatering building would offer dilution benefits
- Building ventilation need not be treated

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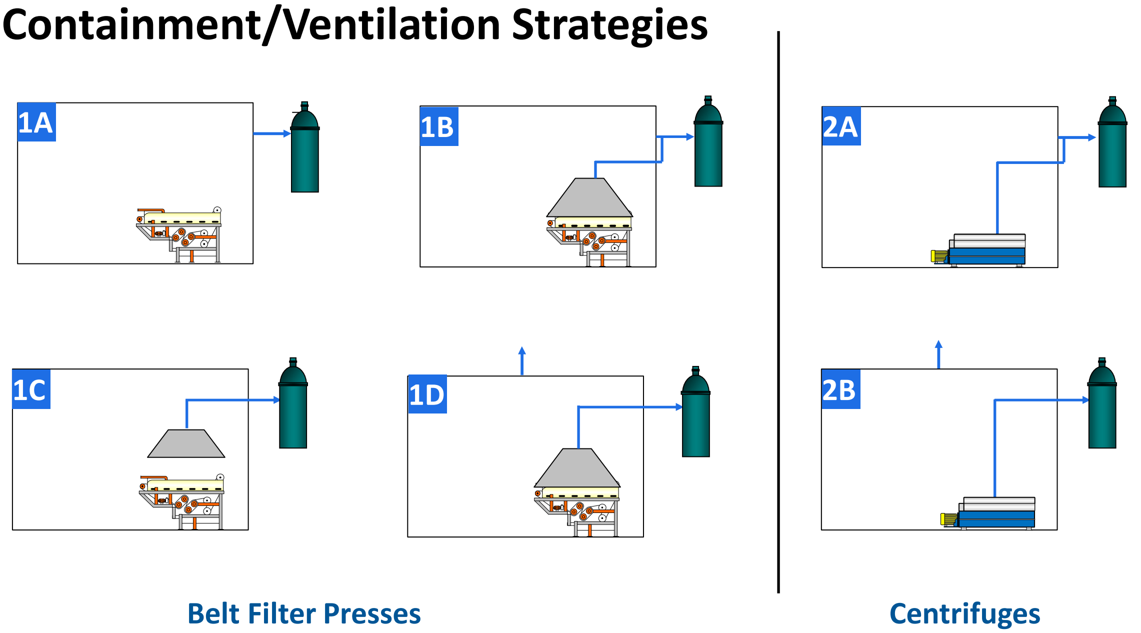
Containment/Ventilation Strategies



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Odor Control Options

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Odor Control Option Overview

Exhaust Volume

- Similar airflow to odor control system
  - Ventilation Strategies 1A, 1B, 1C, 2A
- Reduced airflow to odor control system
  - Ventilation Strategies 1D, 2B

Treatment

- Maintain current water scrubbing
- Convert existing unit to biological treatment
  - Reduced airflow options only

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Similar Airflow to Odor Control System

- Maintain current operation (water scrubber) with similar airflow
- Provide 6 to 12 ac/hr in building (equipment dependent)
  - Verify fan performance
  - Replace fan if needed; consider one fan for all sources
- Considerations
  - More flexibility on room ventilation with airflows on centrifuge
    - Centrifuge exhaust volume small
  - No treatment provided by current system, BUT meets permit limits due to low inlet H_2S concentrations

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Reduced Airflow to Odor Control System (Water Scrubbing)

- Utilize existing scrubber at reduced capacity
  - Increases EBRT, may improve H_2S removal
- Replace fan and duct for smaller capacity
  - Consider one fan for all sources
- Considerations
  - Smaller process flow may be more concentrated
    - Impact on performance (and permit limit) uncertain
  - Requires building ventilation

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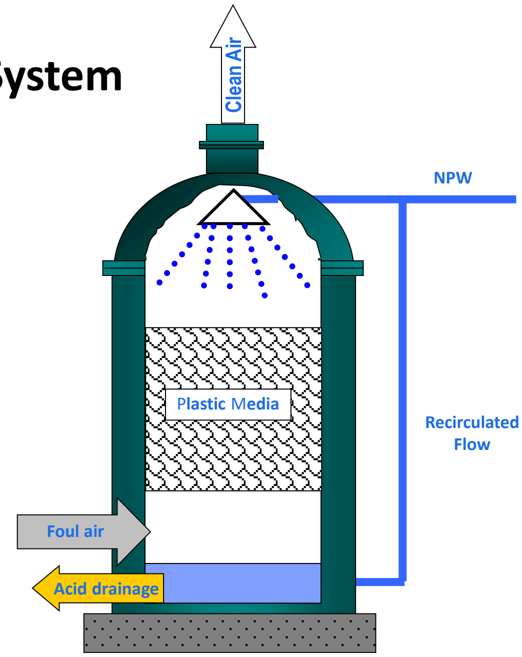
Reduced Airflow to Odor Control System (Biological Scrubbing)

- Convert existing scrubber to biological system at reduced airflow
  - Increases EBRT, leading to improved H_2S removal
- Replace fan and duct for smaller capacity
  - Consider one fan for all sources
- Considerations:
  - Requires building ventilation
  - Replacing packing with a bioscrubber media could increase removal efficiency
  - Eliminate periodic acid washing to encourage biological growth



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Comparison of Options

Option	Advantages	Disadvantages
Similar Airflow to Odor Control System	• May be able to re-use existing fan and duct • Flexibility on room ventilation with centrifuge airflows	• Increased corrosion potential with BFP alternative (containment dependent) • No treatment provided • Complex system balancing • Higher operating costs for larger capacity system
Reduced Airflow to Odor Control System (Water Scrubber)	• Better containment of foul air • Reduced corrosion potential • Increased EBRT through scrubber → may improve performance • Simplified system balancing • Lower operating costs with decreased capacity system	• Requires building ventilation • New equipment (fan and potentially recirc pump) • New, smaller duct • Impact on performance (and permit limit) uncertain
Reduced Airflow to Odor Control System (Biological Scrubber)	• Better containment of foul air • Reduced corrosion potential • Increased EBRT with bioscrubber media → provides improved performance • Simplified system balancing • Lower operating costs with decreased capacity system • Eliminates need for acid washing	• Requires building ventilation • New equipment (fan and potentially recirc pump) • New, smaller duct

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SDAPCD Permit Considerations

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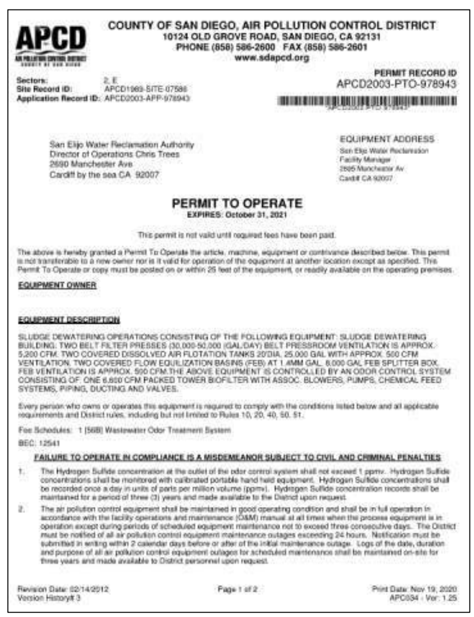
Summary of Permit Requirements

- Permit indicates the following airflow contributions from each source:
  - Dewatering room: ~5,200 cfm
  - DAFs: ~500 cfm
  - FEBs: ~500 cfm
- H_2S permit limit: 1 ppm at outlet
- Nuisance rule compliance (Rule 51): shall not discharge air that causes nuisance to any considerable number of persons or the public
- Permit expires October 31, 2021



APCD AIR POLLUTION CONTROL DISTRICT COUNTY OF SAN DIEGO

COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
PHONE (858) 586-2600 FAX (858) 586-2601
www.sdapcd.org

Sectors: 2, E
Site Record ID: APCD1989-SITE-07586
Application Record ID: APCD2003-APP-978943

PERMIT RECORD ID
APCD2003-PTO-978943

San Elijo Water Reclamation Authority
Director of Operations Chris Trees
2690 Manchester Ave
Cardiff by the sea CA 92007

EQUIPMENT ADDRESS
San Elijo Water Reclamation
Facility Manager
2695 Manchester Av
Cardiff CA 92007

PERMIT TO OPERATE
EXPIRES: October 31, 2021

This permit is not valid until required fees have been paid.

The above is hereby granted a Permit To Operate the article, machine, equipment or contrivance described below. This permit is not transferable to a new owner nor is it valid for operation of the equipment at another location except as specified. This Permit To Operate or copy must be posted on or within 25 feet of the equipment, or readily available on the operating premises.

EQUIPMENT OWNER

EQUIPMENT DESCRIPTION

SLUDGE DEWATERING OPERATIONS CONSISTING OF THE FOLLOWING EQUIPMENT: SLUDGE DEWATERING BUILDING: TWO BELT FILTER PRESSES (30,000-50,000 (GAL/DAY) BELT PRESSROOM VENTILATION IS APPROX. 5,200 CFM. TWO COVERED DISSOLVED AIR FLOTATION TANKS 20'DIA, 25,000 GAL WITH APPROX. 500 CFM VENTILATION. TWO COVERED FLOW EQUILIZATION BASINS (FEB) AT 1.4MM GAL. 8,000 GAL FEB SPLITTER BOX. FEB VENTILATION IS APPROX. 500 CFM.THE ABOVE EQUIPMENT IS CONTROLLED BY AN ODOR CONTROL SYSTEM CONSISTING OF: ONE 6,600 CFM PACKED TOWER BIOFILTER WITH ASSOC. BLOWERS, PUMPS, CHEMICAL FEED SYSTEMS, PIPING, DUCTING AND VALVES.

Every person who owns or operates this equipment is required to comply with the conditions listed below and all applicable requirements and District rules, including but not limited to Rules 10, 20, 40, 50, 51.

Fee Schedules: 1 [56B] Wastewater Odor Treatment System

BEC: 12541

FAILURE TO OPERATE IN COMPLIANCE IS A MISDEMEANOR SUBJECT TO CIVIL AND CRIMINAL PENALTIES

1. The Hydrogen Sulfide concentration at the outlet of the odor control system shall not exceed 1 ppmv. Hydrogen Sulfide concentrations shall be monitored with calibrated portable hand held equipment. Hydrogen Sulfide concentrations shall be recorded once a day in units of parts per million volume (ppmv). Hydrogen Sulfide concentration records shall be maintained for a period of three (3) years and made available to the District upon request.
2. The air pollution control equipment shall be maintained in good operating condition and shall be in full operation in accordance with the facility operations and maintenance (O&M) manual at all times when the process equipment is in operation except during periods of scheduled equipment maintenance not to exceed three consecutive days. The District must be notified of all air pollution control equipment maintenance outages exceeding 24 hours. Notification must be submitted in writing within 2 calendar days before or after of the initial maintenance outage. Logs of the date, duration and purpose of all air pollution control equipment outages for scheduled maintenance shall be maintained on-site for three years and made available to District personnel upon request.

Revision Date: 02/14/2012
Version History# 3

Page 1 of 2

Print Date: Nov 19, 2020
APC034 - Ver: 1.25

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Potential Impacts to Permit

Item	Permit Impact	
	New BFPs	New Centrifuges
Same throughput as existing	In-kind replacement; notify SDAPCD	Permit modification
Increased throughput	Potential permit modification (may result in an increase in emissions)	Permit modification
Modified airflow	Permit modification	Permit modification

- BFP in-kind replacement: letter to agency
- BFP emissions increase as a result of throughput increase: minor permit application
- Centrifuge - new technology w/ no emission increase: potential permit application or notify SDAPCD
- Centrifuge - new technology w/ emission increase: potential minor permit application

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Next Steps

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Next Steps

- B&V
  - Structural / Architectural Workshop
- SEJPA
  - Consider odor control impact on dewatering equipment selection
  - Verify airflow rate of each odor control fan and contribution from each source (if practical)
  - Additional input on information provided today

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Discussion.

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MEETING MINUTES

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
Workshop held on: 4/8/2021
Minutes issued on: 4/27/21
Electrical and I&C Workshop

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Review existing electrical and control systems
- Discuss key electrical design elements, including recommended upgrades to address the conditions of the existing equipment, support proposed centrifuges and other new/replaced equipment, and to achieve code compliance
- Obtain input on SEJPA preferences and standards for key I&C design elements, including P&IDs, I/O, control strategy, SCADA, PLC, and instrumentation

Recorded by: Rika Evans

Attendees: See attached Sign-in Sheet

Handouts: Agenda

Summary of Key Items Discussed

Key items discussed in the meeting and action items are summarized below. See pages 3 and 4 for a list of action items. A copy of the .ppt slides presented during the meeting is attached to the minutes.

1. Electrical Design Elements
    a. Existing MS-2 and MCC-H
        - Based on their age (~30 years, typical end of useful life), the environment of the electrical rooms (invasive marine environment without air conditioning), and visible signs of corrosion on exterior enclosures, BV recommended replacement of the existing Switchgear (SWGR) MS-2 and MCC-H.
        - SEJPA agreed that both SWGR MS-2 and MCC-H should be replaced with new equipment as part of this project.
        - BV will provide an estimate of the total cost for replacement of both equipment, including installation, contractor overhead and profit, contingency, engineering, construction management, and administration.
        - BV indicated that the duration of outage during the MCC replacement will likely range from 3 to 5 days. It will likely be approximately 3 days, if the entire MCC could be taken out of service.

- It was agreed that BV will review the record drawing of MCC-H and identify all equipment that need to remain in service. SEJPA will review and refine the list based on their knowledge of the existing conditions. BV will develop an approach (e.g., suggested sequencing, required temporary equipment, etc.) to maintain operational continuity during the replacement activities.
- SEJPA inquired if BV foresees any COVID-19 related impacts on equipment delivery schedule. BV noted that the pandemic is not anticipated to impact the electrical equipment delivery schedule in North America.
- SEJPA inquired if the new MCC will have power monitoring functionality. BV confirmed that the new MCC will be a "smart or intelligent" MCC with a power monitor at the main incoming breaker, which will monitor power demand and usage and communicate with PLCs. It was also noted that Rockwell Automation (Allen-Bradley) MCCs with Ethernet IP is one of the acceptable products listed in BV's standard specifications.
- SEJPA indicated that extension of the electrical room, where SWGR MS-2 is located, was previously considered. This would allow for installation of a new SWGR at a different location (from the existing unit), which would reduce the shutdown duration (required to pull cables from the existing unit and connect to new) compared to the replace-in-place scenario. SEJPA will provide additional information on the proposed building extension.

b. NETA Testing for Switchgear MS-2 and MCC-H

- Per the decisions made above (i.e., replacement of SWGR MS-2 and MCC-H with new equipment), NETA testing will not be required.

c. Ductbank, conduits, and cables from MS-2 to MCC-H

- Existing ductbank is understood to have 2-3" conduits from SWGR MS-2 to MCC-H (Feeder C9 to Bus A, Feeder C10 to Bus B). With new centrifuge loads, larger cables would be needed for two new 500 A main breakers at MCC-H. In order to maintain the double bus configuration, new ductbank will be required from SWGR MS-2 to MCC-H. BV recommended an alternate ductbank option to utilize the existing 2-3" conduits for parallel circuits to a new single bus MCC. Although this would sacrifice a redundant second feeder, the group agreed that single-points-of-failure already exist at the SDG&E transformer and SWGR MS-2 main bus, and there is little significant value in having bus-tie breakers to allow for one-half of the MCC to be out of service for maintenance. As such, it was agreed that the project will proceed with the single feeder alternative with use of the existing 2-3" conduits. It was noted that should the SDG&E transformer and/or feeder cables to SWGR MS-2 fail, service to the plant can continue by virtue of the existing standby diesel engine-generator. However, a bus fault on SWGR MS-2 will render all SWGR MS-2 plant feeders unavailable.
- SEJPA inquired if it would be challenging to pull the existing cables without damaging the conduit. BV noted that risk mitigation measures (such as cable

removal in shorter segments from a pull box to another pull box to avoid excess tension) will be stipulated in the specifications.

- SEJPA will coordinate with the Administration Building project to confirm that the new SDG&E service associated with that project will not impact the dewatering project (i.e., separate SDG&E 12 kV service from that to SWGR MS-2).

d. Clearance between MCC-H and VC-2 for NEC compliance

- It was confirmed that the existing blue enclosures for two VFDs for Belt Filter Press #1 and #2 will be removed along with the existing belt filter presses. Existing VC-2 (control panel for EF-2, EF-3, and EF-13) will be relocated westwards to achieve the required 42" minimum clearance from the front of new MCC-H to the side of the VC-2 enclosure which will then comply with the NEC.

2. I&C Design Elements

a. SCADA/PLC/Instrumentation Standards

- It was agreed that BV standards could be generally utilized

b. Tagging

- BV will develop a draft equipment list with tags for equipment based on the conventions used in the Headworks project for SEJPA's review and input (to be presented in Draft PDR).

c. Control Strategy

- SEJPA noted that it is desirable to increase the level of automation for the overall dewatering and sludge conveyance facilities (i.e., auto modes for all equipment, smart starters, etc.)

d. Missing Legend Sheet

- SEJPA does not have the abbreviation sheet for the record drawings.

e. PLCs

- Biosolids PLC – The existing PLC for the dewatering facilities (Biosolids PLC) is SLC 505 (older platform). With addition of significant IOs, it is likely that replacement with a CompactLogix platform will be recommended. It was confirmed that the PLC should be referenced as "Biosolids PLC."
- Digester PLC – The PLC for the equipment associated with digesters, including the digested sludge feed pumps (to dewatering equipment), is located near the digesters.

f. Control Panels

- Centrifuges – SEJPA noted that it is desirable to locate the centrifuge VFDs in the vendor supplied local control panels, as long as a barrier from 480 V surfaces is provided for operator safety.
- SEJPA requested that all vendor supplied control panels be able to communicate with the PLC.

g. Integration

- It was noted that SEJPA will perform the programming and integration.

h. Control Description

- BV confirmed that a high-level control description will be developed and included in the PDR.

3. Next steps

a. Architectural and Structural Workshop will be held on April 13, 2021.

b. BV will develop a Draft PDR (scheduled to be submitted to SEJPA by May 28, 2021).

Action Items

Following are Action Items developed during the discussions:

No.	Description of Action	Responsible Party	Due Date
1.	Provide an estimate of the total cost for replacement of SWGR MS-2 and MCC-H, including installation, contractor overhead and profit, contingency, engineering, construction management, and administration.	BV	4/30/21
2.	BV to identify all equipment connected to existing MCC-H that need to remain in service during the MCC replacement (for SEJPA review)	BV	4/30/21
3.	Provide information on the proposed electrical room extension (Will the building modification be included in the dewatering project?).	SEJPA	4/30/21
4.	Confirm that the new SDG&E service associated with the Admin Bldg. project will not impact the dewatering facilities.	SEJPA	4/30/21

No.	Description of Action	Responsible Party	Due Date
5.	Develop a draft equipment list with tags for equipment based on the conventions used in the Headworks project for SEJPA's review and input (to be presented in Draft PDR)	BV	To be provided in Draft PDR (P&IDs)
6.	Develop a list of work items required for code compliance as opposed to work items that are associated with general plant upgrades.	BV	To be provided in Draft PDR

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
4/8/2021
Electrical and I&C Workshop

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Review existing electrical and control systems
- Discuss key electrical design elements, including recommended upgrades to address the conditions of the existing equipment, support proposed centrifuges and other new/replaced equipment, and to achieve code compliance
- Obtain input on SEJPA preferences and standards for key I&C design elements, including P&IDs, I/O, control strategy, SCADA, PLC, and instrumentation

Agenda

1. Introductions
2. Meeting objectives
3. Electrical Design Elements
   a. Existing MCC-H and Preliminary Load Study for MCC-H
   b. NETA Testing for Switchgear MS-2 and MCC-H
   c. Ductbank, conduits, and cables from MS-2 to MCC-H
   d. Clearance between MCC-H and VC-2 for NEC compliance
4. I&C Design Elements
   a. Information to be developed (P&IDs, control system block diagram, and control descriptions)
   b. Review of existing control diagram
   c. Preferences and standards for P&IDs, I/O, control strategy, SCADA, PLC, and instrumentation standards
5. Next steps
6. Open discussion
7. Recap of action items

SEWRF DEWATERING FACILITIES UPGRADES
PRELIMINARY DESIGN
MEETING SIGN IN SHEET

Meeting Date: 4/8/2021
Meeting Time: 8:00 AM – 9:30 AM
Meeting Location: MS Teams
Meeting Topic: Electrical and I&C Workshop

SEJPA Attendees:

Name	Email	Phone	Attendance
Mike Thornton	thornton@sejpa.org	+17607536203 X72	x
Chris Trees	treesc@sejpa.org	+17607536203 X70	x
Casey Larsen	larsenc@sejpa.org	+17607536203	x

Black & Veatch Attendees:

Name	Email	Phone	Attendance
John Bekmanis	BekmanisJT@bv.com	+17606218421	x
Rika Evans	EvansR@bv.com	+17606218533	x
Andrew Franklin	FranklinAC@bv.com	+19494713912	x
Corbin LeGrand	LegrandC@bv.com	+19134582790	x
Keene Matsuda	MatsudaKM@bv.com	+19497884291	x

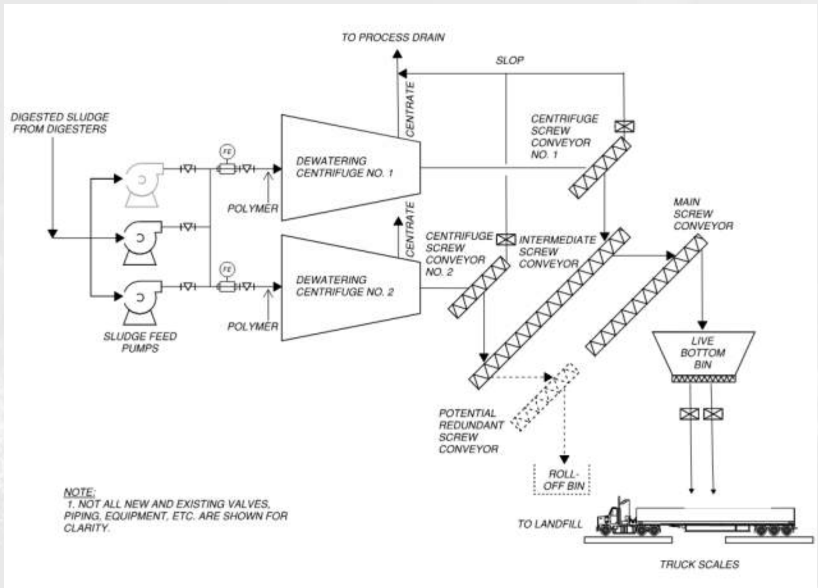
I&C Design Elements

Instrumentation and Controls

Scope:

- Preliminary design level P&IDs and control system block diagram to be developed
  - Current Assumptions: B&V Standards, High Level, Standard I/O
- Preliminary control descriptions to be developed
  - Current Assumptions: High Level, Manual Control

Instrumentation and Controls (Continued)



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Instrumentation and Controls (Continued)

- Discussion Topics:
  - SCADA/PLC/Instrumentation standards and/or vendor preferences
  - Expected Equipment, Instrument and I/O Tagging Standard
  - Control Strategy
    - Will control stay Manual only?
    - Local Control, Control at MCC, LCPs?
  - Explanation of I/O Abbreviations from As-Built P&IDs

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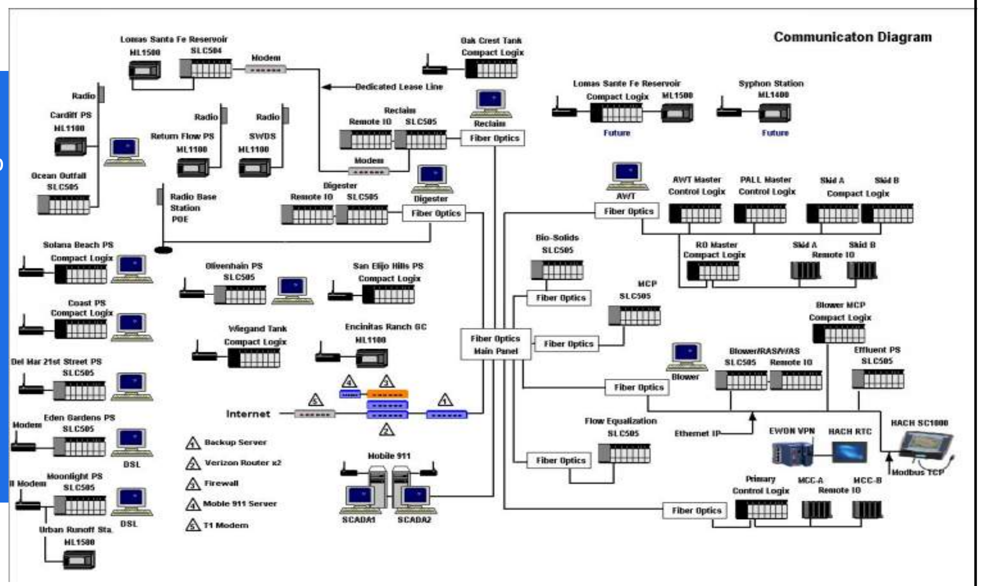
Instrumentation and Controls (Continued)

- Scope for new Control Block Diagram
- Existing I/O Lists or Shop Drawings for PLCs that will be affected
  - Need to know where/if there is capacity for new controls in existing PLCs
  - Do we need to consider upgrades?



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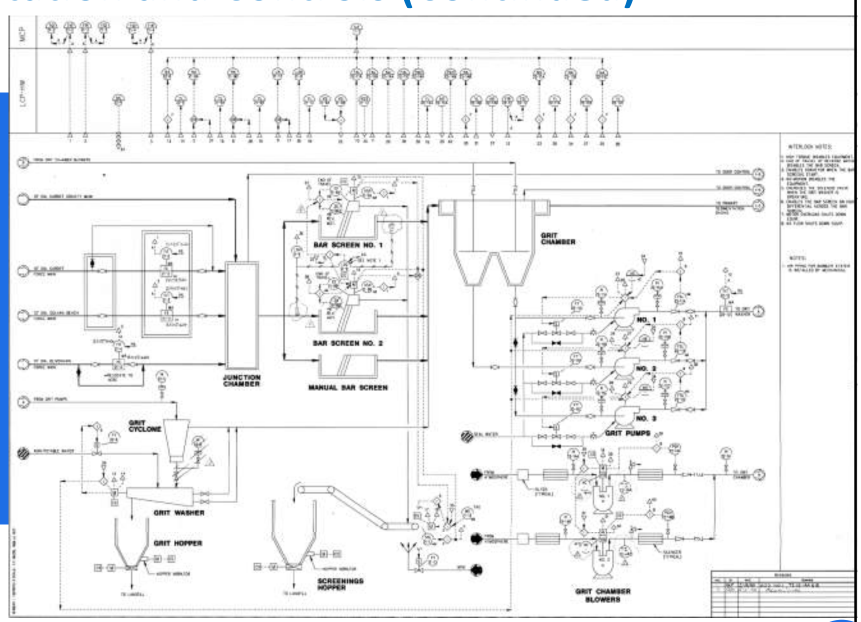
Instrumentation and Controls (Continued)

- Explanation of I/O Abbreviations from As-Built P&IDs



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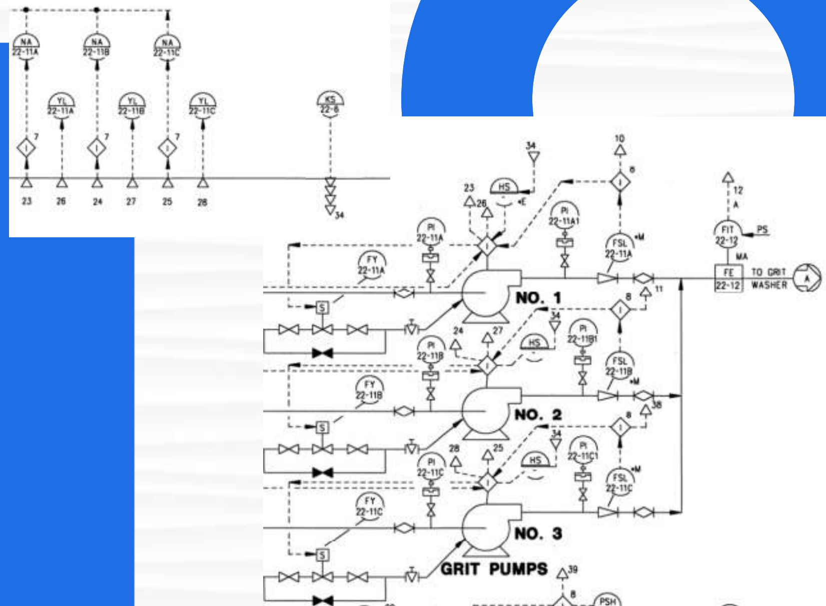
Instrumentation and Controls (Continued)

- Explanation of I/O Abbreviations from As-Built P&IDs



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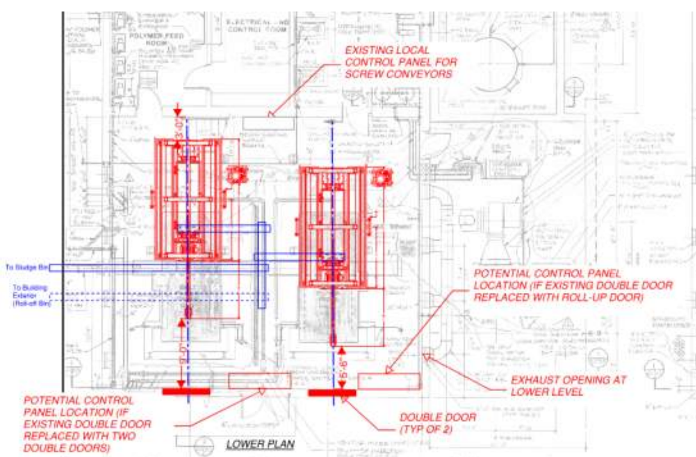
Locations for Local Control Panels



- Coordinate Centrifuge LCPs with new door location(s)
- Screw Conveyor controls to be located at MCC unless LCPs are desired

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Next Steps

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Next Steps

- B&V
  - Structural and architectural workshop 4/13
  - Develop Draft PDR

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MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
4/13/2021
Structural & Architectural Workshop

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Discuss key structural and architectural design elements
- Obtain SEJPA input on centrifuge access (i.e. south door modifications) options, design criteria, and other key items

Recorded by: Rika Evans

Attendees: See attached Sign-in Sheet

Handouts: Agenda and

Summary of Key Items Discussed

Key items discussed in the workshop and action items are summarized below. A copy of the .ppt slides presented during the meeting is attached to the minutes.

1. Dewatering Building
    a. Mezzanine Demolition
        - BV confirmed that mezzanine demolition is feasible.
    b. Equipment Access / South Door Modifications
        - Based on the initial structural evaluation, Option 2 (two double doors, located in front of each centrifuge unit), is recommended. Option 1 (widening the existing door opening to install a wider roll-up door) is also feasible but will result in more structural impacts and costs, as the existing jamb rebar supports vertical and lateral roof loads. It is recommended that the width of the new doors be similar to the existing double door (taller doors will not be an issue).
        - It was agreed that the door dimensions should be optimized for maintenance activities (based on the dimensions of the forklift used at SEJPA, how and where the rotating assembly will be picked up by the forklift or a utility vehicle, etc.). A new vehicle suitable for transportation of the rotating assembly could be purchased by SEJPA, if needed. The rotating assembly will be pulled out of the centrifuge unit and transported to the area directly in front of the door with use of the monorail system. As such, the cabin of the forklift could remain outside, while the rotating assembly is loaded onto the forklift attachment.

- BV will obtain information on the weight of the rotating assembly. *BV subsequently obtained the weight information as follows: Centrisys – 3,400 lbs. Aldec 75 – 1,764 lbs. The rated capacity of the existing forklift is 4,100 lbs at 24" load center.*

c. Skylights

- Immediate replacement is not required as long as they are no leakage. *Subsequently, SEJPA decided that the skylights should be replaced with new, removable skylights.*
- SEJPA will provide photos of the existing roof and skylights.
- BV noted that it is likely that the roof warranty has expired, and based on its age, it is near the end of its useful life. Replacement of the roof will be further discussed after review of the photos and a site visit by BV's structural engineer.

d. Louvers / Windows

- Existing louver openings will be replaced with windows, unless utilized by other purposes (ducting for the new air handling unit or penetration for the new screw conveyor).
- SEJPA indicated that all existing doors should be replaced with new doors.

e. Screw Conveyor Wall Penetration and Supports

- The existing openings on the West wall will be re-utilized to the extent practical. If a new opening will be required, or the existing opening will need to be modified, structural evaluation will be performed.

f. Other

- A redundant screw conveyor could be provided to serve as a backup unit (discharge chute to be located just outside of the building for hauling), when the main screw conveyor is out of service. Alternatively, consider providing a spare drive and screw flight.
- Intermediate conveyor is still a single point of failure. Spare parts should be provided.
- The existing ladder from the mezzanine level to the upper roof will be demolished. A new ladder will be provided on the building exterior, providing access to the North low roof over the existing parapet wall. A security shield should be provided over the base of the ladder to prevent unauthorized access.

2. Truck Loading Structure

- Shop drawing information or field measurements of the existing loading structure would be required to perform a structural analysis to verify that the structure will be able to support the new live bottom bin. Subsequently, field measurements were provided by SEJPA and supplemented by BV structural engineer's field measurements during a site visit conducted on May 5, 2021.

MEETING AGENDA

San Elijo Joint Power Authority (SEJPA)
San Elijo Water Reclamation Facility
Dewatering Facilities Upgrades

B&V Project 407556
B&V File 14.1200
4/13/2021
Structural & Architectural Workshop

Meeting Purpose

The key objectives / outcome of this meeting is to:

- Discuss key structural and architectural design elements
- Obtain SEJPA input on centrifuge access (i.e. south door modifications) options, design criteria, and other key items

Agenda

1. Introductions
2. Meeting objectives
3. Dewatering Building
    a. Mezzanine Demolition
    b. Equipment Access / South Door Modifications
    c. Skylights
    d. Louvers / Windows
    e. Screw Conveyor Wall Penetration and Supports
4. Truck Loading Structure
    a. Live Bottom Bin
    b. Scales
5. Next steps
6. Open discussion

SEWRF DEWATERING FACILITIES UPGRADES
PRELIMINARY DESIGN
MEETING SIGN IN SHEET

Meeting Date: 4/13/2021
Meeting Time: 11:30 AM – 1:00 PM
Meeting Location: MS Teams
Meeting Topic: Structural and Architectural Workshop

SEJPA Attendees:

Name	Email	Phone	Attendance
Mike Thornton	thornton@sejpa.org	+17607536203 X72	x
Chris Trees	treesc@sejpa.org	+17607536203 X70	x

Black & Veatch Attendees:

Name	Email	Phone	Attendance
John Bekmanis	BekmanisJT@bv.com	+17606218421	x
Kevin Davis	DavisKN@bv.com	+17606218419	x
Rika Evans	EvansR@bv.com	+17606218533	x
Mark Lowe	LoweMA@bv.com	+19497884212	x
Phil Rishel	RishelPD@bv.com	+19134583459	x

BLACK & VEATCH

SEWRF Sludge Dewatering Facilities Upgrades

Preliminary Design Services

Structural & Architectural Workshop
April 13, 2021

San Elijo Joint Powers Authority

SAN ELIJO | JOINT POWERS AUTHORITY

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Agenda

- Introductions
- Meeting Objectives
- Dewatering Building
  - Mezzanine Demolition
  - Equipment Access / South Door Modifications
  - Skylights
  - Louvers / Windows
  - Screw Conveyor Wall Penetration and Supports
- Truck Loading Structure
  - Live Bottom Bin
  - Scales
- Next Steps
- Open Discussion

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Introductions / Project Team

Black & Veatch 3

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On the Phone Today

- Kevin Davis – Project Director
- John Bekmanis – Project Manager
- Rika Evans – Engineering Manager
- Mark Lowe – Structural Engineer
- Phil Rishel – Architect

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Meeting Objectives

5

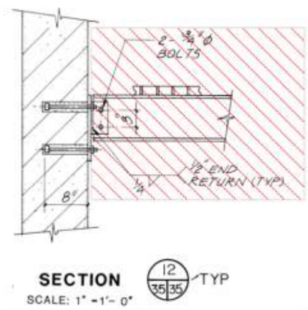
Meeting Objectives

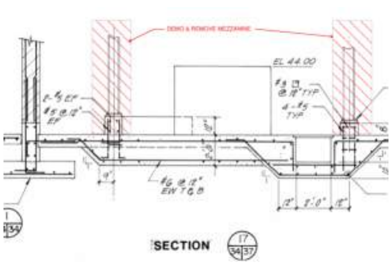
- Discuss key structural and architectural design elements
- Obtain SEJPA input on centrifuge access options, design criteria, and other key items

6

Key Design Elements

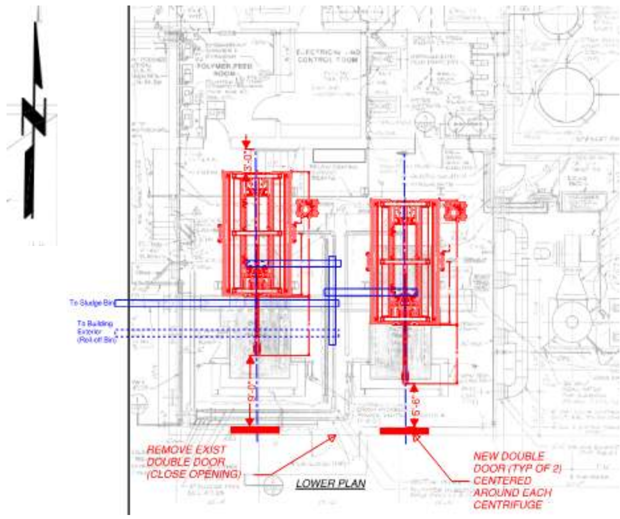
Demolition of the Existing Mezzanine Level





- Existing Steel Framing
  - Demolish and remove existing steel stairs, mezzanine and concrete pedestals
  - Cut anchor bolts flush at wall and floor, apply protective epoxy coating to exposed steel
- Roof Access Ladder
  - Existing ladder is mounted on the mezzanine platform
  - Recommended to be relocated to an outdoor location (NE corner)

Proposed New Centrifuge Plan



- Install (2) New Centrifuges
  - Modify South Wall
  - Recommend Option 2: Cut (2) Dbl Door Openings
  - Infill Exist Dbl Door Opening

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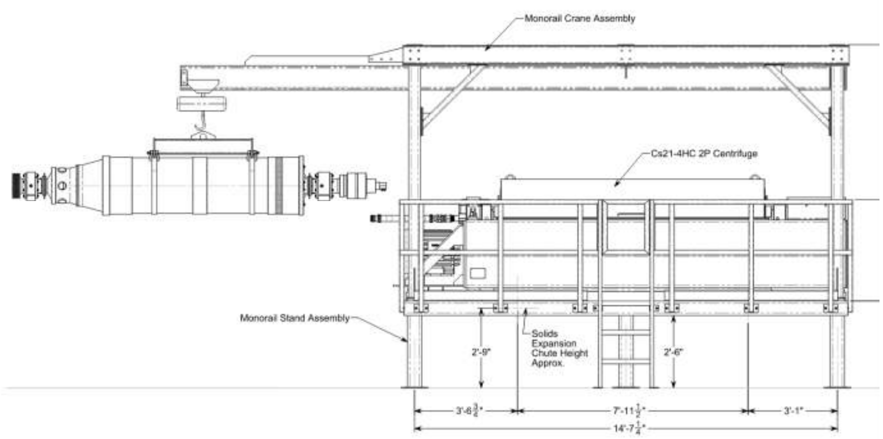
Centrifuge Installation

- Install new Centrifuges on Existing Slab
- Existing Floor slab = 24" thick



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10

Equipment Access – Option 1 Roll-up Door + Single Door [South Wall]

- Load-bearing wall supports main roof beams.
- Exist vertical rebar each jamb of opening.
  - Exist jamb rebar supports vertical and lateral roof loads.

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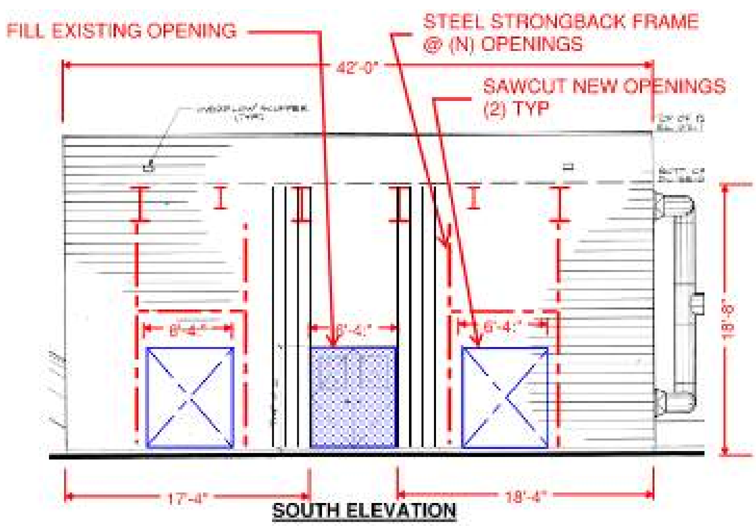
Equipment Access – Option 2 Double Door for Each Centrifuge



- (2) New Dbl Door Openings
- Add Strongback Support Frames at New Openings
  - Existing Wall rebar to remain

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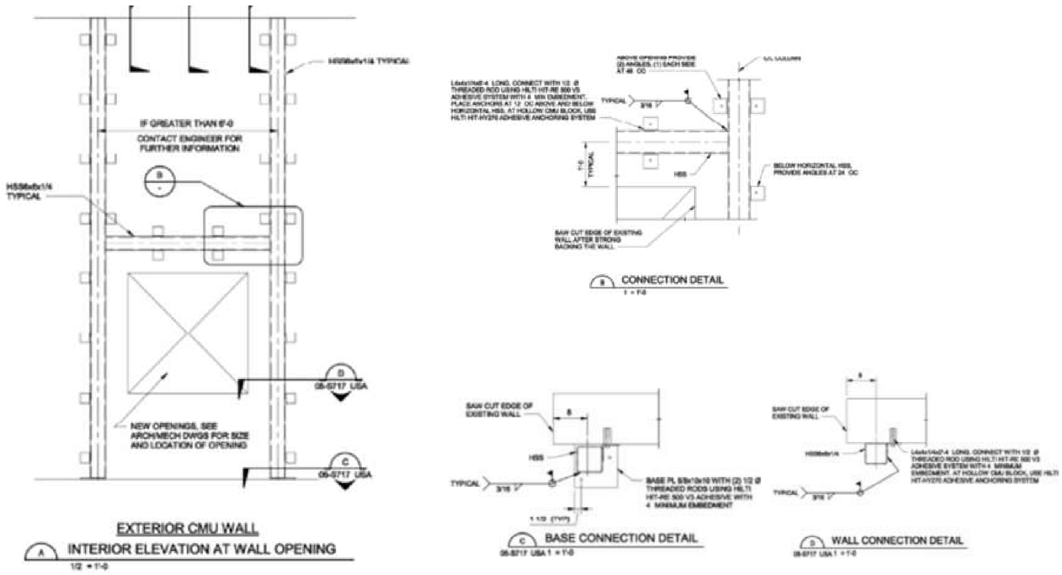
12

New Steel Strongback Support Framing @ New Wall Openings



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Sky Lights

- Not intended to be used for future normal equipment access with the south door improvements
- Modifications not required

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Screened Intake Louvers

- Upper 4 Louvers
  - Replace with windows (fixed)
  - Repair window sills, where needed
- Lower 4 Louvers
  - Forced ventilation / air supply required for NFPA 820 compliance
  - Convert one of the openings to a supply register for the new air handling unit
  - Replace the rest of the openings to windows (operable)
  - One of the openings can be used for a potential redundant screw conveyor penetration

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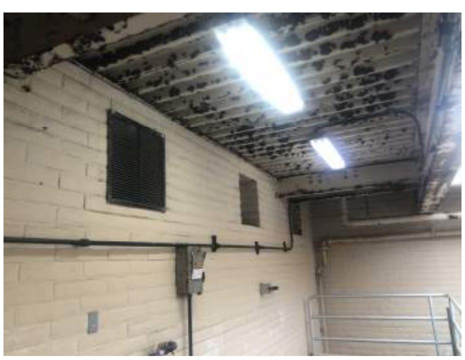
Exhaust Registers



- Some of the exhaust registers are missing
- Provide new registers

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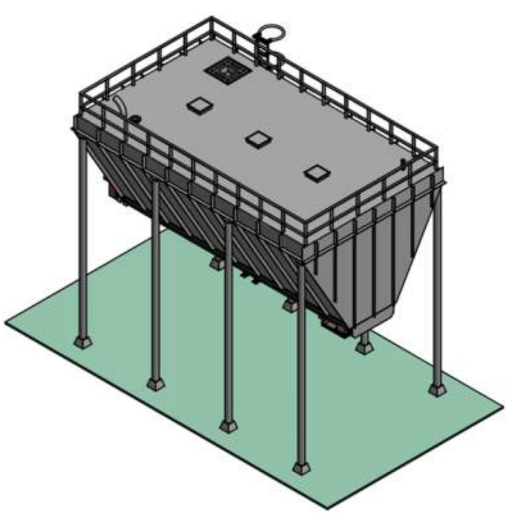
Screw Conveyors

- Penetration Location(s)
  - Re-use the existing penetration location for the main conveyor
  - Recommended to use one of the existing louver openings for a redundant screw conveyors (if implemented)
  - This would avoid new wall penetrations
- Supports
  - Vendor to design the supports
  - Concrete pads underneath the supports to be designed by the Engineer

Live Bottom Bin



- The shape and dimensions of the bin will be customized to fit within the existing support frame to minimize structural support modifications
- Modifications to hopper would add 10,000 lbs additional weight
- Require steel fabrication shop drawings or make field measurements to analyses existing support frame

Truck Scale

- Existing scale to be replaced with similar type (portable axle) scales (longer/both front and back) – no pit or footings required

Structural Recommendations

- Demolition and removal of the existing mezzanine platform and stairs is acceptable.
- Demolition of existing concrete pedestals at floor slab are required to allow installation of new centrifuges. Additional demolition associated with belt press supports and modifications to the trench drain are required.
- Existing floor slab thickness of 24” should be capable of supporting new equipment.
- Preliminary Seismic review of the existing Dewatering Building indicates the proposed structural modifications are feasible with additional reinforcing of walls (Option 2 with two sets of double doors recommended).
- The proposed structural modifications to the sludge hopper will increase the load by 10,000 lbs and required verification of the truck loading structure capacity. B&V requires existing shop drawings or field measurements of existing steel framing.

Architectural Recommendations

- Existing interior roof access ladder to be relocated to an outdoor location (NE corner of the building)
- Two double doors (centered around each centrifuge unit) to be provided
- Existing skylight to be protected in place
- Upper louver openings to be converted to fixed windows
- One of the lower louver openings to be converted to an air supply register for the new air handling unit
- The other lower louver openings to be converted to operable windows (one of them could be used for penetration for a potential redundant screw conveyor)
- Consider replacement of roofing based on age and typical service life

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Next Steps

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Next Steps

- B&V
  - Develop PDR

23

Discussion.

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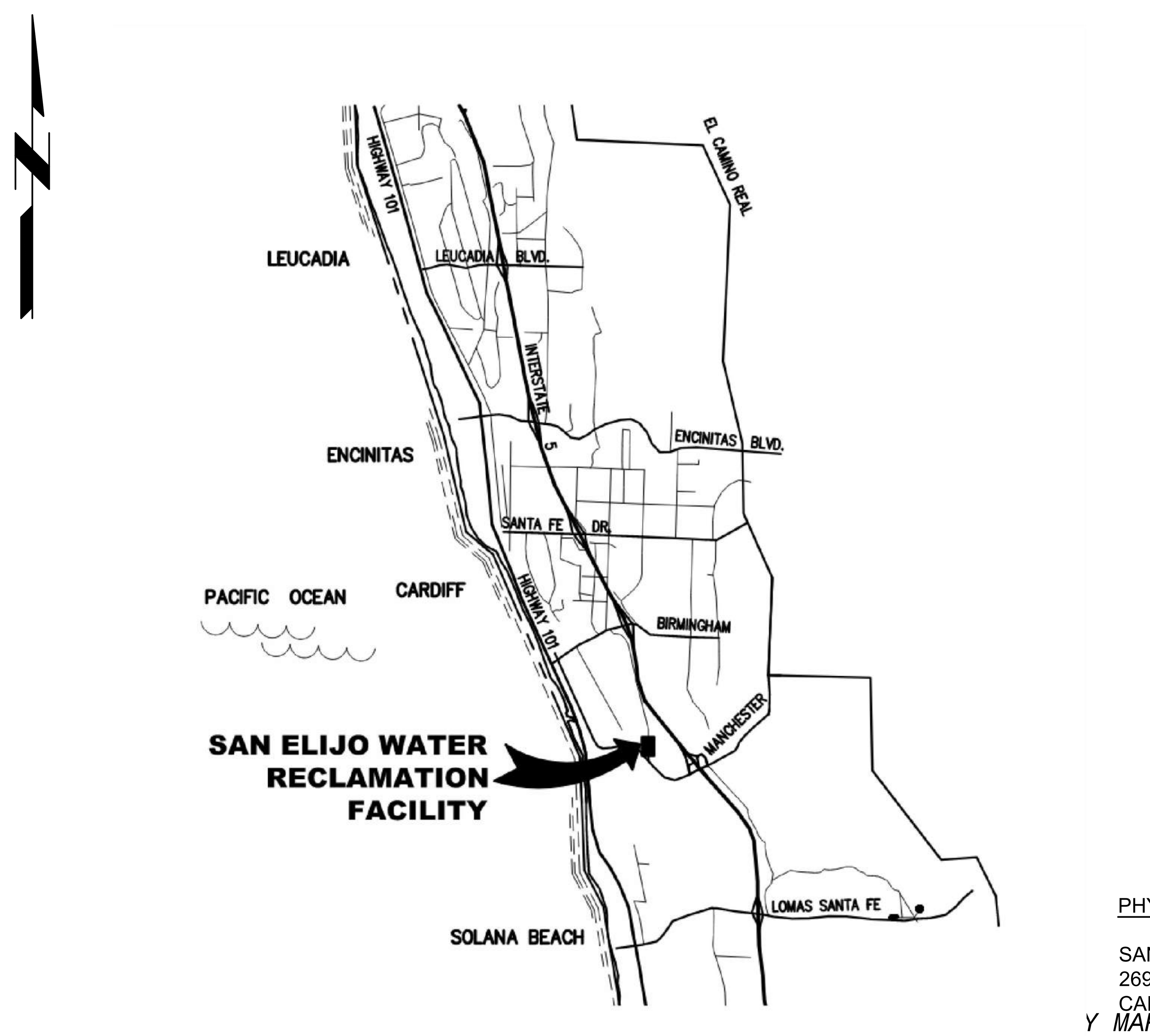
Appendix B – Preliminary Design Drawings

SAN ELIJO WATER RECLAMATION FACILITY

SLUDGE DEWATERING FACILITIES UPGRADES

PRELIMINARY DESIGN DRAWINGS

MAY 2021



VICINITY MAP
NO SCALE

PHYSICAL ADDRESS

SAN ELIJO WATER RECLAMATION FACILITY
2695 MANCHESTER AVENUE
CARDIFF BY THE SEA, CA 92007

Y MAP

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SHEET LIST

DRAWING No.	SHEET No.	DESCRIPTION
GENERAL		
1	G-001	COVER SHEET AND VICINITY MAP
2	G-002	SHEET LIST, NOTES, LEGEND AND ABBREVIATIONS
3	G-003	PROCESS FLOW DIAGRAM
CIVIL		
4	C-001	TRUCK LOADING, POLYMER STORAGE AND FEED
DEMOLITION		
5	D-001	DEWATERING BUILDING – PLANS
6	D-002	DEWATERING BUILDING – SECTIONS
7	D-003	TRUCK LOADING AND POLYMER STORAGE - PLAN AND SECTION
MECHANICAL		
8	M-001	DEWATERING BUILDING AND ODOR REDUCTION FACILITY – PLAN
9	M-002	DEWATERING BUILDING AND ODOR REDUCTION FACILITY – SECTION
10	M-003	TRUCK LOADING, POLYMER STORAGE AND FEED – PLAN AND SECTION
11	M-004	TRUCK LOADING, POLYMER STORAGE AND FEED – SECTIONS
STRUCTURAL		
12	S-001	DEWATERING BUILDING - SOUTH WALL DOOR MODIFICATIONS
ELECTRICAL		
13	E-001	POWER DISTRIBUTION FUNCTIONAL DIAGRAM
14	E-002	MS-2 SWITCHGEAR ROOM - POWER PLAN
15	E-003	ONE-LINE DIAGRAMS - 1 OF 2
16	E-004	ONE-LINE DIAGRAMS - 2 OF 2
INSTRUMENTATION		
17	I-001	P&ID LEGEND & ABBREVIATIONS SHEET 1 OF 3
18	I-002	P&ID LEGEND & ABBREVIATIONS SHEET 2 OF 3
19	I-003	P&ID LEGEND & ABBREVIATIONS SHEET 3 OF 3
20	I-004	LEGEND & ABBREVIATIONS CONTROL BLOCK DIAGRAM
21	I-005	P&ID – DEWATERING FEED PUMPS
22	I-006	P&ID – THICKENING POLYMER STORAGE AND FEED
23	I-007	P&ID – DEWATERING POLYMER STORAGE AND FEED
24	I-008	P&ID – DEWATERING CENTRIFUGE NO. 1
25	I-009	P&ID – DEWATERING CENTRIFUGE NO. 2
26	I-010	P&ID – DEWATERED CAKE CONVEYOR AND TRUCK LOADING - SHEET 1 OF 2
27	I-011	P&ID – DEWATERED CAKE CONVEYOR AND TRUCK LOADING - SHEET 2 OF 2
28	I-012	P&ID – VENTILATION AND ODOR CONTROL SYSTEM
29	I-013	CONTROL SYSTEM BLOCK DIAGRAM

GENERAL NOTES:

1. PRELIMINARY DESIGN DRAWINGS ARE INCLUDED IN THIS DRAWING SET. EXACT LIMITS OF DEMOLITION AND ADDITIONAL DESIGN DETAILS ARE TO BE DEVELOPED DURING SUBSEQUENT PHASES OF DESIGN.
2. THE DEMOLITION SHEETS ARE BASED ON PLANS, SECTIONS, AND DETAILS FROM AVAILABLE RECORD DRAWINGS, SUPPLEMENTED WITH PHOTOS FROM SITE VISITS.THE INFORMATION SHOWN IS TO CONVEY EXISTING CONDITIONS. SCREENED LINES AND TEXT REPRESENT RECORD DRAWING INFORMATION AND SHOULD ONLY BE USED TO GATHER AN UNDERSTANDING OF WHAT EXISTS. BOLD LINES AND TEXT REPRESENT ITEMS TO BE DEMOLISHED AND DISPOSED OF OFFSITE. ITEMS TO BE SALVAGED WILL BE IDENTIFIED DURING DETAILED DESIGN.

GENERAL LEGEND

- SURFACED STREET, ROAD OR DRIVE
- SURFACED STREET ROAD OR DRIVE WITH CURBS
- 326 — EXISTING GROUND CONTOUR
- 326 — FINISH GRADE CONTOUR
- SMALLER THAN 24" / 24" AND LARGER — EXISTING
- GENERAL LAYOUT YARD PIPING
- SMALLER THAN 24" / 24" AND LARGER — NEW
- BUILDINGS, STRUCTURES
- EXISTING BUILDINGS, STRUCTURES
- 1 / AC45 — SECTION NUMBER/LETTER OR DETAIL LETTER/NUMBER; DRAWING NUMBER ON WHICH SECTION OR DETAIL APPEARS; OR WHERE SECTION IS CUT OR DETAIL IS NOTED
- PV / 10 — EQUIPMENT IDENTIFICATION CODE; EQUIPMENT NUMBER
- PV-10 — EQUIPMENT IDENTIFICATION CODE; EQUIPMENT NUMBER
- EQUIP CALLOUT — EQUIPMENT REPRESENTATION WITH CALLOUT

MATERIALS LEGEND

- EARTH, GRADE OR ENGINEERED FILL
- NEW CONCRETE
- CONCRETE MASONRY UNITS (CMU)
- GRATING
- NEW PIPING
- EXISTING PIPING

PIPING ACCESSORIES LEGEND

- BLIND FLANGE
- CAP OR PLUG
- CO — CLEANOUT
- ELBOW
- ELBOW DOWN
- LINE TURNING UP
- Q — QUICK COUPLING
- REDUCER
- TEE
- TEE LINE DOWN
- TEE LINE UP

VALVE LEGEND

- PLUG VALVE, ECCENTRIC
- BUTTERFLY VALVE
- BALL VALVE
- CHECK VALVE
- FM — MAGNETIC FLOWMETER

PIPING SYSTEMS LEGEND

- NPW — WATER, NON-POTABLE COLD
- PS — POLYMER SOLUTION
- 1W — POTABLE WATER
- 2W — PROCESS WATER

ABBREVIATIONS

1W	POTABLE WATER
AC	ASPHALT CONCRETE
AFF	ABOVE FINISHED FLOOR
ALUM	ALUMINUM
AHU	AIR HANDLING UNIT
ARCH	ARCHITECTURAL
BLDG	BUILDING
BOT	BOTTOM
CMU	CONCRETE MASONRY UNIT
DIA	DIAMETER
DN	DOWN
DWG(S)	DRAWING(S)
EA	EACH
EL	ELEVATION
ELEC	ELECTRICAL
EXIST	EXISTING
EQUIP	EQUIPMENT
FA	FOUL AIR
FD	FLOOR DRAIN
FG	FINISHED GRADE
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FOOT
HP	HIGH POINT, HORSEPOWER
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
KVA	KILOVOLT AMPERES
KW	KILOWATTS
IN	INCH
LCP	LOCAL CONTROL PANEL
MCC	MOTOR CONTROL CENTER
MH	MANHOLE
MIN	MINIMUM
NPW	NON POTABLE WATER
NTS	NOT TO SCALE
OC	ON CENTER
PB	PULL BOX
SWGR	SWITCHGEAR
TOC	TOP OF CONCRETE
TOW	TOP OF WALL
TYP	TYPICAL
V	VALVE, VOLT
VFD	VARIABLE FREQUENCY DRIVE
&	AND
@	AT
C/L, CL	CENTERLINE

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SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

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PROJECT NO.:	407556

GENERAL

SHEET LIST, NOTES, LEGEND AND ABBREVIATIONS

G-002

02 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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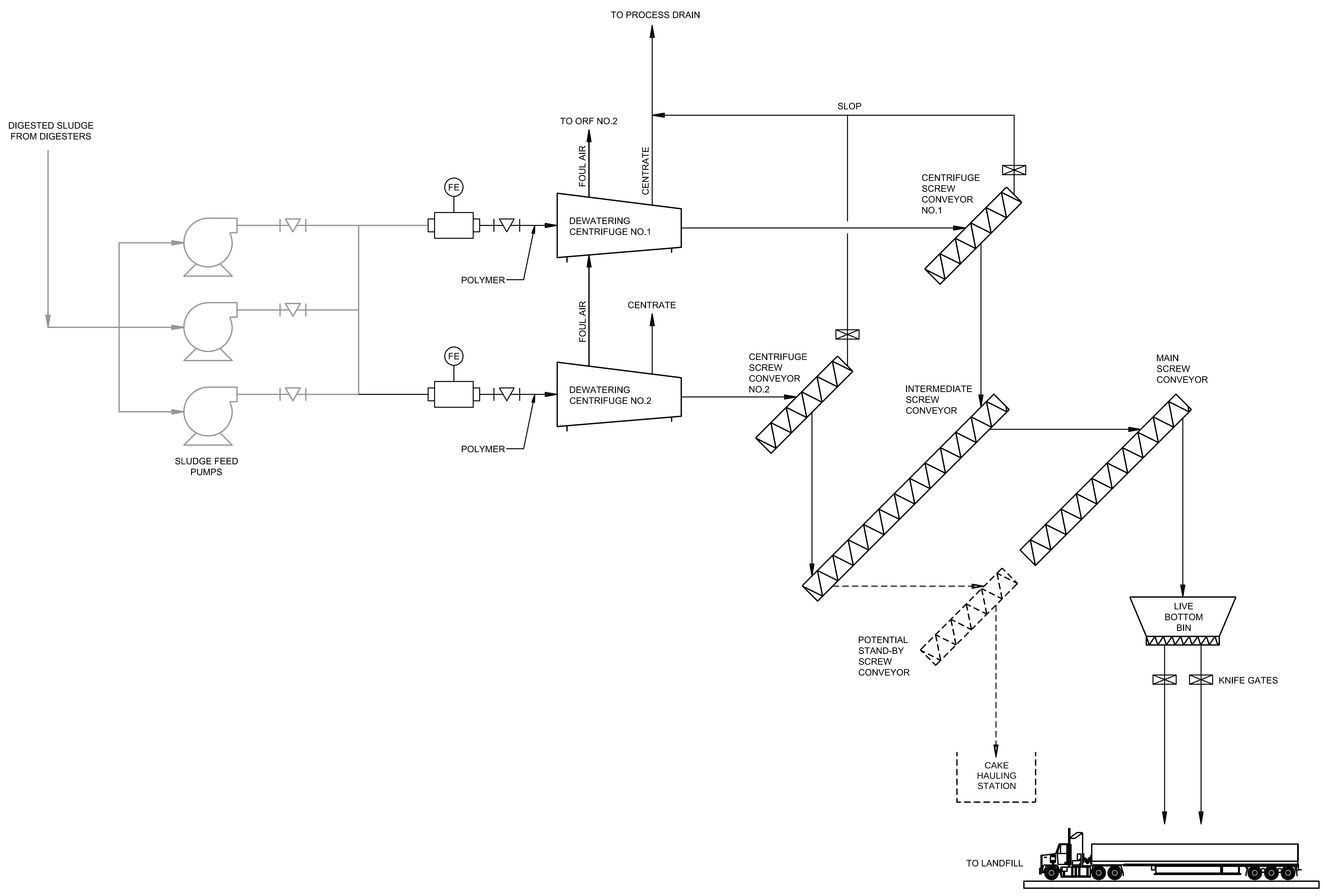

NOTE:
1. NOT ALL NEW AND EXISTING VALVES, PIPING, EQUIPMENT, ETC. ARE SHOWN FOR CLARITY.

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GENERAL

PROCESS FLOW DIAGRAM

G-003

03 OF 29

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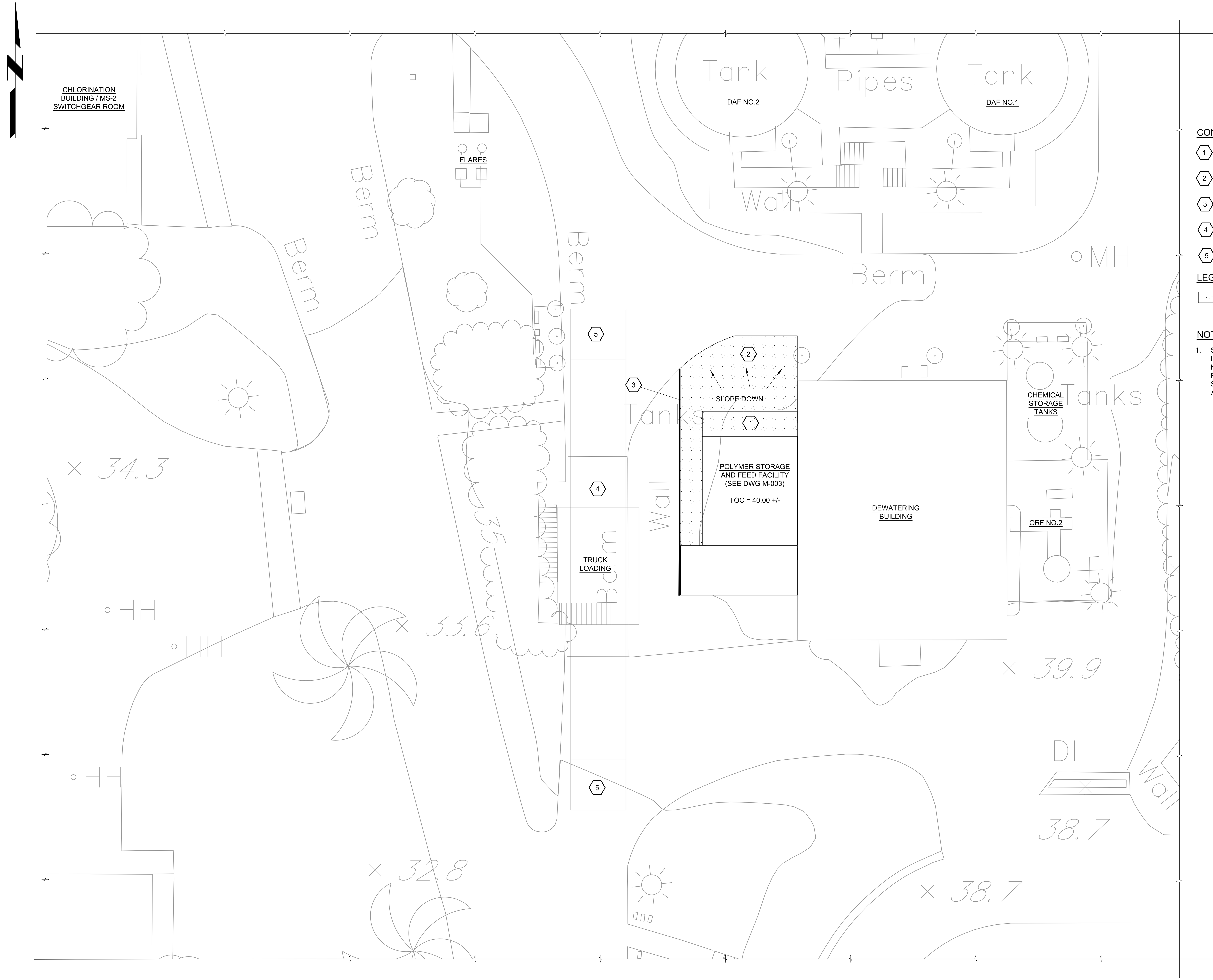

CONSTRUCTION KEY NOTES

1. 5'X19' AREA DIRECTLY NORTH OF THE POLYMER STORAGE AND FEED AREA SHALL BE FLAT FOR FORKLIFT APPROACH/PARKING.
2. NEW PAVEMENT TO SLOPE DOWN TO MATCH THE ELEVATION OF ADJACENT EXISTING PAVEMENT.
3. RETAINING WALL. TOW = 40.00 +/-. AT NORTHERN END OF THE WALL, TOW TO STEP DOWN TO FOLLOW PAVEMENT SLOPE
4. TRUCK SCALE
5. CONCRETE APPROACH FOR TRUCK SCALE

LEGEND

APPROXIMATE LIMITS OF NEW PAVEMENT

NOTE:

1. SURVEYING INFORMATION FROM THE PREVIOUS GEOTECHNICAL INVESTIGATIONS SHOWN. FINISHED GRADE ELEVATIONS OF THE NEW PAVEMENT IS NOT SHOWN (SPOT ELEVATIONS OF EXISTING PAVEMENT IN THE AREA NOT AVAILABLE). LAND SURVEYING SHALL BE PERFORMED DURING DETAILED DESIGN TO OBTAIN ADDITIONAL INFORMATION ON EXISTING CONDITIONS.

10' 0 10' 20'
1"=10'

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CIVIL

TRUCK LOADING, POLYMER STORAGE AND FEED

C-001

04 OF 29

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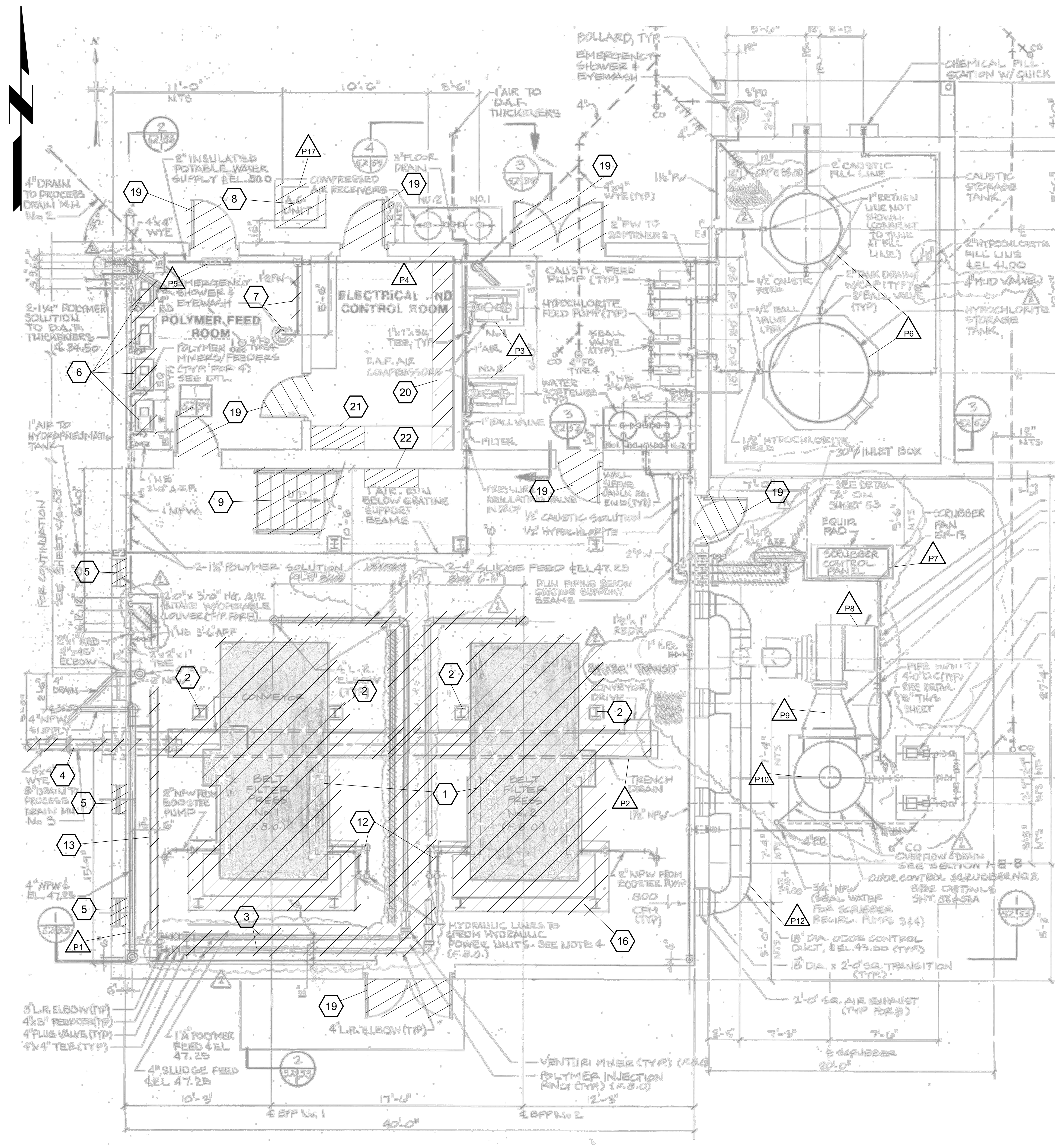
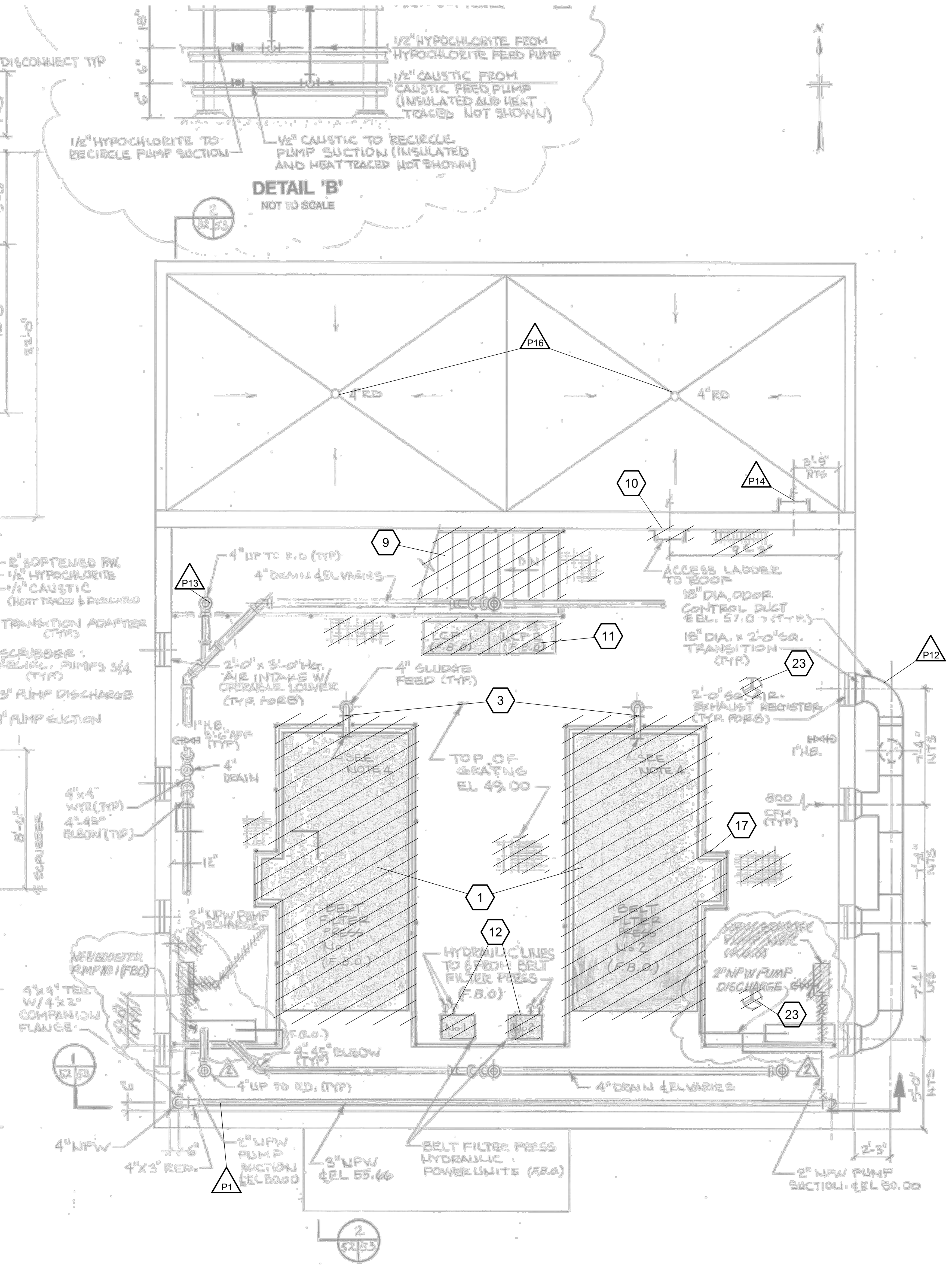


LOWER PLAN
3/16" = 1'-0"



UPPER PLAN
3/16" = 1'-0"

DEMOLITION KEY NOTES

1. BELT FILTER PRESS (TYP OF 2) - REMOVE
2. MEZZANINE SUPPORT COLUMNS AND BEAMS - REMOVE
3. 4" SLUDGE FEED - REMOVE
4. SCREW CONVEYOR - REMOVE
5. LOUVER/SCREEN (TYP OF 8) - REMOVE
6. POLYMER FEED EQUIPMENT - REMOVE
7. EMERGENCY EYE WASH - REMOVE
8. AC UNIT - REMOVE OUTDOOR UNIT, INDOOR UNIT, AND REFRIGERANT PIPING AND ACCESSORIES, REMOVE CONTROL/POWER WIRING AND CONDUIT
9. STAIRS - REMOVE
10. ACCESS LADDER - REMOVE
11. LOCAL CONTROL PANELS - REMOVE
12. BELT FILTER PRESS HYDRAULIC POWER UNITS AND PIPING - REMOVE
13. POLYMER FEED PIPING - REMOVE
14. SKYLIGHT (TYP OF 2) - REMOVE
15. BOOSTER PUMP (TYP OF 2) - REMOVE
16. CONCRETE PEDESTALS AND WASHWATER CURB - REMOVE FLUSH WITH FLOOR
17. HANDRAILS - REMOVE
18. MEZZANINE PLATFORM/GRATING - REMOVE
19. DOOR - REMOVE
20. MCC-H - REMOVE
21. BFP VFD - REMOVE
22. SCREW CONVEYOR LCP - REMOVE
23. FAN (EF-2 AND EF-3 ON ROOF) - REMOVE AND CLOSE OFF OPENING

PROTECT IN PLACE KEY NOTES

- P1 4"/3" NPW - PROTECT IN PLACE
- P2 TRENCH DRAIN - PROTECT IN PLACE
- P3 AIR COMPRESSORS - PROTECT IN PLACE
- P4 COMPRESSED AIR RECEIVERS - PROTECT IN PLACE
- P5 2" INSULATED POTABLE WATER SUPPLY - PROTECT IN PLACE
- P6 CHEMICAL STORAGE TANK - ABANDON IN PLACE
- P7 SCRUBBER CONTROL PANEL - PROTECT IN PLACE
- P8 SCRUBBER FAN - PROTECT IN PLACE
- P9 TRANSITION ADAPTER - PROTECT IN PLACE
- P10 ODOR CONTROL SCRUBBER - PROTECT IN PLACE
- P11 SCRUBBER RECIRC PUMPS - PROTECT IN PLACE
- P12 DUCT WORK - PROTECT IN PLACE
- P13 4" ROOF DRAIN PIPING - PROTECT IN PLACE
- P14 EXTERIOR LADDER - PROTECT IN PLACE
- P15 4" VENT - PROTECT IN PLACE
- P16 ROOF DRAIN - PROTECT IN PLACE
- P17 CONCRETE PAD - PROTECT IN PLACE
- P18 SLUDGE TRUCK LOADING STRUCTURE - PROTECT IN PLACE

6' 4' 2' 0 5' 10'
3/16"=1'-0"

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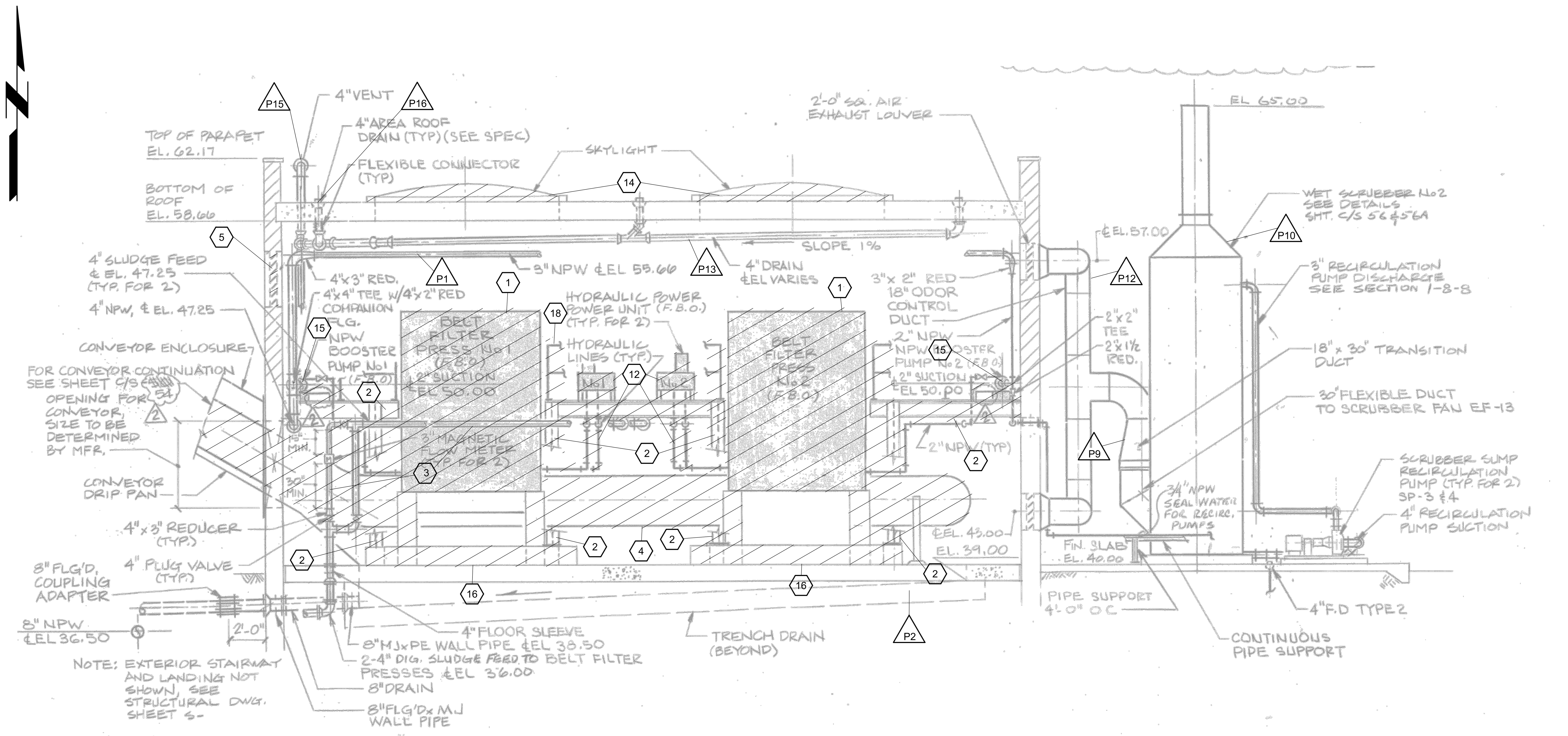
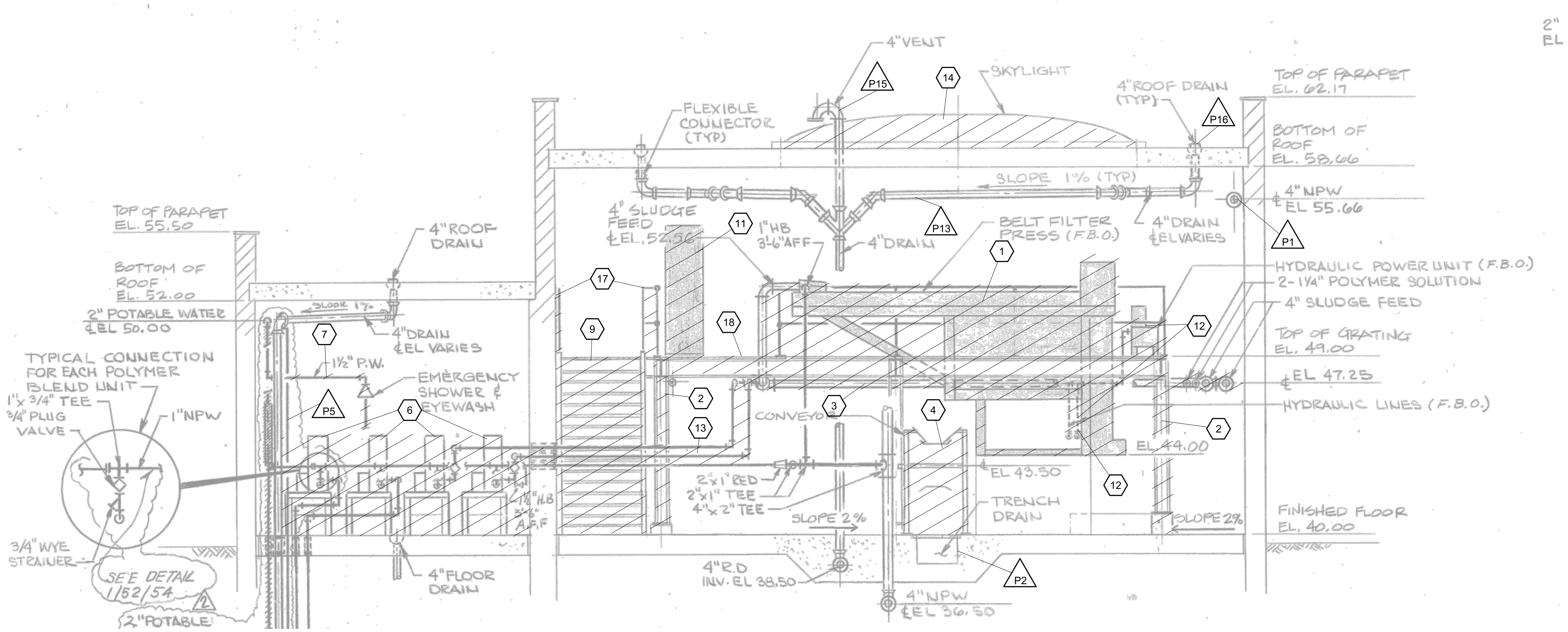
DEMOLITION

DEWATERING BUILDING - PLANS

D-001

05 OF 29





2" EL

DEMOLITION KEY NOTES

1. BELT FILTER PRESS (TYP OF 2) - REMOVE
2. MEZZANIZE SUPPORT COLUMNS AND BEAMS - REMOVE
3. 4" SLUDGE FEED - REMOVE
4. SCREW CONVEYOR AND SUPPORTS - REMOVE
5. LOUVER/SCREEN - REMOVE
6. POLYMER FEED EQUIPMENT - REMOVE
7. EMERGENCY EYE WASH - REMOVE
8. NOT USED
9. STAIRS - REMOVE
10. NOT USED
11. LOCAL CONTROL PANELS - REMOVE
12. BELT FILTER PRESS HYDRAULIC POWER UNITS AND PIPING - REMOVE
13. POLYMER FEED PIPING - REMOVE
14. SKYLIGHT (TYP OF 2) - REMOVE
15. BOOSTER PUMP - REMOVE
16. CONCRETE PEDESTALS AND WASHWATER CURB - REMOVE
17. HANDRAILS - REMOVE
18. MEZZANINE LEVEL PLATFORM/GRATING GUARDRAIL- REMOVE

PROTECT IN PLACE KEY NOTES

- P1 4"/3" NPW - PROTECT IN PLACE
- P2 TRENCH DRAIN - PROTECT IN PLACE
- P3 NOT USED
- P4 NOT USED
- P5 2" INSULATED POTABLE WATER SUPPLY LINE - PROTECT IN PLACE
- P6 NOT USED
- P7 NOT USED
- P8 NOT USED
- P9 TRANSITION ADAPTER - PROTECT IN PLACE
- P10 ODOR CONTROL SCRUBBER - PROTECT IN PLACE
- P11 SCRUBBER RECIRC PUMPS - PROTECT IN PLACE
- P12 DUCT WORK - PROTECT IN PLACE
- P13 ROOF DRAIN PIPING - PROTECT IN PLACE
- P14 NOT USED
- P15 4" VENT - PROTECT IN PLACE
- P16 ROOF DRAIN - PROTECT IN PLACE
- P17 NOT USED
- P18 NOT USED

4' 2' 0 4' 8'
1"=4'

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SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

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DEMOLITION

DEWATEWRING BUILDING - SECTIONS

D-002

06 OF 29

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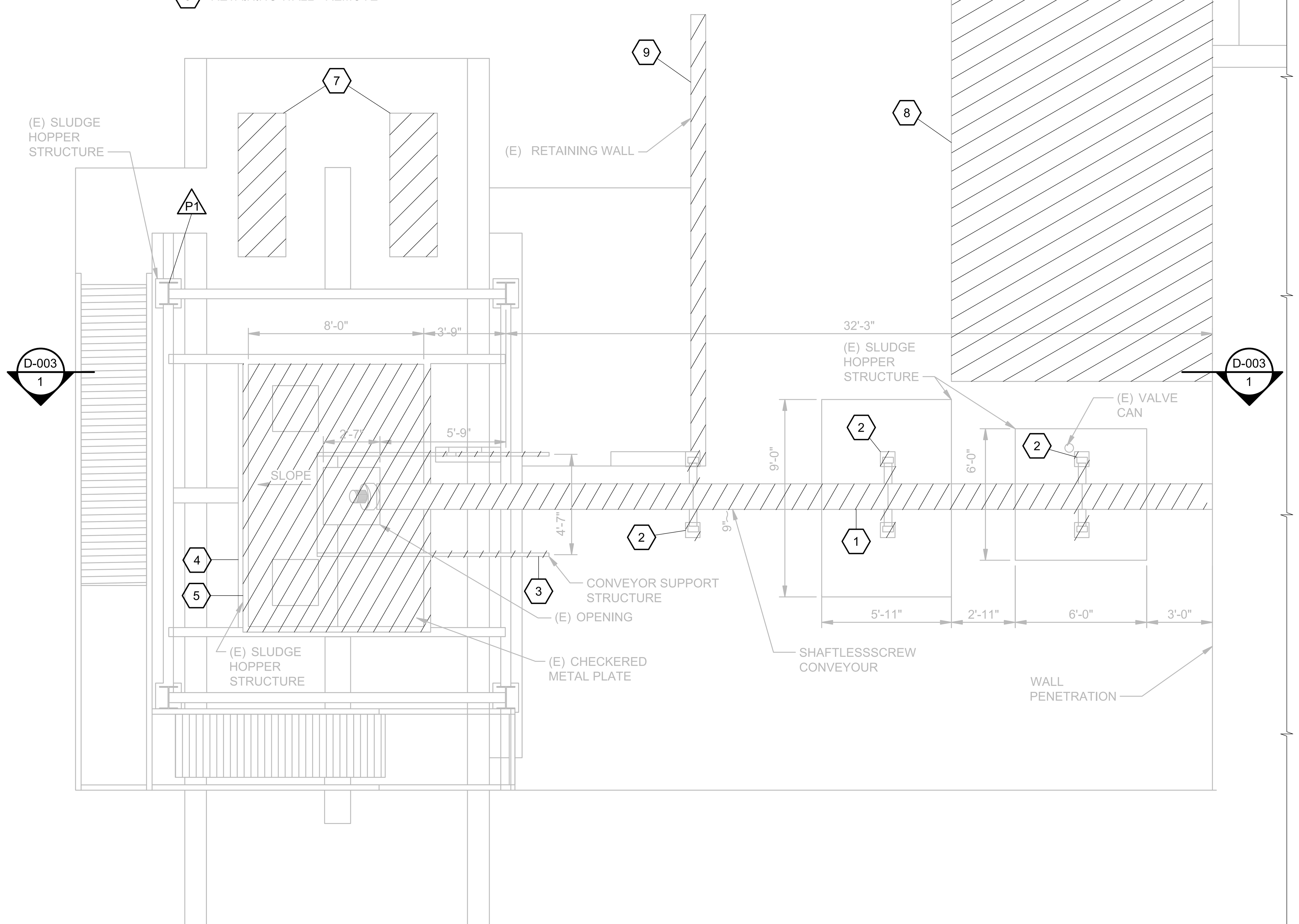
DEMOLITION KEY NOTES

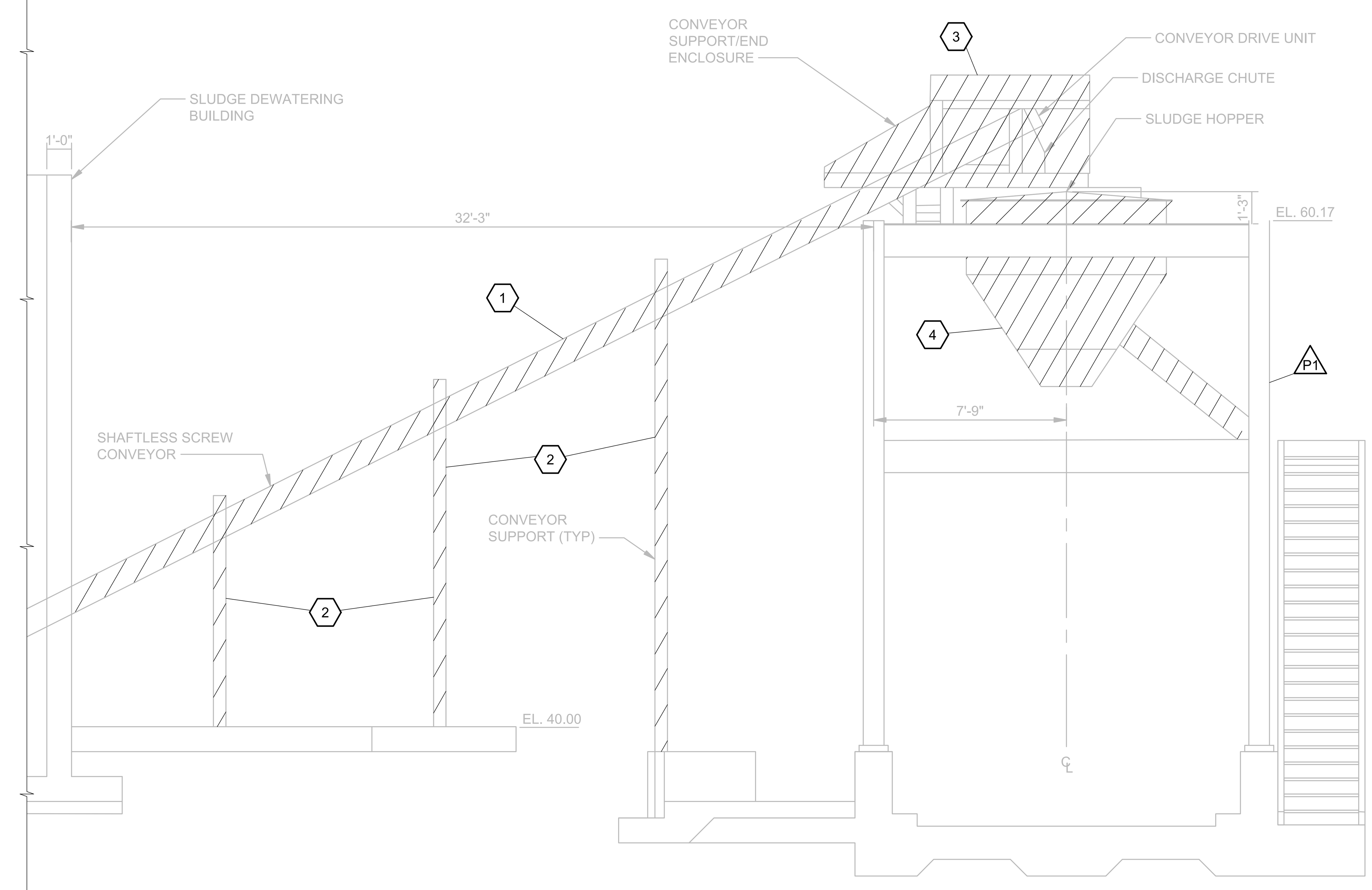
1. SCREW CONVEYOR AND DRIVE UNIT - REMOVE
2. SCREW CONVEYOR SUPPORTS - REMOVE
3. SCREW CONVEYOR END ENCLOSURE - REMOVE
4. SLUDGE HOPPER - REMOVE
5. CHECKER PLATES - REMOVE
6. POLYMER STORAGE AREA CONTAINMENT - REMOVE
7. TRUCK SCALE - REMOVE
6. POLYMER STORAGE AREA CONTAINMENT - REMOVE
7. TRUCK SCALE - REMOVE
8. CONCRETE SLAB-ON-GRADE - REMOVE
9. RETAINING WALL - REMOVE

PROTECT IN PLACE KEY NOTES

P1 SCREW CONVEYOR AND DRIVE UNIT - REMOVE



PLAN



SECTION 1-1

4' 2' 0 4' 8'
1/4"=1'-0"

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SAN ELIJO JOINT POWERS AUTHORITY

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SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

PRELIMINARY NOT FOR CONSTRUCTION

REVISIONS AND RECORD OF ISSUE

DESIGNED:	RE
DETAILED:	JN
CHECKED:	-
APPROVED:	RE
DATE:	28/05/21
PROJECT NO.:	407556

DEMOLITION

TRUCK LOADING AND POLYMER STORAGE - PLAN & SECTION

D-003

07 OF 29

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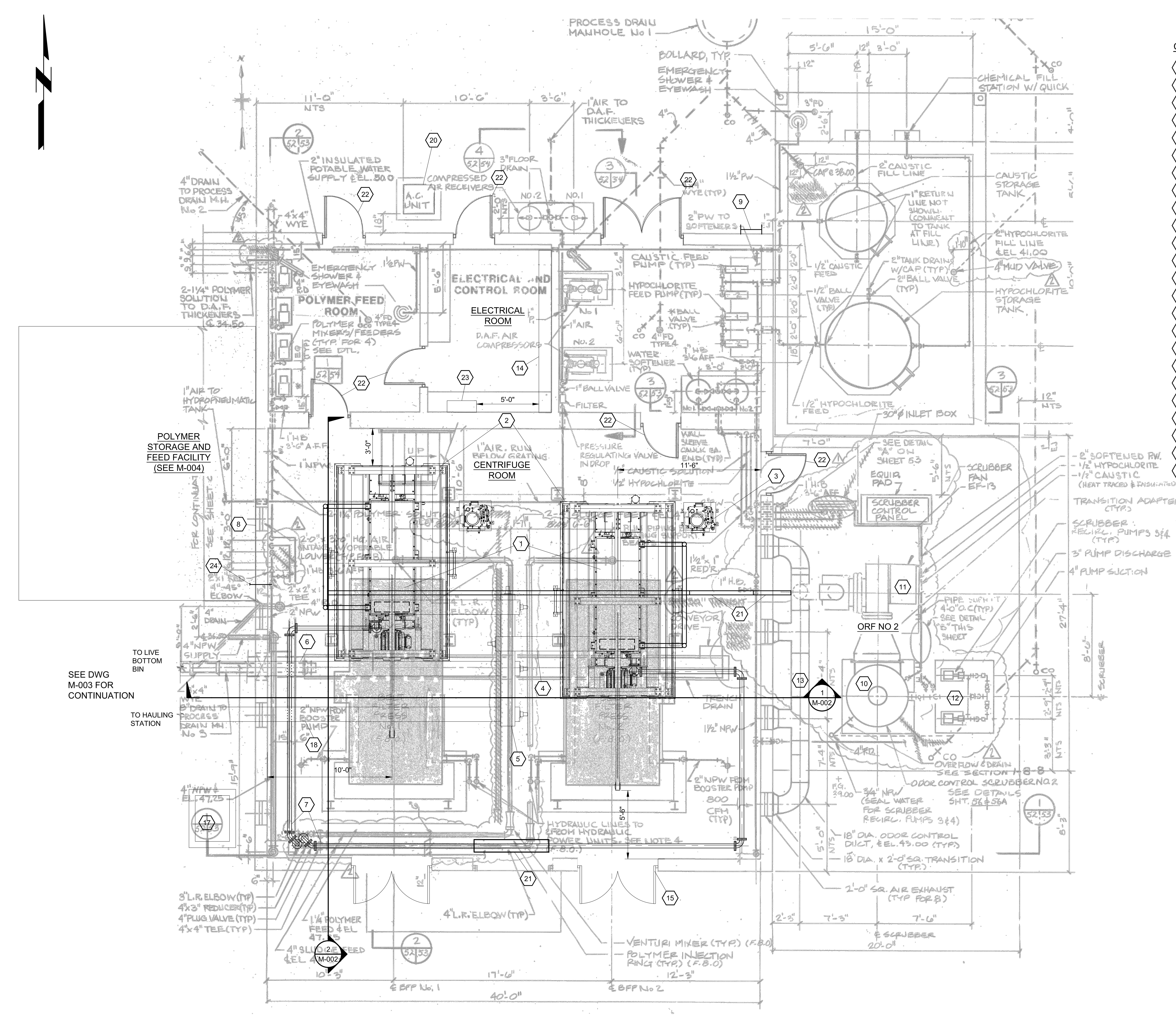
D11000

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



CONSTRUCTION KEY NOTES

1. CENTRIFUGE (TYP OF 2)
2. OPERATING PLATFORM WITH MONORAIL ASSEMBLY (TYP OF 2)
3. HYDRAULIC POWER UNIT (TYP OF 2)
4. SCREW CONVEYOR FOR SLOP MANAGEMENT (TYP OF 2)
5. INTERMEDIATE SCREW CONVEYOR
6. MAIN SCREW CONVEYOR
7. 4" SLUDGE FEED
8. OPERABLE WINDOW AT LOWER OPENING (TYP OF 2) FIXED WINDOW AT UPPER OPENING (TYP OF 4)
9. ALUM LADDER WITH SECURITY GUARD
10. EXIST ODOR SCRUBBER TO REMAIN IN SERVICE
11. EXIST ODOR SCRUBBER FAN TO REMAIN IN SERVICE
12. EXIST RECIRCULATION PUMPS TO REMAIN IN SERVICE
13. EXIST FOUL AIR DUCT TO REMAIN IN SERVICE. INSTALL NEW EXHAUST REGISTER (TYP OF 8)
14. MCC-H
15. 6'-4" W X 9'-0" H DOUBLE DOOR (TYP OF 2) - SEE DWG S-001
16. EXIST OPENING TO BE FILLED - SEE DWG S-001
17. AIR HANDLING UNIT
18. STANDBY SCREW CONVEYOR
19. NOT USED
20. AIR CONDITIONING UNIT
21. 4" FA (FRP) - CONNECT TO EXISTING
22. DOOR
23. VC-2 - RELOCATE
24. 2" NPW - ROUTE TO POLYMER FEEDER BLENDERS

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PROJECT NO.:	407556

DEWATERING

MECHANICAL

DEWATERING BUILDING AND ODOR REDUCTION FACILITY - PLAN

M-001

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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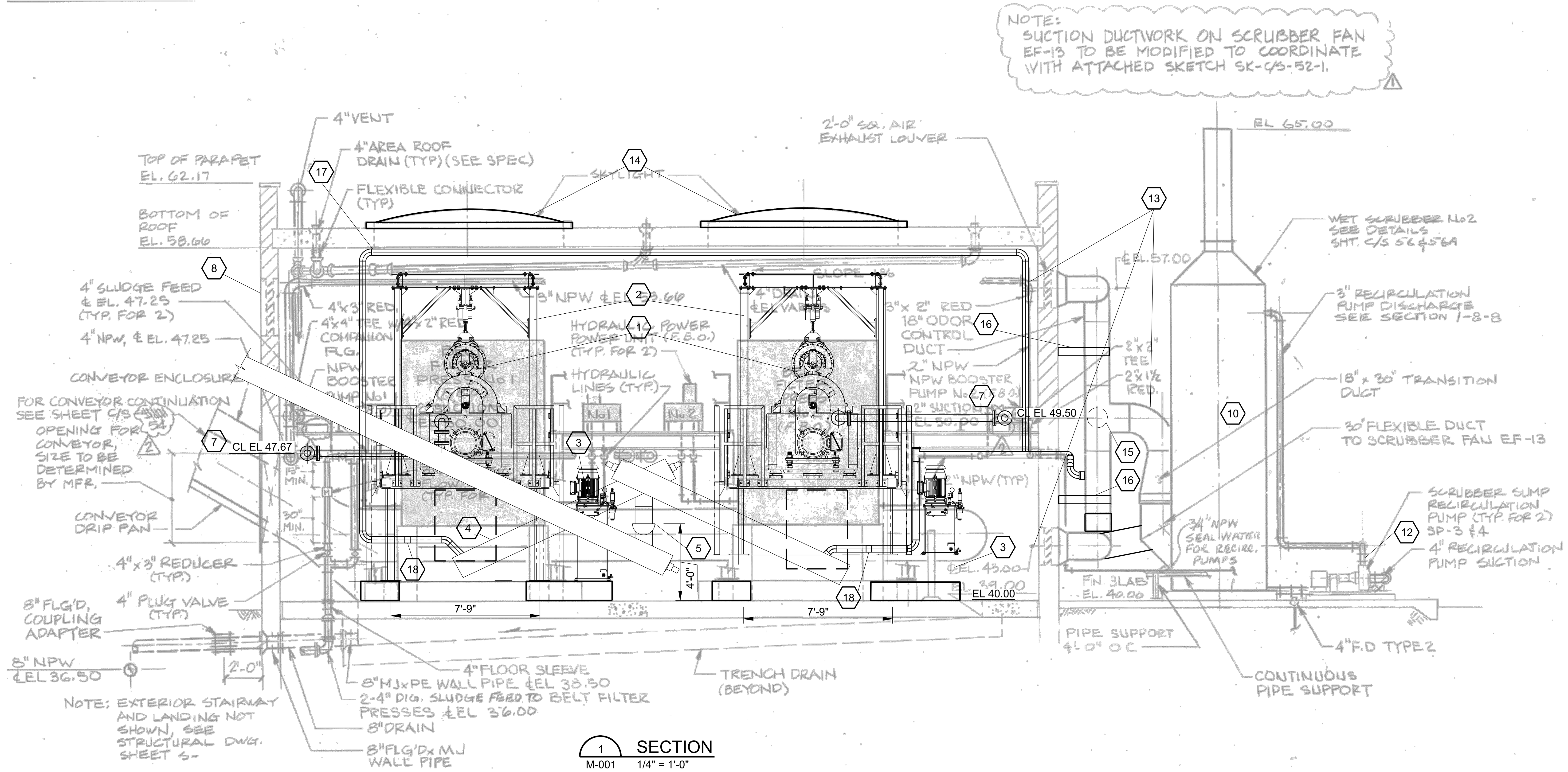
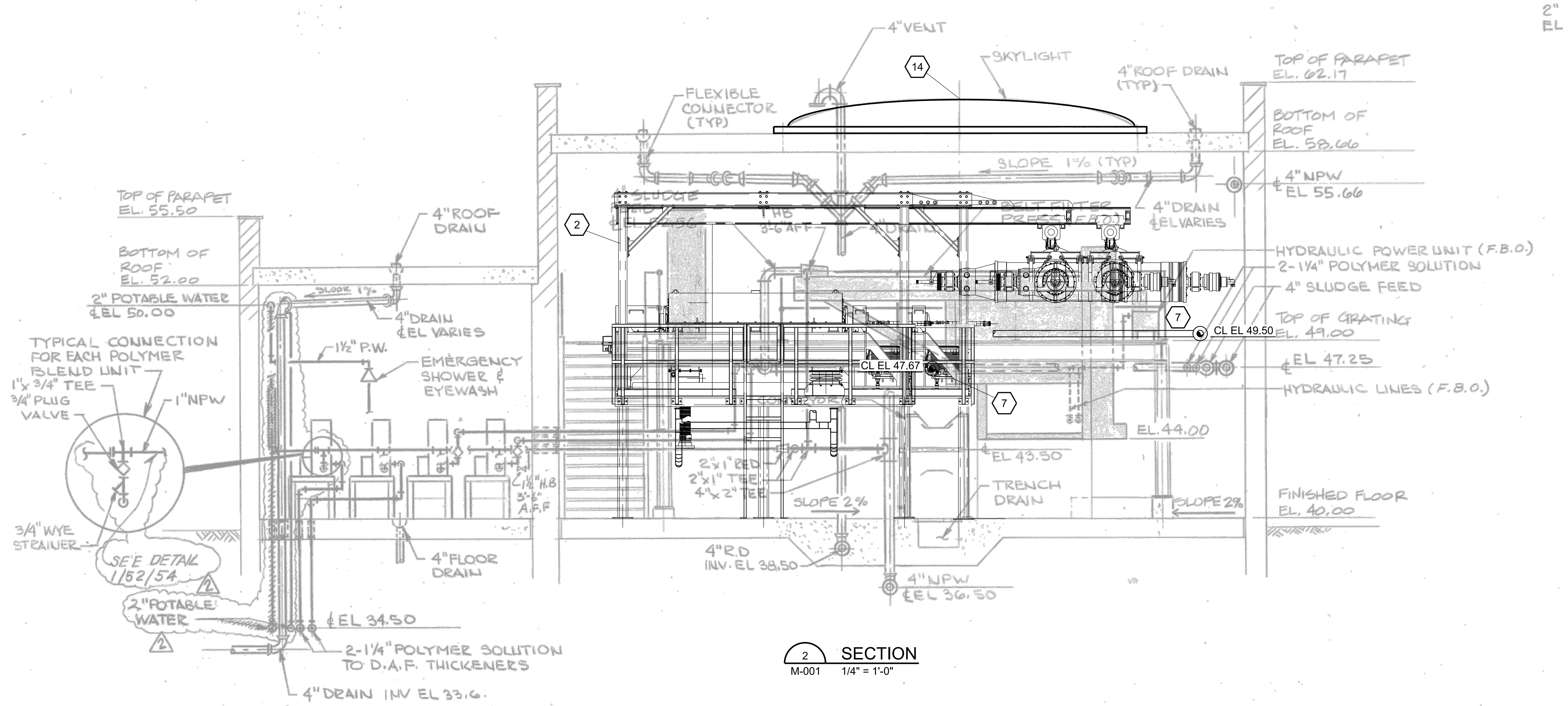


1 SECTION
M-001 1/4" = 1'-0"



2 SECTION
M-001 1/4" = 1'-0"

CONSTRUCTION KEY NOTES

1. CENTRIFUGE (TYP OF 2)
2. OPERATING PLATFORM WITH MONORAIL ASSEMBLY (TYP OF 2)
3. HYDRAULIC POWER UNIT (TYP OF 2)
4. SCREW CONVEYOR FOR SLOP MANAGEMENT (TYP OF 2)
5. INTERMEDIATE SCREW CONVEYOR
6. MAIN SCREW CONVEYOR
7. 4" SLUDGE FEED
8. OPERABLE WINDOW AT LOWER OPENING (TYP OF 2) FIXED WINDOW AT UPPER OPENING (TYP OF 4)
9. NOT USED
10. EXIST ODOR SCRUBBER TO REMAIN IN SERVICE
11. NOT USED
12. EXIST RECIRCULATION PUMPS TO REMAIN IN SERVICE
13. EXIST FOUL AIR DUCT TO REMAIN IN SERVICE. INSTALL NEW EXHAUST REGISTER (TYP OF 8)
14. REMOVABLE SKYLIGHT
15. EXIST CONNECTION FROM FEB/DAF
16. EXIST FA SUPPORTS
17. NEW 4" FA (FRP)
18. DAMPER

4' 2' 0 4' 8'
1/4"=1'-0"

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PROJECT NO.:	407556

DEWATERING

MECHANICAL

DEWATERING BUILDING AND ODOR REDUCTION FACILITY - SECTION

M-002

09 OF 29

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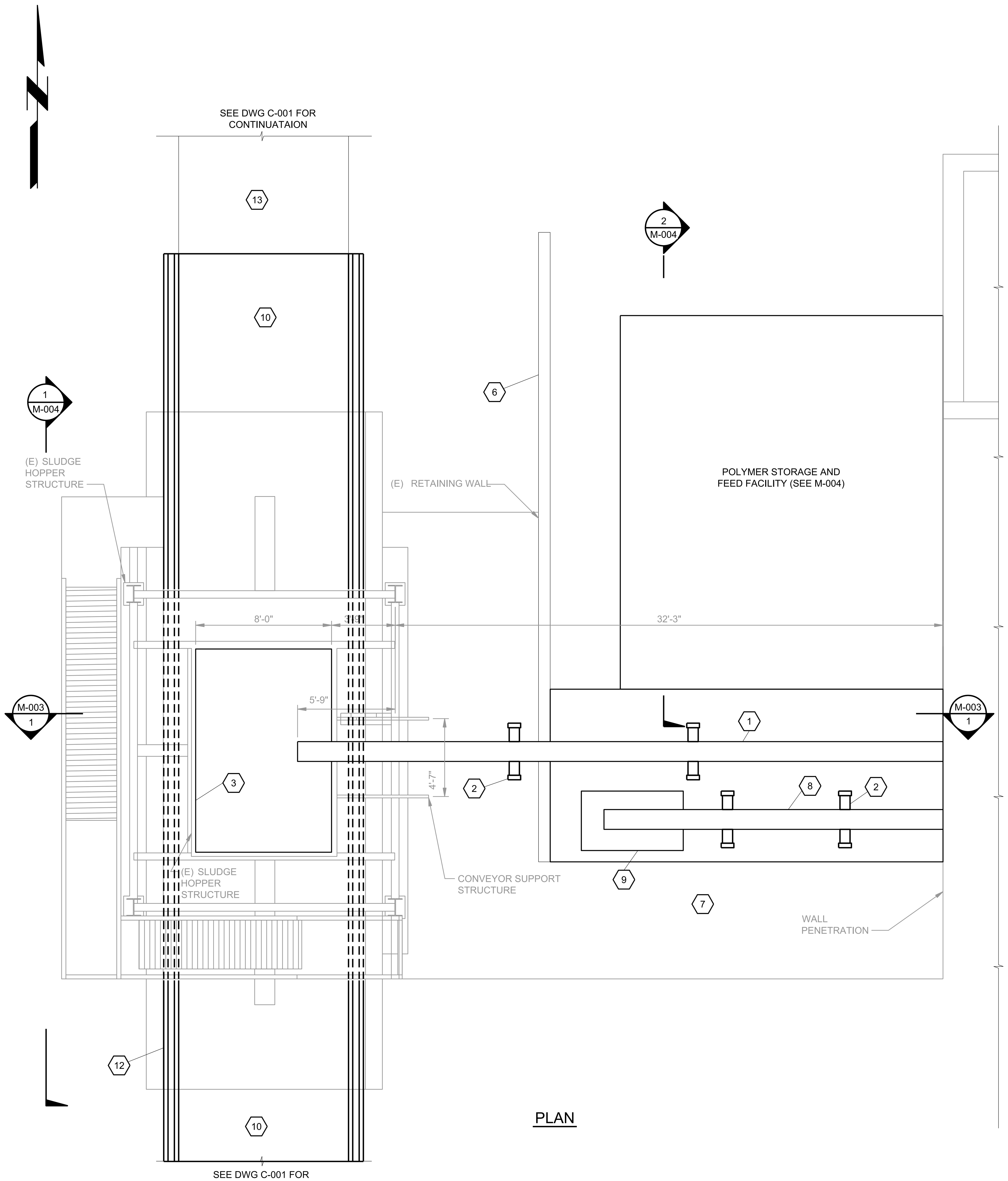
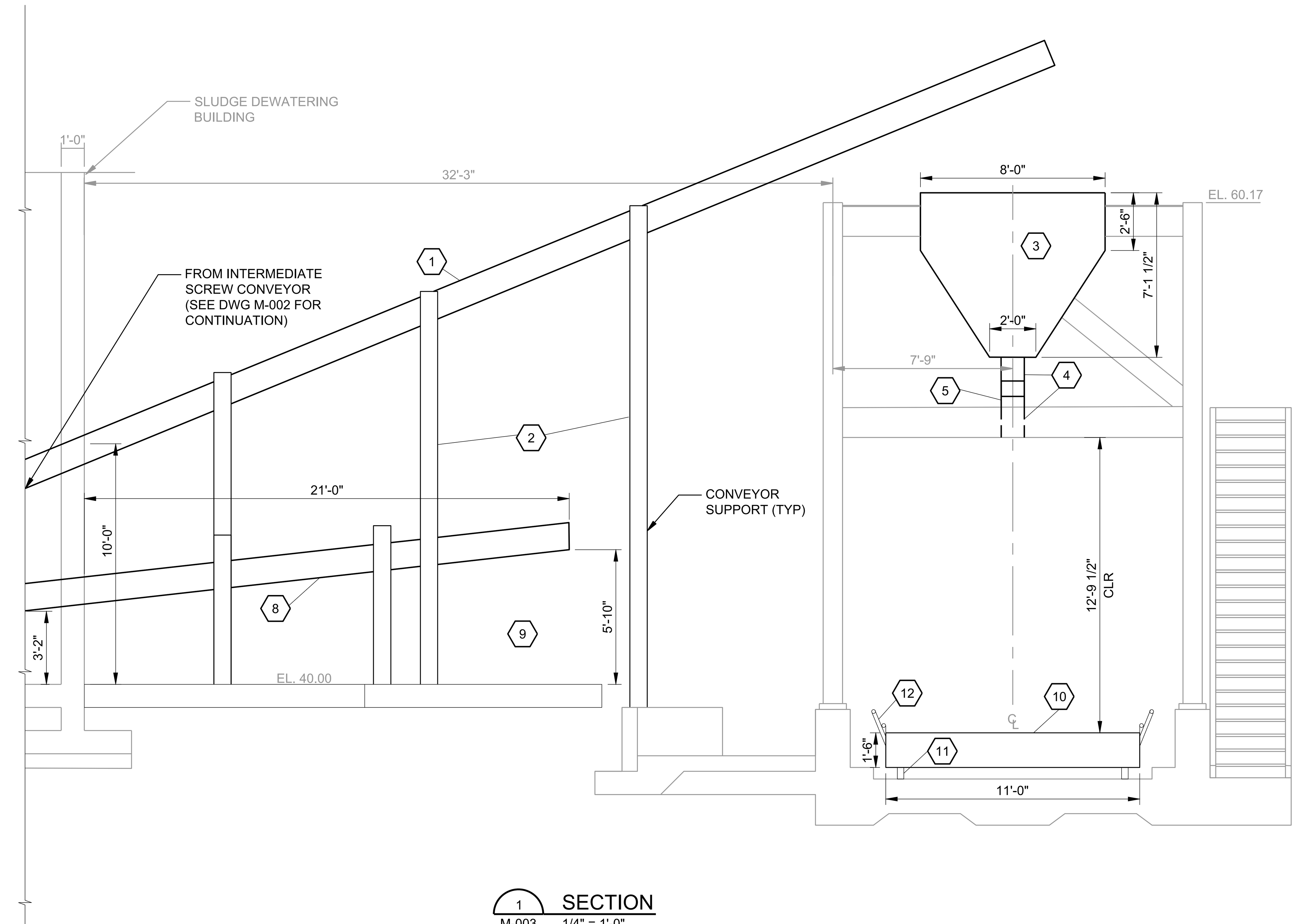


PLAN



1 M-003 SECTION 1/4" = 1'-0"

CONSTRUCTION KEY NOTES

1. MAIN SCREW CONVEYOR
2. MAIN SCREW CONVEYOR SUPPORTS (TO BE DESIGNED BY CONVEYOR SUPPLIER)
3. LIVE BOTTOM BIN
4. CHUTE
5. KNIFE GATE
6. RETAINING WALL
7. CONCRETE SLAB ON GRADE
8. STANDBY SCREW CONVEYOR
9. CAKE HAULING STATION
10. TRUCK SCALE STEEL DECK (80' L X 10' W)
11. TRUCK SCALE LOAD CELL (TYP)
12. TRUCK SCALE GUARD RAILS
13. TRUCK SCALE APPROACH RAMP

4' 2' 0 4' 8'
1/4"=1'-0"

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PROJECT NO.:	407556

MECHANICAL

TRUCK LOADING, POLYMER STORAGE & FEED - PLAN & SECTIONS

M-003

10 OF 29

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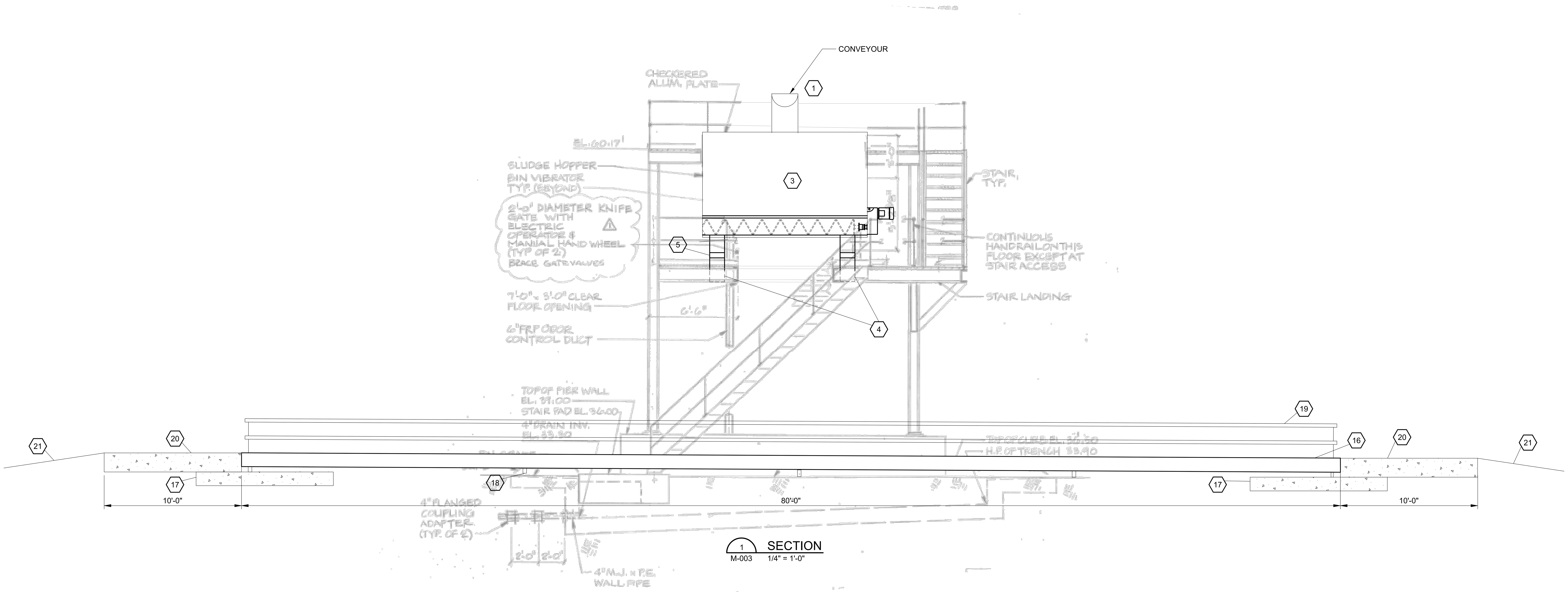
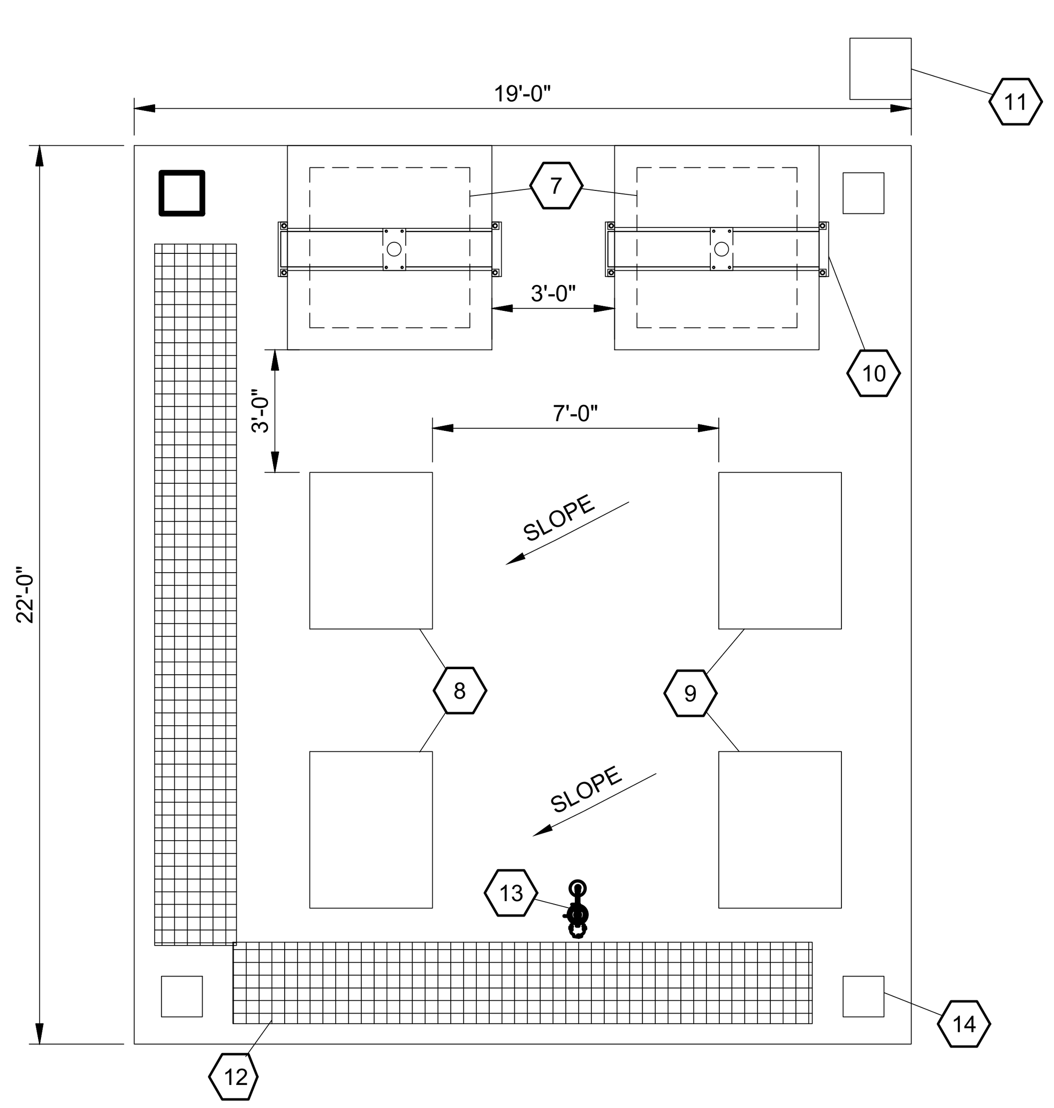
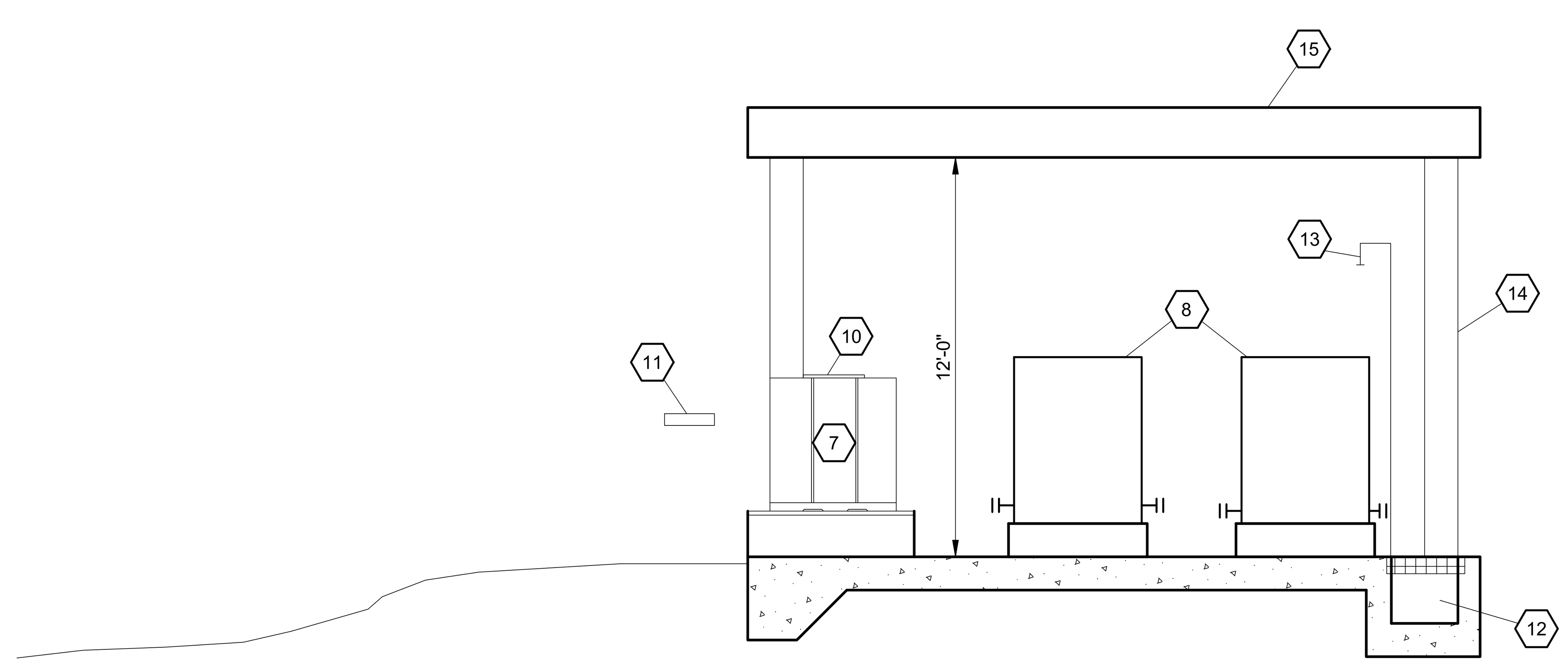


SECTION 1
M-003 1/4" = 1'-0"



POLYMER STORAGE AND FEED FACILITY PLAN
1/4" = 1'-0"



SECTION 2
M-003 1/4" = 1'-0"

CONSTRUCTION KEY NOTES

1. MAIN SCREW CONVEYOR
2. NOT USED
3. LIVE BOTTOM BIN
4. CHUTE
5. KNIFE GATE
6. NOT USED
7. POLYMER TOTE (TYP OF 2 OR RESERVE SPACE FOR SECOND ONE)
8. POLYMER FEEDER BLENDER FOR THICKENING (TYP OF 2)
9. NOT USED
10. POLYMER TOTE MIXER BRAKET (TYP OF 2)
11. WALL MOUNTED HANGER FOR PORTABLE MIXER
12. CONTAINMENT TRENCH WITH GRATING
13. EMERGENCY EYEWASH AND SHOWER
14. CANOPY FRAMING
15. CANOPY
16. TRUCK SCALE STEEL DECK (80' L X 10' W)
17. CONCRETE SLAB ON GRADE - EXTEND TO SUPPORT TRUCK SCALE
18. TRUCK SCALE LOAD CELL (TYP)
19. TRUCK SCALE GUARD RAILS
20. TRUCK SCALE APPROACH RAMP
21. AC PAVEMENT - SLOPE UP TOWARDS RAMP

4' 2' 0 4' 8'
1/4"=1'-0"

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MECHANICAL

TRUCK LOADING, POLYMER STORAGE & FEED - SECTIONS

M-004

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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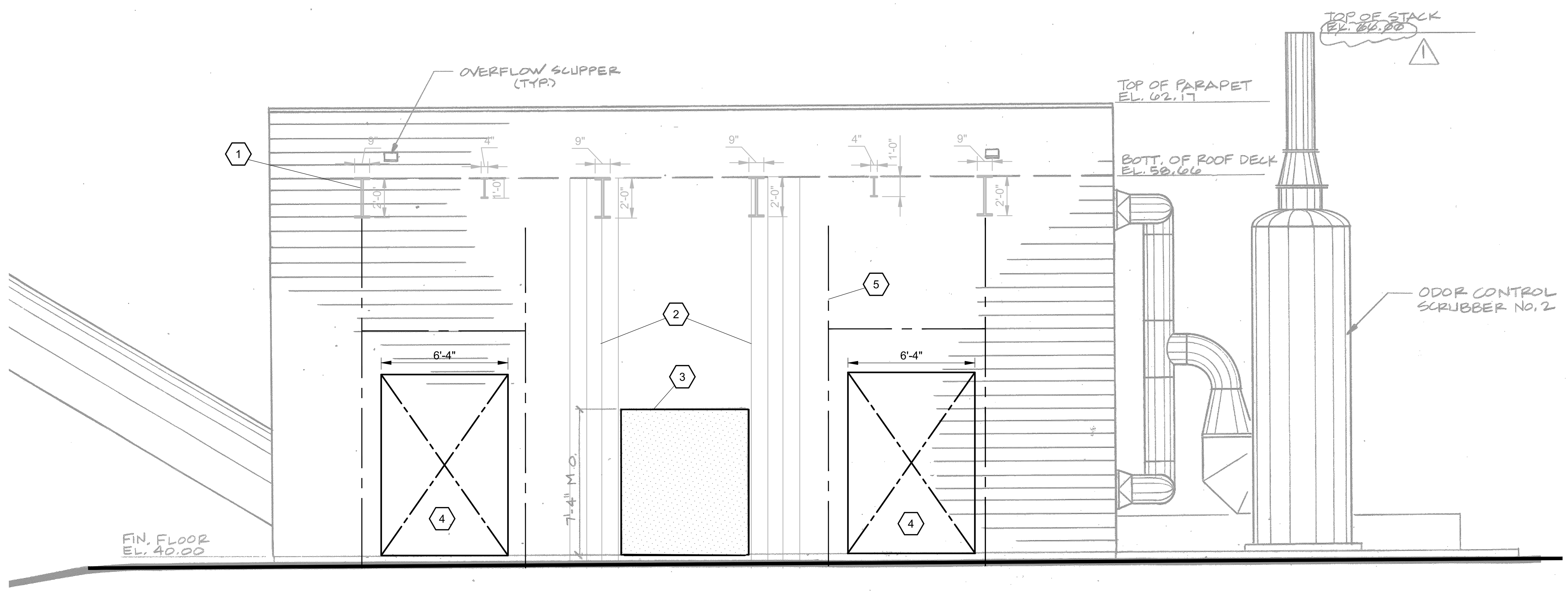

SOUTH ELEVATION

CONSTRUCTION KEY NOTES

1. EXIST BEAM - PROTECT IN PLACE (TYP)
2. EXIST REBAR - PROTECT IN PLACE (TYP)
3. FILL EXIST OPENING
4. SAW CUT NEW OPENING FOR DOUBLE DOOR (TYP OF 2)
5. STEEL STRONGBACK FRAME AT NEW OPENINGS

4' 2' 0 4' 8'
1/4"=1'-0"

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DEWATERING BUILDING

STRUCTURAL

DEWATERING BUILDING - SOUTH WALL DOOR MODIFICATIONS

S-001

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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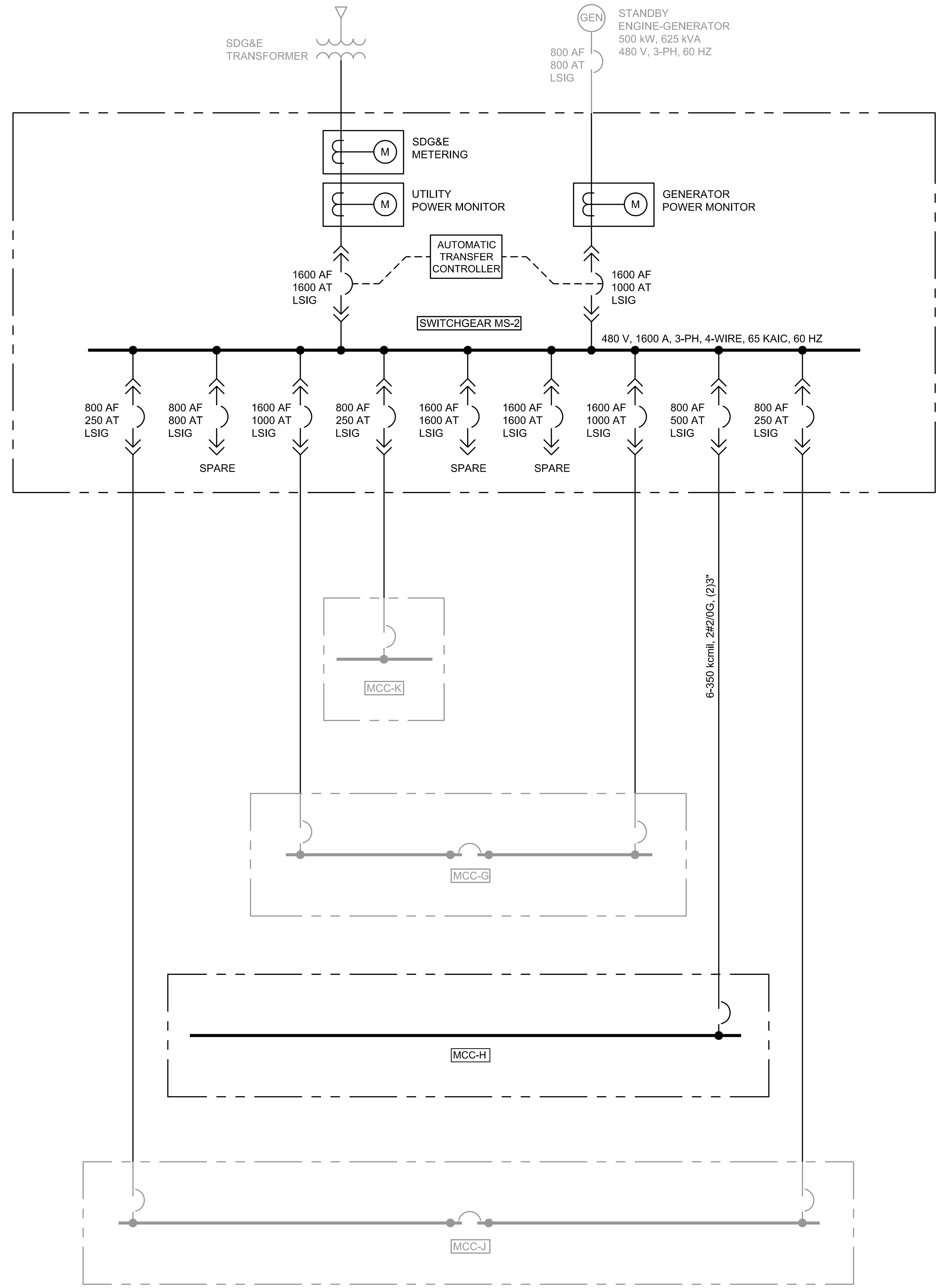

POWER DISTRIBUTION FUNCTIONAL DIAGRAM

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PROJECT NO.:	407556

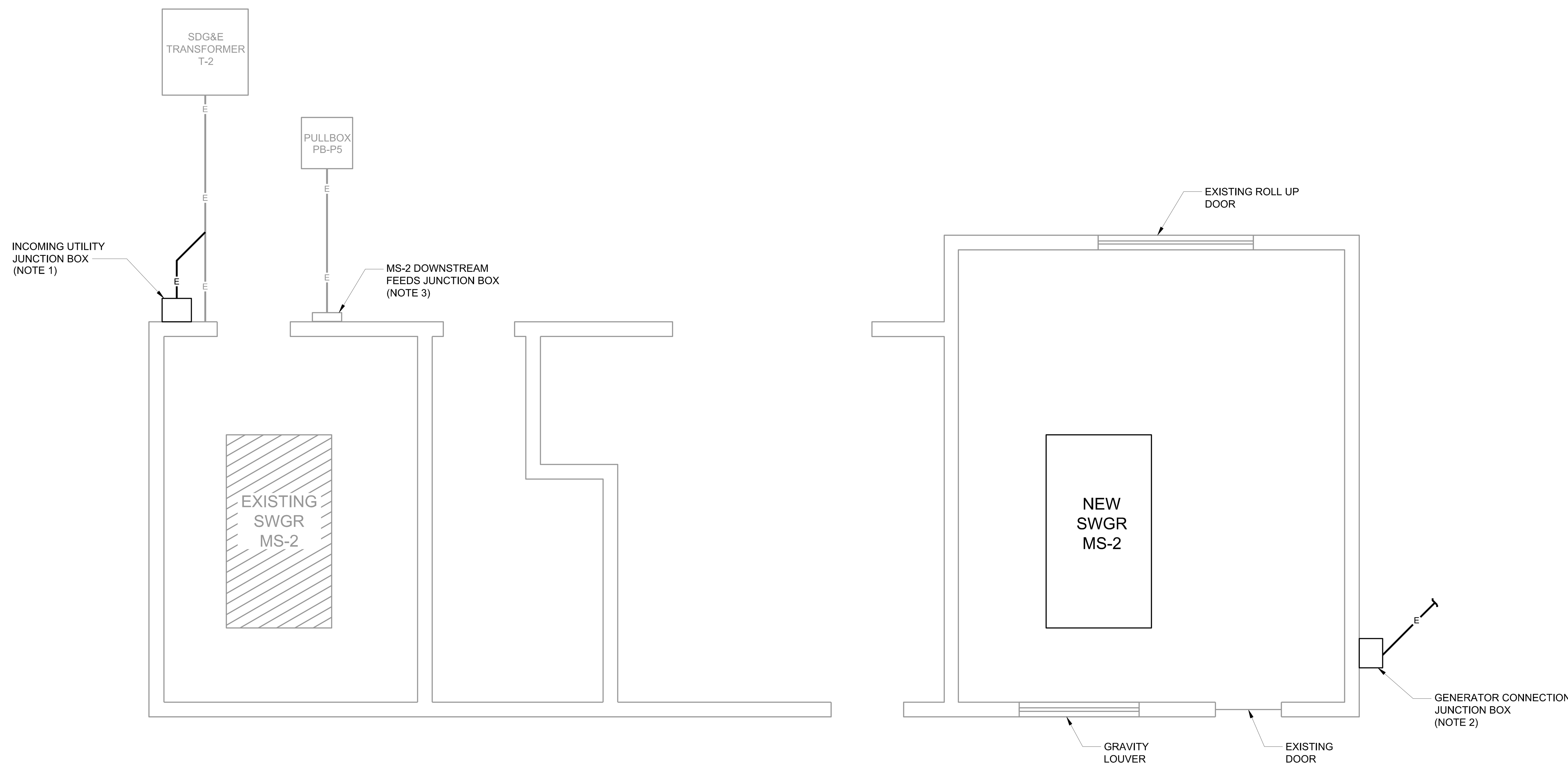
ELECTRICAL

POWER DISTRIBUTION FUNCTIONAL DIAGRAM

E-001

13 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



CHLORINATION BUILDING / MS-2 SWITCHGEAR ROOM - POWER PLAN
1" = 50'-0"

NOTES:

1. CONTRACTOR SHALL INTERCEPT INCOMING DUCT BANK FROM SDG&E TRANSFORMER T-2 AND ROUTE NEW DUCT BANK TO THE EDGE OF BUILDING WHERE THE CONDUIT WILL TURN UP ON THE OUTSIDE OF THE BUILDING AND ROUTE TO A NEW JUNCTION BOX. NEW CONDUITS SHALL THEN PUNCH THROUGH THE WALL FROM THIS NEW JUNCTION BOX AND BE ROUTED INDOORS TO THE STORAGE ROOM WHERE THE NEW SWITCHGEAR MS-2 WILL BE INSTALLED. CONDUITS WILL ENTER NEW SWITCHGEAR MS-2 FROM THE TOP.
2. CONTRACTOR SHALL ROUTE OVERHEAD CONDUITS OUT OF THE TOP OF NEW SWITCHGEAR MS-2 TO THE WALL TO INTERCEPT THE EXISTING CONDUITS THAT PUNCH THROUGH THE WALL INTO THE EXISTING JUNCTION BOX THAT THEN ROUTES TO THE ENGINE-GENERATOR SWITCHGEAR.
3. CONTRACTOR SHALL INSTALL CONDUITS FROM NEW SWITCHGEAR MS-2 THAT FEED THE DOWNSTREAM LOADS. CONDUITS SHALL BE ROUTED OVERHEAD TO THE WALL AND THEN INDOORS TO THE EXISTING MS-2 ROOM WHERE THEY SHALL INTERCEPT THE EXISTING CONDUITS THAT PUNCH THROUGH THE WALL INTO THE EXISTING JUNCTION BOX THAT ROUTES TO EXISTING UNDERGROUND PULL BOX PB-P5.

50' 25' 0 50' 100'
1"=50'

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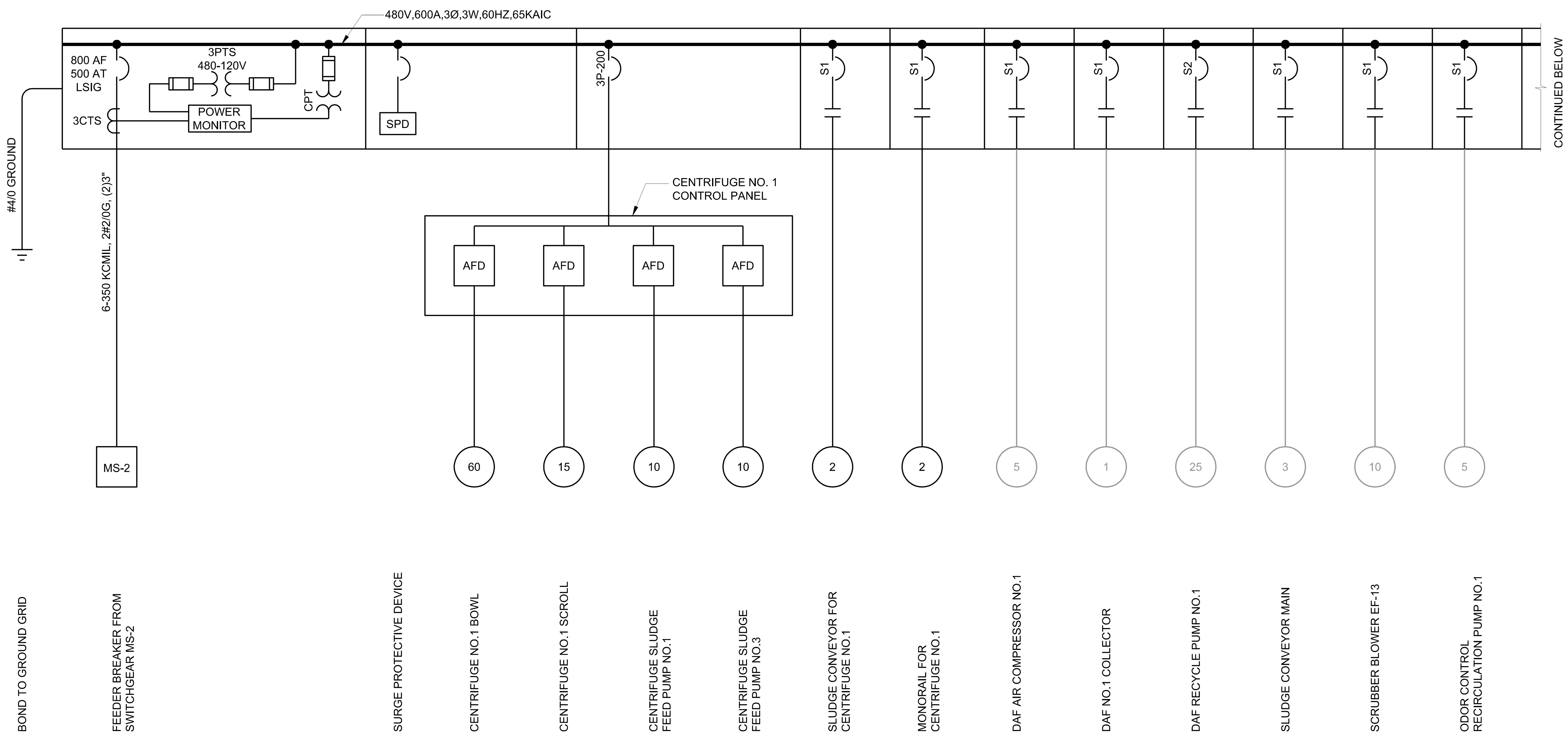
ELECTRICAL

MS-2 SWITCHGEAR ROOM - POWER PLAN

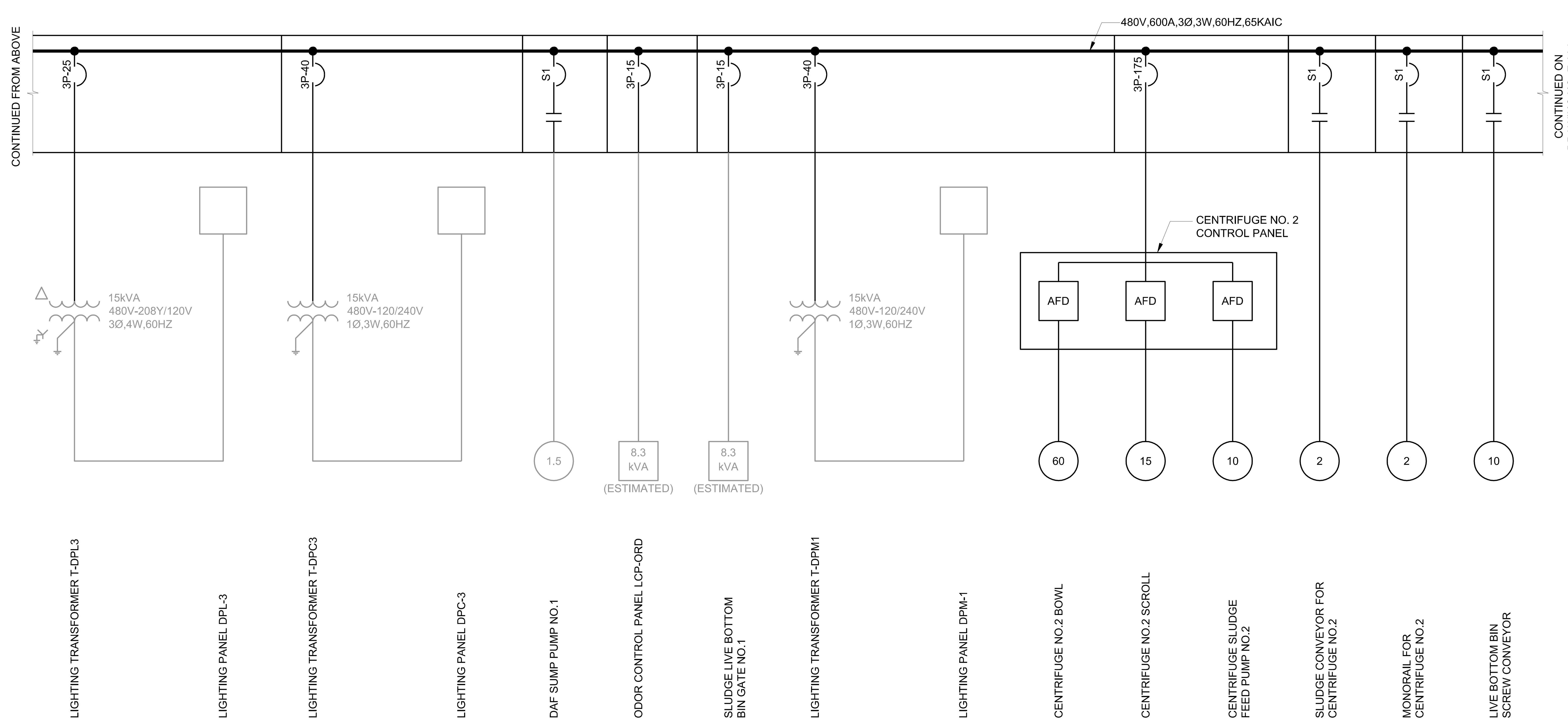
E-002

14 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



MCC-H ONE-LINE DIAGRAM
NO SCALE



MCC-H ONE-LINE DIAGRAM
NO SCALE

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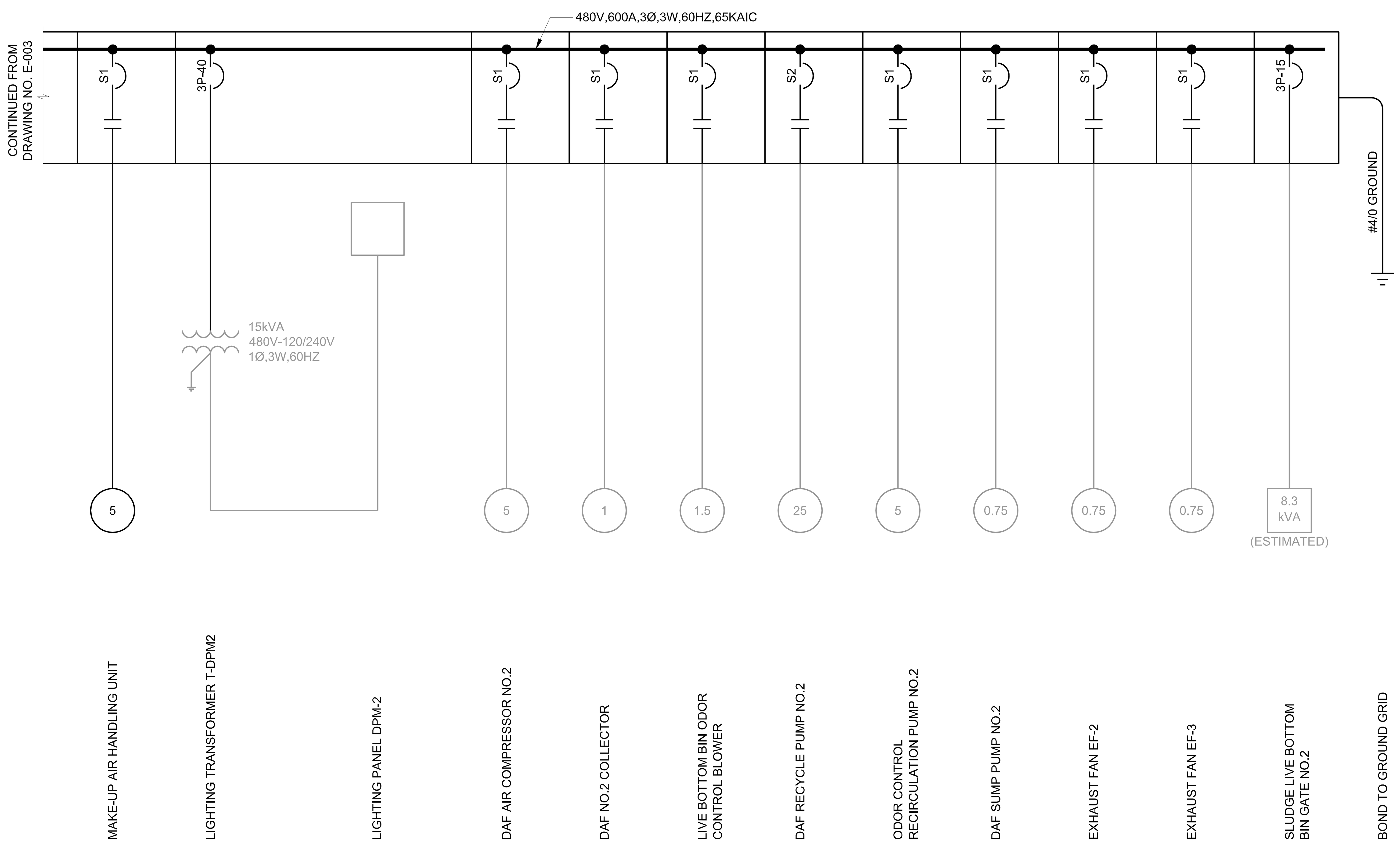
ELECTRICAL

MCC-H
ONE LINE DIAGRAM
1 OF 2

E-003

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



MCC-H ONE-LINE DIAGRAM (CONTINUED)

NO SCALE

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ELECTRICAL

MCC-H
ONE LINE DIAGRAM
2 OF 2

E-004

13 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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FD1000
D1000

EQUIPMENT IDENTIFICATION DESCRIPTION

SSS - FFF - 9999

- SYSTEM CODE - DENOTES ASSOCIATED SYSTEM STREAM
- FUNCTION CODE - DENOTES ASSOCIATED EQUIPMENT ABBREVIATION
- SEQUENCE CODE - UNIQUE ALPHA-NUMERIC IDENTIFIER

PIPELINE IDENTIFICATION DESCRIPTION

SSS - PPP - 999 - MTL - INS - THK - SPL

- PIPE SIZE - INCHES UNLESS OTHERWISE NOTED
- PROCESS CODE - DENOTES PROCESS STREAM
- SEQUENCE NUMBER - DENOTES PIPE NUMBER
- PIPELINE MATERIAL CODE - DENOTES MATERIAL
- INSULATION MATERIAL CODE - DENOTES INSULATION MATERIAL (SEE MECHANICAL INSULATION SPECIFICATION)
- INSULATION THICKNESS - DENOTES INSULATION THICKNESS
- SPECIAL CODE

LINE SYMBOLS

- MAJOR PROCESS PIPING OR FLOW CHANNEL
- SECONDARY PROCESS PIPING
- MISCELLANEOUS PIPING
- SCREENED LINE DENOTES EXISTING PIPE OR EQUIPMENT
- DASHED LINE DENOTES FUTURE PIPE AND EQUIPMENT
- ELECTRIC SIGNAL
- HYDRAULIC SIGNAL
- PNEUMATIC SIGNAL
- SIGNAL CONNECTION POINT
- CONTROL SYSTEM BACKBONE NETWORK SIGNAL (ETHERNET)
- FIELD DEVICE NETWORK SIGNAL (ETHERNET)
- NON-STANDARD OR INDEPENDENT CONTROL SYSTEM NETWORK SIGNAL (AS NOTED ON DRAWINGS)
- B | I-XXX — SIGNAL LINE COMING/GOING TO/FROM SHEET (MATCH LETTERS)
- B | I-XXX — PROCESS LINE COMING/GOING TO/FROM ANOTHER (MATCH LETTERS)
- MATCH SHEET NO. IDENTIFIER
- MATCH LINE NO.
- B — SIGNAL CONNECTION WITHIN THE SAME SHEET
- FLOW ARROW FOR PROCESS PIPING
- PROCESS LINES CROSSING (NOT CONNECTED)

MISCELLANEOUS MECHANICAL EQUIPMENT SYMBOLS

- AFTERCOOLER
- BOILER
- FILTER, AIR
- FILTER, WATER CARTRIDGE TYPE
- FILTER, WATER MEMBRANE TYPE
- FILTER SEPARATOR
- HEAT EXCHANGER, AIR
- HEAT EXCHANGER, DOUBLE PIPE
- HEAT EXCHANGER, FINNED TUBE
- HEAT EXCHANGER, PLATE & FRAME
- HEAT EXCHANGER, SHELL & TUBE
- HEAT EXCHANGER, SPIRAL
- HEAT EXCHANGER, TYPE 1
- HEAT EXCHANGER, TYPE 2
- HYDROCYCLONE
- MIXER, MECHANICAL
- MIXER, STATIC
- PARTICULATE FILTER
- REGULATOR, AIR
- SILENCER
- VALVE, MATERIAL HANDLING ROTARY
- VAPORIZER, AMBIENT

PUMP & BLOWER SYMBOLS

- BLOWER, CENTRIFUGAL
- BLOWER, POSITIVE DISPLACEMENT
- COMPRESSOR
- COMPRESSOR, LIQUID RING
- COMPRESSOR, RECIPROCATING
- COMPRESSOR, ROTARY SCREW
- COMPRESSOR, ROTARY SCROLL
- FAN, CENTRIFUGAL
- MOTOR, ELECTRIC
- PUMP, CENTRIFUGAL OR OTHER TYPE NOT SPECIFIED
- PUMP, CENTRIFUGAL SUBMERGED
- PUMP, DIAPHRAGM METERING, MOTOR DRIVEN
- PUMP, DIAPHRAGM METERING, SOLENOID DRIVEN
- PUMP, DOUBLE DIAPHRAGM
- PUMP, DRUM
- PUMP, PERISTALTIC
- PUMP, PLUNGER
- PUMP, POSITIVE DISPLACEMENT
- PUMP, PROGRESSING CAVITY
- PUMP, ROTARY
- PUMP, SCREW (LIFT)
- PUMP, SUBMERSIBLE
- PUMP, VERTICAL

WATER & WASTEWATER MECHANICAL EQUIPMENT SYMBOLS

- BAR SCREEN, MANUAL
- BAR SCREEN, MECHANICAL
- BASIN, RECTANGULAR
- BELT FILTER PRESS
- CENTRIFUGE
- DISSOLVED AIR FLOTATION (DAF) THICKENER
- FLARE, GAS; WASTE GAS BURNER
- GRAVITY BELT THICKENER
- GRAVITY FILTER
- GRIT BASIN
- GRIT CLASSIFIER
- GRIT COLLECTOR, VORTEX TYPE
- GRIT CONCENTRATOR
- GRIT CONCENTRATOR & DEWATERING SCREW
- OZONE GENERATOR
- OZONE GENERATOR WITH POWER SUPPLY
- SEDIMENTATION BASIN, CIRCULAR
- SEDIMENTATION BASIN, RECTANGULAR W/SETTLING PLATES AND SOLIDS COLLECTOR
- SEDIMENTATION BASIN, RECTANGULAR W/ SOLIDS COLLECTOR
- SLUDGE GRINDER, CHANNEL MOUNTED
- SLUDGE GRINDER, INLINE
- SOLIDS COLLECTOR
- THICKENER, GRAVITY
- UV, W/HORIZONTAL BULBS

PRIMARY ELEMENT & FITTING SYMBOLS

- CAP
- COUPLING
- DIAPHRAGM SEAL
- DIAPHRAGM SEAL, ANNULAR TYPE
- DRAIN, BELL-UP TYPE (D)
- DRAIN, FUNNEL TYPE (D)
- EXPANSION JOINT
- EXPANSION LOOP
- FLAME ARRESTER
- FLAME CHECK
- FLANGE
- FLEXIBLE CONNECTION
- FLOW CONDITIONER
- HORN OR SIREN
- HOSE CONNECTION
- IN-LINE TYPE ULTRASONIC FLOWMETER (SINGLE OR MULTI-PATH)
- P — INSTRUMENT PURGE OR FLUSHING DEVICE
- LE CON — LEVEL SENSOR, CONDUCTANCE TYPE
- LE GWR — LEVEL SENSOR, GUIDED WAVE RADAR TYPE
- LE DP — LEVEL SENSOR, PRESSURE SENSING TYPE
- LIT RAD — LEVEL SENSOR, RADAR TYPE
- LE US — LEVEL SENSOR, ULTRASONIC TYPE
- MOISTURE SEPARATOR
- PLUG
- PRIMARY FLOW ELEMENT, AVERAGING PITOT TYPE
- PRIMARY FLOW ELEMENT, CORIOLIS MASS FLOWMETER
- PRIMARY FLOW ELEMENT, FLUME
- PRIMARY FLOW ELEMENT, MAGNETIC
- PRIMARY FLOW ELEMENT, ORIFICE PLATE
- PRIMARY FLOW ELEMENT, THERMAL DISPERSION FLOWMETER
- PRIMARY FLOW ELEMENT, TURBINE OR PROPELLER-TYPE
- PRIMARY FLOW ELEMENT, VENTURI TUBE, FLOW NOZZLE, OR FLOW TUBE. * SEE MEASUREMENT SYMBOL NOTATIONS LIST
- PRIMARY FLOW ELEMENT, WEIR
- QUICK CONNECT (Q)
- REDUCER - CONCENTRIC
- REDUCER - ECCENTRIC
- FG — ROTAMETER
- SEDIMENT TRAP
- SIGHTGLASS
- STRAINER, BASKET TYPE
- STRAINER, Y TYPE
- SUCTION DIFFUSER
- SURGE CHAMBER
- T — TRAP
- UNION
- VENT
- VENT, SCREENED

CHEMICAL FEED EQUIPMENT SYMBOLS

- AS — AUTOMATIC SWITCHOVER
- CALIBRATION COLUMN
- CHLORINE DIOXIDE (CO2) VAPORIZER
- CYLINDER, GAS
- DIFFUSER, CHANNEL
- DIFFUSER, INLINE
- DIFFUSER, POLYMER INJECTION RING
- DIFFUSER, TANK
- DOUBLE CONTAINED PIPING
- DRIP LEG HEATER
- DRY CHEMICAL FEEDER
- EMERGENCY COMBINATION SHOWER AND EYEWASH FOUNTAIN
- EMERGENCY EYEWASH FOUNTAIN
- EMERGENCY SHOWER
- EVAPORATOR
- EXPANSION TANK OR FUNNEL
- GAS FEEDER
- INJECTOR/EDUCTOR
- LIME SLAKER, PASTE TYPE
- PRESSURE BUILDING COIL
- PULSATION DAMPENER
- RUPTURE DISK
- SPECTACLE FLANGE, BLIND, CLOSED
- SPECTACLE FLANGE, BLIND, OPEN
- TON CONTAINER
- TOTE
- VAPOR SUPERHEATER
- WEIGH SCALE

VALVE & GATE SYMBOLS

- BACKFLOW PREVENTER
- CHLORINE VACUUM REGULATOR ASSEMBLY
- DAMPER
- EXPLOSION RELIEF
- GATE, SLUICE OR SLIDE
- VALVE, AIR RELEASE
- VALVE, AIR VACUUM BREAK
- VALVE, ANGLE
- VALVE, BALL
- VALVE, BUTTERFLY
- VALVE, CHECK
- VALVE, CHECK W/STOP
- VALVE, CHLORINE WITH YOKE
- VALVE, COMBINATION AIR RELEASE AND VACUUM BREAK
- VALVE, DIAPHRAGM
- VALVE, DIVERTER
- VALVE, DIVERTER ASSEMBLY
- VALVE, ECCENTRIC PLUG
- VALVE, FLAP GATE
- VALVE, FOUR FUNCTION
- VALVE, FOUR WAY
- VALVE, GATE OR OTHER TWO-WAY TYPE NOT OTHERWISE IDENTIFIED
- VALVE, GLOBE
- VALVE, KNIFE GATE
- VALVE, MUD
- VALVE, NEEDLE
- VALVE, NON-ECCENTRIC PLUG
- VALVE, PINCH
- VALVE, PRESSURE AND VACUUM RELIEF
- VALVE, PRESSURE REDUCING
- VALVE, PRESSURE REDUCING (SELF ACTUATING TYPE)
- VALVE, PRESSURE RELIEF
- VALVE, PRESSURE SUSTAINING
- VALVE, PRESSURE SUSTAINING (SELF ACTUATING TYPE)
- VALVE, RELIEF, PILOT ACTUATED
- VALVE, ROTARY, GENERIC
- VALVE, SET STOP
- VALVE, SLEEVE
- VALVE, TELESCOPING
- VALVE, THERMAL SHUTOFF
- VALVE, THREE WAY
- VALVE, V-PORT BALL
- VALVE, VACUUM RELIEF
- VALVE, VENTED BALL

VALVE AND GATE ACTUATOR SYMBOLS

- P — AIR CYLINDER ACTUATOR
- P DA — AIR CYLINDER ACTUATOR - DOUBLE ACTING
- P SC — AIR CYLINDER ACTUATOR - SPRING CLOSE
- P SO — AIR CYLINDER ACTUATOR - SPRING OPEN
- P/O — AIR-OIL CYLINDER ACTUATOR
- DIAPHRAGM, PRESSURE BALANCED
- DIAPHRAGM, SPRING, OR OTHERWISE UNSPECIFIED
- E/H — ELECTRIC-HYDRAULIC
- FLOAT OPERATED FOR VALVE
- H — HYDRAULIC CYLINDER ACTUATOR
- M — INTELLIGENT ELECTRIC ACTUATOR
- LOADING/BACK PRESSURE FOR VALVE
- MANUAL
- QUICK CLOSING FOR VALVE
- QUICK OPENING FOR VALVE
- S — SOLENOID
- S R — SOLENOID - MANUAL RESET
- S R R — SOLENOID - REMOTE RESET
- SPRING OR WEIGHT FOR RELIEF VALVE OR LOADED FOR SAFETY VALVE
- M SM — STANDARD ELECTRIC ACTUATOR
- P V — VANE TYPE PNEUMATIC ACTUATOR

MATERIAL HANDLING EQUIPMENT SYMBOLS

- BIN, LIVE BOTTOM
- BIN, SLIDING FRAME
- BIN ACTIVATOR
- BIN/HOPPER, CLOSED TOP
- BIN/HOPPER, OPEN TOP
- CONVEYOR, BELT
- CONVEYOR, SCREW
- CONVEYOR, VIBRATORY
- CYCLONE SEPARATOR
- DUMPSTER
- DUST COLLECTOR
- GRINDER
- HORIZONTAL BAR SCREEN
- INSULATION
- INSULATION, W/ HEAT TRACING
- MIXER, BLENDER
- MIXER, PUGMILL
- PISTON CAKE PUMP, DOUBLE
- PISTON CAKE PUMP, SINGLE
- SCREEN, DOUBLE VIBRATORY
- SCREEN, SINGLE VIBRATORY
- TARGET BOX

GENERAL NOTES

1. IN GENERAL, THE P&ID SYMBOLS AND DEVICE IDENTIFICATIONS ARE BASED ON INTERNATIONAL SOCIETY OF AUTOMATION, STANDARD PRACTICE ANSI/ISA-5.1 (2009). SOME MODIFICATIONS, ADDITIONS AND ALTERATIONS HAVE BEEN MADE AS NEEDED TO ACCOMMODATE THE PROJECT REQUIREMENTS.
2. SOME CONTROL AND INTERLOCK REQUIREMENTS WHICH CAN BE MORE CLEARLY ILLUSTRATED ON SCHEMATIC DRAWINGS HAVE BEEN OMITTED FROM THE P&ID DRAWINGS.
3. THIS IS A GENERAL LEGEND SHEET. SOME SYMBOLS AND ABBREVIATIONS MAY NOT BE UTILIZED ON THIS SPECIFIC PROJECT.

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PROJECT NO.:	407556

INSTRUMENTATION

LEGEND & ABBREVIATIONS SHEET 1 OF 3

I-001

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

INSTRUMENT AND I/O ABBREVIATIONS

MEANINGS OF IDENTIFICATION LETTERS

LETTER	FIRST LETTER: MEASURED OR INITIATING VARIABLE	FIRST LETTER: VARIABLE MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT OR ACTIVE FUNCTION	SUCCEEDING LETTERS: FUNCTION MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE			CONTROL	CLOSE
D	USER'S CHOICE	DIFFERENTIAL			DEVIATION
E	VOLTAGE (EMF)		SENSOR, PRIMARY ELEMENT		
F	FLOW, FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS, GAUGE, VIEWING DEVICE		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER		SCAN		
K	TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE	MOMENTARY			MIDDLE OR INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE	INTEGRATE OR TOTALIZE		
R	RADIATION		RECORD		RUN
S	SPEED OR FREQUENCY	SAFETY		SWITCH	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	
V	VIBRATION OR MECHANICAL ANALYSIS			VALVE, DAMPER OR LOUVER	
W	WEIGHT OR FORCE		WELL, PROBE		
X	UNCLASSIFIED	X-AXIS	ACCESSORY DEVICES OR UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, OR PRESENCE	Y-AXIS		AUXILIARY DEVICES	
Z	POSITION, DIMENSION	Z-AXIS		DRIVE, ACTUATOR OR FINAL CTRL ELEMENT	

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PIPELINE MATERIAL CODE ABBREVIATIONS

ABBR.	PIPE MATERIAL	SPECIFICATION NO.
BR	BRASS	40 05 41
CBCP	CONCRETE BAR-WRAPPED STEEL CYLINDER PIPE	40 05 39.16
CCFP	CENTRIFUGALLY CAST FIBERGLASS PIPE	40 05 36.11
CCP	CONCRETE CULVERT PIPE	33 42 16
CI	CAST IRON SOIL PIPE	22 13 16
CMP	CORRUGATED METAL PIPE	33 42 14
CPVC	CPVC	40 05 32
CS	MISCELLANEOUS STEEL PIPE	40 05 24.43
CSG	GALVANIZED STEEL PIPE	40 05 24.43
CSP	COMPOSITE SEWER PIPE	40 05 43
CU	COPPER TUBING	40 05 17
DIP	DUCTILE IRON PIPE	40 05 19
FRP	FRP	40 05 32
FRPA	FRP EXHAUST AIR PIPE	40 05 36.11
HDPE	HDPE PRESSURE PIPE	40 05 33.11
HS	HOSE	40 05 41
LHCP	LOW-HEAD CONCRETE PRESSURE	40 05 39.18
LWSP	LIGHT WALL STEEL PIPE	40 05 24.14
PCCP	PRESTRESSED CONCRETE CYLINDER PIPE	40 05 39.14
PE	POLYETHYLENE	40 05 32
PP	POLYPROPYLENE	40 05 32
PVC	PVC	40 05 32
PVCFJ	PVC FUSED JOINT PIPE	40 05 31.13
PVCPP	PVC PRESSURE PIPE	40 05 31.12
PVCSP	PVC SEWER PIPE	40 05 31.16
PVDF	PVDF	40 05 32
RCP	CONCRETE SEWER PIPE	40 05 39.24
RPT	REINFORCED PLASTIC TUBING	40 05 32
SP	STEEL PIPE	40 05 24
SS	STAINLESS STEEL PIPE	40 05 23
TG	TEMPERED GLASS	40 05 41
VCP	VITRIFIED CLAY PIPE	40 05 44

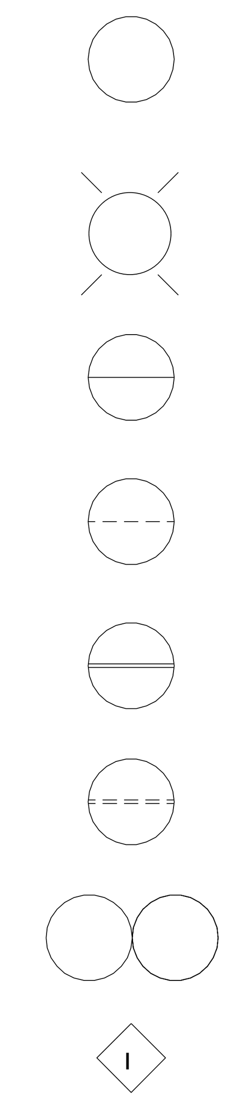
NOTE:

1. ABBREVIATION EXTENSIONS ARE ADDED AS NEEDED TO IDENTIFY THE MATERIAL SUB-CLASSIFICATION IN THE SPECIFICATION, SUCH AS "SS-1" FOR DIGESTER GAS PIPING.

INSTRUMENT AND I/O ABBREVIATION DEFINITIONS

AAH	ANALYZER ALARM HIGH
AAHH	ANALYZER ALARM HIGH-HIGH
AAL	ANALYZER ALARM LOW OR STROBE ALARM LIGHT
AALL	ANALYZER ALARM LOW-LOW
AAX	ALARM HORN
AE	ANALYZER SENSOR
AI	ANALYZER INDICATION
AIT	ANALYZER INDICATING TRANSMITTER
ASH	ANALYZER SWITCH HIGH
ASHH	ANALYZER SWITCH HIGH-HIGH
CB	CONTROL BLOCK REFERENCE (SCADA LEVEL)
FAH	FLOW ALARM HIGH
FAL	FLOW ALARM LOW
FC	FLOW CONTROLLER
FE	PRIMARY FLOW ELEMENT/SENSOR
FG	FLOW SIGHT GAUGE
FI	FLOW DIGITAL INDICATOR (LED OR SCREEN)
FIC	FLOW INDICATING CONTROLLER
FIT	FLOW INDICATING TRANSMITTER
FQG	FLOW TOTALIZING GAUGE
FQIT	FLOW TOTALIZING INDICATING TRANSMITTER
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
FY	FLOW SIGNAL CONVERTER, REPEATER, OR ISOLATOR
HIC	HAND INDICATING CONTROLLER
HMS	MOMENTARY PUSHBUTTON OR SELECTOR SWITCH
HS	HAND SWITCH
IAH	CURRENT ALARM HIGH (MOTOR OVERLOAD)
IE	CURRENT ELEMENT/SENSOR
ISH	CURRENT SWITCH HIGH USED TO DETECT HIGH TORQUE
JA	POWER FAILURE ALARM
JI	POWER INDICATOR
JIT	POWER INDICATING TRANSMITTER
JL	POWER INDICATING LIGHT
KQI	TIME TOTALIZING INDICATOR
LAH	LEVEL ALARM HIGH
LAHH	LEVEL ALARM HIGH-HIGH
LAL	LEVEL ALARM LOW
LALL	LEVEL ALARM LOW-LOW
LE	PRIMARY LEVEL ELEMENT/SENSOR
LG	LEVEL SIGHT GAUGE
LI	LEVEL INDICATOR (LED OR SCREEN)
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW LOW
LY	LEVEL SIGNAL CONVERTER, ISOLATOR, OR REPEATER
OAH	TORQUE ALARM HIGH
OAHH	TORQUE ALARM HIGH HIGH
OSH	TORQUE SWITCH HIGH
OSHH	TORQUE SWITCH HIGH-HIGH
PAH	PRESSURE ALARM HIGH
PAHH	PRESSURE ALARM HIGH-HIGH
PAL	PRESSURE ALARM LOW
PALL	PRESSURE ALARM LOW-LOW
PB	PUSHBUTTON
PDAH	DIFFERENTIAL PRESSURE ALARM HIGH
PDAHH	DIFFERENTIAL PRESSURE ALARM HIGH-HIGH
PDG	DIFFERENTIAL PRESSURE GAUGE
PDI	DIFFERENTIAL PRESSURE INDICATOR (LED OR SCREEN)
PDIT	DIFFERENTIAL PRESSURE INDICATING TRANSMITTER
PDSH	DIFFERENTIAL PRESSURE SWITCH HIGH
PDSHH	DIFFERENTIAL PRESSURE SWITCH HIGH-HIGH
PDSL	DIFFERENTIAL PRESSURE SWITCH LOW
PDSLL	DIFFERENTIAL PRESSURE SWITCH LOW-LOW
PE	PRESSURE SENSOR
PG	PRESSURE GAUGE
PI	PRESSURE INDICATOR (LED OR SCREEN)
PIT	PRESSURE INDICATING TRANSMITTER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
SC	SPEED CONTROL
SI	SPEED INDICATION (LED OR SCREEN)
SIT	SPEED INDICATING TRANSMITTER
SSL	SPEED SWITCH LOW
TAH	TEMPERATURE ALARM HIGH
TAHH	TEMPERATURE ALARM HIGH-HIGH
TAL	TEMPERATURE ALARM LOW
TDI	DIFFERENTIAL TEMPERATURE INDICATOR (LED OR SCREEN)
TDIT	DIFFERENTIAL TEMPERATURE TRANSMITTER
TE	TEMPERATURE SENSOR/RESISTANCE TEMPERATURE DETECTOR
TG	TEMPERATURE GAUGE
TI	TEMPERATURE INDICATOR (LED OR SCREEN)
TIT	TEMPERATURE INDICATING TRANSMITTER
TSH	TEMPERATURE SWITCH HIGH
TSHH	TEMPERATURE SWITCH HIGH HIGH
TSL	TEMPERATURE SWITCH LOW
UA	MULTIVARIABLE/COMMON ALARM/COMMON FAULT
UCR	RUN COMMAND
UCS	STOP COMMAND
VAH	VIBRATION ALARM HIGH
WE	PRIMARY WEIGHT SENSOR/LOAD CELL
WG	WEIGHT GAUGE
WIT	WEIGHT INDICATING TRANSMITTER
YA	GENERAL ALARM EVENT
YI	EVENT INDICATION (LED OR SCREEN)
YIR	RUNNING INDICATION
YIS	STOPPED INDICATION
YL	EVENT INDICATING LIGHT
YLR	RUNNING INDICATING LIGHT
YLS	STOPPED INDICATING LIGHT
ZI	POSITION INDICATOR
ZIC	CLOSED INDICATION
ZIO	OPEN INDICATION
ZIT	POSITION INDICATING TRANSMITTER
ZLC	CLOSED INDICATING LIGHT
ZLO	OPEN INDICATING LIGHT
ZSC	CLOSED POSITION SWITCH
ZSO	OPEN POSITION SWITCH
ZT	POSITION TRANSMITTER

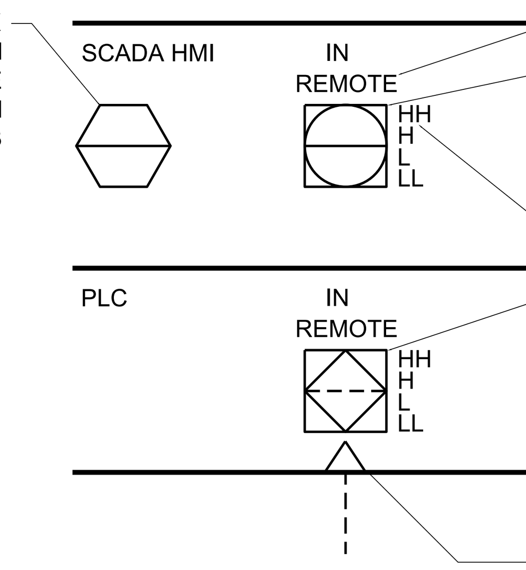
GENERAL INSTRUMENT SYMBOLS



- FIELD MOUNTED DISCRETE INSTRUMENT
- PILOT LIGHT
- DISCRETE INSTRUMENT MOUNTED ON FACE OF PRIMARY PANEL
- DISCRETE INSTRUMENT MOUNTED BEHIND OR INSIDE OF PRIMARY PANEL
- DISCRETE INSTRUMENT MOUNTED ON FACE OF LOCAL PANEL
- DISCRETE INSTRUMENT MOUNTED BEHIND OR INSIDE OF LOCAL PANEL
- SINGLE INSTRUMENT HOUSING CONTAINING TWO (OR MORE) INSTRUMENTATION FUNCTIONS
- GENERAL CONTROL INTERLOCK FUNCTION, SEE SCHEMATICS AND SYSTEM SPECIFICATIONS FOR SPECIFIC FUNCTION

DIGITAL SYSTEMS INTERFACE SYMBOLS

NOTE: REFER TO DETAILED SYSTEM SPECIFICATIONS FOR FUNCTIONAL DESCRIPTION. ALSO SEE I/O SCHEDULES FOR COMPLETE INPUT AND OUTPUT LISTINGS.



CONTROL BLOCK DESCRIPTION REFERENCE SEE SPECIFICATION 40 68 83

I/O DESCRIPTION

COMPUTER, DISTRIBUTED CONTROL SYSTEM OR DISPLAY FUNCTION BLOCK. LETTERS, TAG NUMBERS, ABBREVIATIONS AND OTHER ANNOTATIONS ARE SIMILAR TO THE GENERAL INSTRUMENT LEGEND.

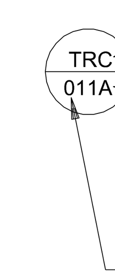
CALCULATED ALARM DESIGNATION

PROGRAMMABLE LOGIC CONTROLLER SYSTEM I/O POINT. SEE I/O ABBREVIATIONS.

PLC I/O SYMBOL. DIRECTION OF ARROW DENOTES INPUT OR OUTPUT.

- △ DISCRETE INPUT
- ▽ DISCRETE OUTPUT
- ▲ ANALOG INPUT
- ▼ ANALOG OUTPUT
- PULSE INPUT

INSTRUMENTATION SYMBOLOGY AND DESIGNATIONS

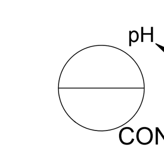


INSTRUMENT ABBREVIATION

NUMBER AFTER DASH (-1, -2, ETC) DENOTES MULTIPLE DEVICES USED IN IDENTICAL DUPLICATE SYSTEMS.

A LETTER AFTER THE LOOP NUMBER (31A, 31B, ETC) IS USED TO DISTINGUISH MULTIPLE SIMILAR DEVICES IN THE SAME INSTRUMENT LOOP.

LOOP DESIGNATION NUMBER



INSTRUMENT FUNCTION OR HAND SWITCH DESIGNATION

MEASUREMENT PRINCIPLE NOTATION (IF APPLICABLE)

FUNCTION DESIGNATIONS AND ABBREVIATIONS

MEASUREMENT PRINCIPLE NOTATIONS

CON	CONDUCTANCE
DP	DIFFERENTIAL PRESSURE SENSING
FLN	FLOW NOZZLE
FLT	FLOW TUBE
GWR	GUIDED WAVE RADAR
RAD	RADAR
US	ULTRASONIC
VENT	VENTURI TUBE

CALCULATED ALARM DESIGNATIONS

H	HIGH
HH	HIGH-HIGH
L	LOW
LL	LOW-LOW

INDICATING LIGHT/ALARM DESIGNATIONS

FWD	FORWARD
OVRLD	OVERLOAD
REV	REVERSE
TRQ HI	TORQUE HIGH
TRQ HI-HI	TORQUE HIGH HIGH
ZEROSP	ZERO SETPOINT

INSTRUMENT FUNCTIONS

Δ	SUBTRACT (DIFFERENCE)
Σ	ADD OR SUM (ADD AND SUBTRACT)
$\sqrt{}$	EXTRACT SQUARE ROOT
÷	DIVIDE
>	HIGH-SELECT
<	LOW-SELECT
×	MULTIPLY
$\int$	INTEGRATE (TIME INTEGRAL)
CH4	METHANE
CL2	CHLORINE RESIDUAL
CO2	CARBON DIOXIDE
COND	CONDUCTIVITY
DO	DISSOLVED OXYGEN
DWPT	DEWPOINT
F(X)	CHARACTERIZE SIGNAL
H2S	HYDROGEN SULFIDE
K	GAIN OR ATTENUATE (INPUT:OUTPUT)
-K	GAIN AND REVERSE
LEL	LOWER EXPLOSIVE LIMIT
MCC	MOTOR CONTROL CENTER
MLSS	MIXED LIQUOR SUSPENDED SOLIDS
O2	OXYGEN (PURITY)
O3	OZONE
pH	pH

HAND SWITCH DESIGNATIONS

E-STOP	EMERGENCY STOP
FR	FORWARD-REVERSE
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
LOA	LOCAL-OFF-AUTO
LOR	LOCAL-OFF-REMOTE
LOS	LOCKOUT-STOP
LR	LOCAL REMOTE
M/A	MANUAL-AUTO
OC	OPEN-CLOSE
OCA	OPEN-CLOSE-AUTO
OO	ON-OFF
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
OSC	OPEN-STOP-CLOSE
SS	START-STOP

TRANSDUCER & CONVERTER DESIGNATION

E	VOLTAGE
FSK	FREQUENCY SHIF KEYING
H	HYDRAULIC
I	CURRENT
P	PNEUMATIC PULSE
PD	PULSE DURATION
PF	PULSE FREQUENCY
R	RESISTANCE (ELECTRICAL)

EXAMPLE: I/P = CURRENT TO PNEUMATIC TRANSDUCER

POWER SUPPLY ABBREVIATIONS

120V	POWER SUPPLY SOURCE LABEL. USED ONLY WHERE NECESSARY TO HELP CLARIFY AN INSTRUMENT OR SYSTEM FUNCTION.
120V	120VAC
AS	AIR SUPPLY
ES	ELECTRIC SUPPLY
GS	GAS SUPPLY
HS	HYDRAULIC SUPPLY
NS	NITROGEN SUPPLY
SS	STEAM SUPPLY
WS	WATER SUPPLY

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INSTRUMENTATION

LEGEND & ABBREVIATIONS SHEET 2 OF 3

I-002

18 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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D11000

SYSTEM CODE ABBREVIATIONS

ACE	ACETIC ACID
ACT	ACETYLENE
AER	AERATION SYSTEM
AIR	AIR, AERATION OR PROCESS
ALS	ALUMINUM SULFATE
ARG	ARGON
ARW	AIR WASH
AS	ANTI-SEALANT
ASH	ASH
BAL	BALLASTED FLOCCULATION
BIO	BIOSOLIDS
BIT	BIOTOWER
BLS	BLENDED SLUDGE
BNR	BNR
BRN	BRINE
BWH	BACKWASH FOR MEMBRANE OR FILTER
CA	CITRIC ACID
CACL	CALCIUM HYPOCHLORITE
CAH	LIME, HYDRATED
CAI	COMPRESSED AIR, INSTRUMENT
CAO	LIME, QUICKLIME
CAS	CARBON SLURRY
CATS	CALCIUM THIOSULFATE
CDW	CONDENSATE WATER
CEB	CHEMICAL ENHANCED BACKWASH FOR MEMBRANE
CEN	CENTRATE
CI	CORROSION INHIBITOR
CIP	CLEAN IN PLACE
CL2	CHLORINE
CLO2	CHLORINE DIOXIDE
CMS	COMPRESSED AIR, SERVICE
C02	CARBON DIOXIDE
COA	COAGULATION
COLW	COOLING WATER
CUS	COPPER SULFATE
DAF	DISSOLVED AIR FLOTATION
DCB	DISINFECTION CONTACT BASIN
DCL	DECHLORINATION
DEIW	DEIONIZED WATER
DET	DETERGENT
DGA	DIGESTION, AEROBIC
DGM	DIGESTER GAS MIXING
DGG	DIGESTER GAS
DGS	DIGESTER SLUDGE
DIG	DIGESTION, ANAEROBIC
DRN	DRAINAGE
DW	DISTILLED WATER
DWT	DEWATERING
EFP	EFFLUENT PUMPING
EQB	EQUALIZATION BASIN
EXH	ENGINE EXHAUST
FE	FILTER EFFLUENT
FEC	FERRIC CHLORIDE
FES	FERRIC SULFATE
FLC	FLOCCULATION
FLT	FILTRATION
FO	FUEL OIL
FRC	FERROUS CHLORIDE
FRS	FERROUS SULFATE
FUE	DIESEL FUEL
FW	FIRE WATER
GAC	GRANULAR ACTIVATED CARBON
GOX	GASEOUS OXYGEN
GRS	GREASE
GRT	GRIT
GSL	GASOLINE
HCL	HYDROCHLORIC ACID
HCO3	CARBONIC ACID
HEL	HELIUM
HFL	HYDRAULIC FLUID
HFS	HYDROFLUOSILICIC ACID (FLUORIDE)
HSO4	SULFURIC ACID
HW	HOT OR HEATING WATER
HYD	HYDROGEN
INC	INCINERATION
INFP	INFLUENT PUMPING
INT	INTAKE
IRW	IRRIGATION WATER
KMN	POTASSIUM PERMANGANATE
LAG	LAGOON STORAGE
LAP	LAND APPLICATION
LIM	LIME, STABILIZATION
LOX	LIQUID OXYGEN
LPG	LP GAS OR PROPANE GAS
MEG	METHANE GAS
MEM	MEMBRANE
MGOH	MAGNESIUM HYDROXIDE
MTH	METHANOL
MXL	MIXED LIQUOR
NAC	SODA ASH
NAF	SODIUM FLUORIDE
NAL	SODIUM ALUMINATE
NAOH	SODIUM HYDROXIDE
NAM	SODIUM ALUMINATE
NASF	SODIUM SILICOFLUORIDE
NAX	SODIUM HEXAMETAPHOSPHATE
NBC	SODIUM BICARBONATE
NCL	SODIUM CHLORIDE
NCL2	SODIUM CHLORITE
NG	NATURAL GAS
NH3	ANHYDROUS AMMONIA
NHOH	AQUA AMMONIA
NHS	SODIUM BISULFITE
NIO	NITROUS OXIDE
NIT	NITROGEN
NOCL	SODIUM HYPOCHLORITE
NPW	NON-POTABLE WATER
NSO4	AMMONIUM SULFATE
ODC	ODOR CONTROL
OIL	OIL
OZD	OZONE DESTRUCT
OZN	OZONE
OZW	OZONATED WATER
PAC	POWDERED ACTIVATE CARBON
PACL	POLYALUMINUM CHLORIDE
PAR	PRE-AERATION
PER	HYDROGEN PEROXIDE
PEW	PLANT EFFLUENT WATER
PO4	PHOSPHORIC ACID
POLY	POLYMER
PPP	PHOSPHATE
PRC	PRIMARY CLARIFICATION
PRS	PRIMARY SLUDGE
PSC	PRIMARY SCUM
PSD	PRESEDIMENTATION
PW	POTABLE WATER
RAS	RETURN ACTIVATED SLUDGE
RCS	RECIRCULATED SLUDGE
RCW	RECLAIMED WATER
REF	REFRIGERANT
RES	RESIDUALS
ROS	REVERSE OSMOSIS
RW	RAW WATER
RWP	RAW WATER PUMPING
RWS	RAW WATER STORAGE
SCL	SECONDARY CLARIFICATION
SCR	SCREENINGS
SEP	SEPTAGE
SET	SETTLED WATER
SEW	SEWAGE
SO2	SULFUR DIOXIDE
SSC	SECONDARY SCUM
STM	STEAM
STS	STORM SEWER
STW	STORM WATER
SW	SURFACE WASH
SWT	SEAL WATER
TERT	TERTIARY TREATMENT
TF	TRICKLING FILTER
THCK	THICKENING
TPRS	THICKENED PRIMARY SLUDGE
TW	TREATED WATER
TWAS	THICKENED WASTE ACTIVATED SLUDGE
UV	ULTRAVIOLET
VAC	VACUUM
WAS	WASTE ACTIVATED SLUDGE
WW	WASH WATER
WWP	RAW WASTEWATER PUMPING
WWT	WET WEATHER TREATMENT
WWW	WASTE WASH WATER
ZOP	ZINC ORTHOPHOSPHATE

PROCESS CODE ABBREVIATIONS

ACE_X	ACETIC ACID
ACT_X	ACETYLENE
AER_X	AERATION SYSTEM
AIR_X	AIR, AERATION OR PROCESS
ALS_X	ALUMINUM SULFATE
ARG_X	ARGON
ARW_X	AIR WASH
AS_X	ANTI-SEALANT
ASH_X	ASH
BAL_X	BALLASTED FLOCCULATION
BIO_X	BIOTOWER
BIT_X	BLENDED SLUDGE
BLS_X	BNR
BNR_X	BIOSOLIDS
BRN_X	BRINE
BWH_X	BACKWASH FOR MEMBRANE OR FILTER
CA_X	CITRIC ACID
CACL_X	CALCIUM HYPOCHLORITE
CAH_X	LIME, HYDRATED
CAI_X	COMPRESSED AIR, INSTRUMENT
CAO_X	LIME, QUICKLIME
CAS_X	CARBON SLURRY
CATS_X	CALCIUM THIOSULFATE
CDW_X	CONDENSATE WATER
CEB_X	CHEMICAL ENHANCED BACKWASH FOR MEMBRANE
CEN_X	CENTRATE
CI_X	CORROSION INHIBITOR
CIP_X	CLEAN IN PLACE
CL2_X	CHLORINE
CLO2_X	CHLORINE DIOXIDE
CMS_X	COMPRESSED AIR, SERVICE
COA_X	COAGULATION
C02_X	CARBON DIOXIDE
COLW_X	COOLING WATER
CUS_X	COPPER SULFATE
DAF_X	DISSOLVED AIR FLOTATION
DCB_X	DISINFECTION CONTACT BASIN
DCL_X	DECHLORINATION
DEIW_X	DEIONIZED WATER
DET_X	DETERGENT
DGA_X	DIGESTION, AEROBIC
DGG_X	DIGESTER GAS
DGM_X	DIGESTER GAS MIXING
DGS_X	DIGESTER SLUDGE
DIG_X	DIGESTION, ANAEROBIC
DRN_X	DRAINAGE
DW_X	DISTILLED WATER
DWT_X	DEWATERING
EFP_X	EFFLUENT PUMPING
EQB_X	EQUALIZATION BASIN
EXH_X	ENGINE EXHAUST
FE_X	FILTER EFFLUENT
FEC_X	FERRIC CHLORIDE
FES_X	FERRIC SULFATE
FLC_X	FLOCCULATION
FLT_X	FILTRATION
FO_X	FUEL OIL
FRC_X	FERROUS CHLORIDE
FRS_X	FERROUS SULFATE
FUE_X	DIESEL FUEL
FW_X	FIRE WATER
GAC_X	GRANULAR ACTIVATED CARBON
GOX_X	GASEOUS OXYGEN
GRS_X	GREASE
GRT_X	GRIT
GSL_X	GASOLINE
HCL_X	HYDROCHLORIC ACID
HCO3_X	CARBONIC ACID
HEL_X	HELIUM
HFL_X	HYDRAULIC FLUID
HFS_X	HYDROFLUOSILICIC ACID (FLUORIDE)
HSO4_X	SULFURIC ACID
HW_X	HOT OR HEATING WATER
HYD_X	HYDROGEN
INC_X	INCINERATION
INFP_X	INFLUENT PUMPING
INT_X	INTAKE
IRW_X	IRRIGATION WATER
KMN_X	POTASSIUM PERMANGANATE
LAG_X	LAGOON STORAGE
LAP_X	LAND APPLICATION
LIM_X	LIME STABILIZATION
LOX_X	LIQUID OXYGEN
LPG_X	LP GAS OR PROPANE GAS
MEG_X	METHANE GAS
MEM_X	MEMBRANE
MGOH_X	MAGNESIUM HYDROXIDE
MTH_X	METHANOL
MXL_X	MIXED LIQUOR
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NBC_X	SODIUM BICARBONATE
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NCL2_X	SODIUM CHLORITE
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NHS_X	SODIUM BISULFITE
NIO_X	NITROUS OXIDE
NIT_X	NITROGEN
NOCL_X	SODIUM HYPOCHLORITE
NPW_X	NON-POTABLE WATER
NSO4_X	AMMONIUM SULFATE
ODC_X	ODOR CONTROL
OIL_X	OIL
OZD_X	OZONE DESTRUCT
OZN_X	OZONE
OZW_X	OZONATED WATER
PAC_X	POWDERED ACTIVATE CARBON
PACL_X	POLYALUMINUM CHLORIDE
PAR_X	PRE-AERATION
PER_X	HYDROGEN PEROXIDE
PEW_X	PLANT EFFLUENT WATER
PO4_X	PHOSPHORIC ACID
POLY_X	POLYMER
PPP_X	PHOSPHATE
PRC_X	PRIMARY CLARIFICATION
PRS_X	PRIMARY SLUDGE
PSC_X	PRIMARY SCUM
PSD_X	PRESEDIMENTATION
PW_X	POTABLE WATER
RAS_X	RETURN ACTIVATED SLUDGE
RCS_X	RECIRCULATED SLUDGE
RCW_X	RECLAIMED WATER
REF_X	REFRIGERANT
RES_X	RESIDUALS
ROS_X	REVERSE OSMOSIS
RW_X	RAW WATER
RWP_X	RAW WATER PUMPING
RWS_X	RAW WATER STORAGE
SCL_X	SECONDARY CLARIFICATION
SCR_X	SCREENINGS
SEP_X	SEPTAGE
SET_X	SETTLED WATER
SEW_X	SEWAGE
SO2_X	SULFUR DIOXIDE
SSC_X	SECONDARY SCUM
STM_X	STEAM
STS_X	STORM SEWER
STW_X	STORM WATER
SW_X	SURFACE WASH
SWT_X	SEAL WATER
TERT_X	TERTIARY TREATMENT
TF_X	TRICKLING FILTER
THCK_X	THICKENING
TPRS_X	THICKENED PRIMARY SLUDGE
TW_X	TREATED WATER
TWAS_X	THICKENED WASTE ACTIVATED SLUDGE
UV_X	ULTRAVIOLET
VAC_X	VACUUM
WAS_X	WASTE ACTIVATED SLUDGE
WW_X	WASH WATER
WWP_X	RAW WASTEWATER PUMPING
WWT_X	WET WEATHER TREATMENT
WWW_X	WASTE WASH WATER
ZOP_X	ZINC ORTHOPHOSPHATE

X = PROCESS CODE SUFFIX USED TO FURTHER SPECIFY A PROCESS STREAM (I.E. CL2_G FOR CHLORINE GAS OR CL2_S FOR CHLORINE SOLUTION)

FUNCTION CODE ABBREVIATIONS

ACD	AERATOR, COARSE BUBBLE DIFFUSED
ACMB	ACTIVATION CHAMBER
AD	AIR DRYER
AEFD	AERATOR, FINE PORE DIFFUSED
AES	AERATOR, SURFACE
AF	AIR FILTER
AFC	AFTERCOOLER
AFD	ADJUSTABLE FREQUENCY DRIVE
AFS	AERATOR, FLOATING SURFACE
AR	AIR RECEIVER OR REGULATOR
AS	AIR SEPARATOR
AST	AIR STRIPPER
B	BIN (STORAGE - ALL TYPES)
BA	BIN ACTIVATOR
BDZ	BULLDOZER
BFP	BACKFLOW PREVENTER
BFPS	BELT FILTER PRESS
BL	BLOWER, POSITIVE DISPLACEMENT
BLC	BLOWER, CENTRIFUGAL
BLR	BOILER
BNR	BASIN, BNR
BSNA	BASIN, AERATION
BSNC	BASIN, CHLORINE CONTACT
BSNO	BASIN, OXIC
BSNS	BASIN, SEDIMENTATION
BSNX	BASIN, ANOXIC/OXIC
CAB	COVER, ALUMINUM DOME BASIN
CCLM	CALIBRATION COLUMN
CDG	COVER, GAS HOLDER
CFD	COVER, FIXED DIGESTER
CFG	CENTRIFUGE
CFL	COVER, FLOATING DIGESTER
CGR	CLASSIFIER, GRIT
CGS	CHLORINE GAS SCRUBBER
CHF	CHEMICAL FEEDER
CMB	COVER, MEMBRANE
CML	COMPRESSOR, LIQUID RING
CMP	COMPRESSOR
CMPS	COMPRESSOR, STEAM
CMR	COMPRESSOR, ROTARY SCREW
COB	CONVEYOR, BELT
COS	CONVEYOR, SCREW
CRG	CRANE, GANTRY
CRJ	CRANE, JIB
CRN	CRANE
CRP	CRANE, PORTABLE GANTRY
CRT	CRANE, TRAVELING BRIDGE
CTR	CONTAINER, PROCESS
CW	CLEARWELL
CYG	CYLINDER, GAS
CYLC	CYLINDER, CHLORINE
DAF	DISSOLVED AIR FLOTATION THICKENER
DFB	DIFFUSER BANK
DFP	DIFFUSER, PIPELINE
DFT	DIFFUSER, TANK
DGAP	DIGESTER, ANAEROBIC PRIMARY
DGAS	DIGESTER, ANAEROBIC SECONDARY
DGE	DIGESTER, AEROBIC
DIF	DIFFUSER, CHANNEL
DPS	DIAPHRAGM SEAL
DSUV	DISINFECTION UNIT, UV
DUC	DUST COLLECTOR
DWS	DEWATERING SCREW
EDC	EDUCTOR
EEWF	EMERGENCY EYE WASH FOUNTAIN
EQPB	EQUIPMENT, BUILDING SERVICES
EQPE	ELECTRICAL EQUIPMENT, GENERAL
EQPG	EQUIPMENT, GENERAL OR UNSPECIFIED
ESEW	EMERGENCY SHOWER AND EYEWASH
ESHR	EMERGENCY SHOWER
ETSW	ETHERNET SWITCH
EXC	EXPANSION CHAMBER
EV	EVAPORATOR
FAN	FAN, CENTRIFUGAL
FAR	FLAME ARRESTER
FAX	FAN, AXIAL FLOW
FC	FLAME CHECK
FD	FLOOR DRAIN
FGP	FILTER, GAS PARTICULATE
FL	FORKLIFT
FLC	FILTER, CARTRIDGE TYPE
FLCH	FLOCCULATOR, HORIZONTAL
FLCV	FLOCCULATOR, VERTICAL
FLG	FLARE, GAS
FLM	FLUME, PARSHALL
FLT	FILTER, UNDERDRAINS OR PRESSURE
FMSP	FOAM SEPARATOR
FS	FLOW SPLITTER
FST	FENCE STIRRER
FSW	FILTER, SURFACE WASH EQUIPMENT
FTNG	FITTING, MISCELLANEOUS
GBT	GRAVITY BELT THICKENER
GEN	GENERATOR, ENGINE (BACKUP POWER)
GFD	GAS FEEDER
GFL	GATE, FLAP
GRB	GRIT BASIN, VORTEX TYPE
GRC	GRIT SCREW CONCENTRATOR
GRD	GRINDER PULVERIZER
GRI	GRINDER, INLINE SEWAGE
GSD	GATE, SLIDE
GSL	GATE, SLUICE
GVT	GRAVITY THICKENER
GWH	GAS WATER HEATER
GWR	GATE, WEIR
HEX	HEAT EXCHANGER
HSC	HOIST, CHAIN
HST	HOIST
HSW	HOIST, WIRE ROPE
HYC	HYDROCYCLONE
HYDF	HYDRANT, FIRE
HYDW	HYDRANT, WALL
INJ	INJECTOR, CHEMICAL
LS	LIME SLAKER
M	MOTOR
MBMF	MEMBRANE, MICROFILTRATION
MBNF	MEMBRANE, NANOFILTRATION
MBR	MEMBRANE
MBRO	MEMBRANE, REVERSE OSMOSIS
MBUF	MEMBRANE, ULTRAFILTRATION
MFL	MIXER, FLOCCULATION
MXC	MIXER, CARBON
MXI	MIXER, IN-LINE
MXP	MIXER, SUBMERSIBLE, PROP OR BLENDER
MXPG	MIXER, PUGMILL
MXR	MIXER, RAPID
MXS	MIXER, STATIC
ODU	OZONE DESTRUCT UNIT
OGEN	OZONE GENERATOR
OPSU	OZONE POWER SUPPLY UNIT
ORD	OVERFLOW ROOF DRAIN
P	PUMP, POSITIVE DISPLACEMENT, ROTARY, DRUM OR BELL MOUNTED
PAD	PUMP, AIR DIAPHRAGM
PBC	PRESSURE BUILDING COIL
PCL	PUMP, CENTRIFUGAL
PCLR	PRIMARY CLARIFIER
PCN	PARTICLE COUNTER
PD	PULSATION DAMPENER
PDM	PUMP, DIAPHRAGM METERING
PHE	PUMP, HORIZONTAL END SUCTION
PHW	PUMP, HOT OR HEATING WATER
PINJ	POLYMER INJECTOR RING
PIPE	PIPE
PLT	PELLETIZER
PNS	PENSTOCK
PP	PACKAGED PLANT
PPC	PUMP, PROGRESSING CAVITY
PPL	PUMP, PLUNGER
PPS	PUMP, PERISTALTIC
PSC	PUMP, HORIZONTAL SPLIT CASE
PSCH	PUMP, SUBMERSIBLE CHOPPER
PSE	PUMP, SCREW ENCLOSED
PSL	PUMP, SUBMERSIBLE
PSO	PUMP, SCREW OPEN
PSP	PUMP, SUMP
PSS	PUMP, SUBMERSIBLE SUMP
PST	PLATE SETTLER
PVD	PUMP, VERTICAL DIFFUSION VANE
PVE	PUMP, VERTICAL END SUCTION
PVW	PUMP, VERTICAL WET PIT
RCO	RESIDUAL COLLECTOR
RD	RUPTURE DISK
RM	ROTAMETER
RSV	RESERVOIR
SAMP	SAMPLER
SBL	SOLIDS BLENDER, INLINE
SC	SCALE, WEIGHT
SCB	SCRUBBER
SCC	SLUDGE COLLECTOR, CIRCULAR
SCFC	SLUDGE COLLECTOR, FLOC-CLARIFYING
SCL	SCALE
SCLC	SLUDGE COLLECTOR, CROSS
SCLR	SECONDARY CLARIFIER
SCRB	SCREEN, MANUAL OR MECH CLEANED BAR
SCRH	SCREEN, HORIZONTAL
SCRI	SCREEN, INLINE SLUDGE
SCRS	SCREEN, STEP
SCRT	SCREEN, TRAVELING WATER
SCRV	SCREEN, VIBRATORY
SCSC	SLUDGE COLLECTOR, SOLIDS CONTACT
SCSE	SLUDGE COLLECTOR, SEC CLARIFIERS
SCSL	SLUDGE COLLECTOR, STRAIGHT LINE
SCW	SCUM WEIR, ROTATING
SEP	SEPARATOR, MOISTURE OR CYCLONE
SG	SIGHT GAUGE
SGR	SLUDGE GRINDER, INLINE OR CHANNEL
SGT	SIGHT GLASS, TALL
SIL	SILENCER
SMC	SCUM COLLECTOR
SRCH	SURGE CHAMBER
STR	STRAINER
STRB	STRAINER, BASKET TYPE
STRY	STRAINER, Y TYPE
TB	TURBINE
TBC	TURBINE COMPRESSOR
TBE	TURBINE ENGINE
TCC	TANK, CHLORINE CONTACTOR
TCN	TANK, AMMONIA STORAGE
TCP	TANK, METHANOL
TCR	TANK, CRYOGENIC STORAGE
TDW	TANK, DOUBLE WALL
TNK	TANK, GENERAL OR UNSPECIFIED
TNS	TANK, FRP CHEMICAL STORAGE
TRK	TRUCK
TRP	TRAP, DRIP
TRPS	TRAP, SEDIMENT
TSA	TANK, STORAGE, ABOVE GROUND
TSE	TANK, ELEVATED STORAGE
TSMP	TANK, SAMPLER
TSW	TANK, STEEL WATER
TX	TANK, EXPANSION
UPS	UNINTERRUPTIBLE POWER SUPPLY
UVR	UV REACTOR
V	VALVE, GENERAL OR UNSPECIFIED
VAG	VALVE, ANGLE
VAP	VAPORIZER
VAR	VALVE, AIR RELEASE
VAVB	VALVE, AIR VACUUM BREAK
VBA	VALVE, AWWA BALL
VBF	VALVE, AWWA BUTTERFLY
VBFI	VALVE, INDUSTRIAL BUTTERFLY
VBFP	VALVE, BACKFLOW PREVENTER
VBM	VALVE, BALL MISCELLANEOUS
VCAV	VALVE, COMBINATION AIR RELEASE AND VACUUM BREAK
VCK	VALVE, CHECK
VCN	VALVE, CONE
VDG	VALVE, DIAPHRAGM OPERATED
VER	VALVE, EXPLOSION RELIEF
VFG	VALVE, FLAP GATE
VFW	VALVE, FOUR WAY
VG	VALVE, GATE
VGD	VALVE, DOUBLE DISC GATE
VGL	VALVE, GLOBE
VGR	VALVE, RESILIENT SEATED GATE
VKG	VALVE, KNIFE GATE
VMD	VALVE, MUD
VMR	VALVE, MATERIAL HANDLING ROTARY
VND	VALVE, NEEDLE
VP	VALVE, PROCESS
VPE	VALVE, ECCENTRIC PLUG
VPL	VALVE, NON-ECCENTRIC PLUG
VPN	VALVE, PINCH
VPO	VALVE, PISTON OPERATED
VPRD	VALVE, PRESSURE REDUCING
VPRL	VALVE, PRESSURE RELIEF
VPS	VALVE, PRESSURE SUSTAINING
VPT	VALVE, PILOT
VPVR	VALVE, PRESSURE/VACUUM RELIEF
VRG	VACUUM REGULATOR
VS	VALVE, SAFETY
VSL	VALVE, SOLENOID
VSLB	VESSEL, BOOT
VSLV	VALVE, SLEEVE
VTLS	VALVE, TELESCOPING
VTS	VALVE, THERMAL SHUTOFF
VTW	VALVE, THREE WAY
VVB	VALVE, VACUUM BREAKER
VVP	VALVE, V-PORT BALL
VVR	VALVE, VACUUM RELIEF
WC	WEIR, CIPOLLETTI
WLHC	WELL, HORIZONTAL COLLECTOR
WLV	WELL, VERTICAL
WR	WEIR, RECTANGULAR
WV	WEIR, V-NOTCH

GENERAL NOTES

1. THIS IS A GENERAL LEGEND SHEET. SOME CODES AND ABBREVIATIONS MAY NOT BE UTILIZED ON THIS SPECIFIC PROJECT. ADDITIONS AND ALTERATIONS HAVE BEEN MADE AS NEEDED TO ACCOMMODATE THE PROJECT REQUIREMENTS.

BLACK & VEATCH
Black & Veatch Corporation
San Marcos, California

SAN ELIJO JOINT POWERS AUTHORITY

SAN ELIJO
JOINT POWERS
AUTHORITY

SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

PRELIMINARY
NOT FOR
CONSTRUCTION

REVISIONS AND RECORD OF ISSUE

DESIGNED:	AA
DETAILED:	AD
CHECKED:	CL
APPROVED:	RE
DATE:	05/28/21
PROJECT NO.:	407556

INSTRUMENTATION

LEGEND & ABBREVIATIONS SHEET 3 OF 3

I-003

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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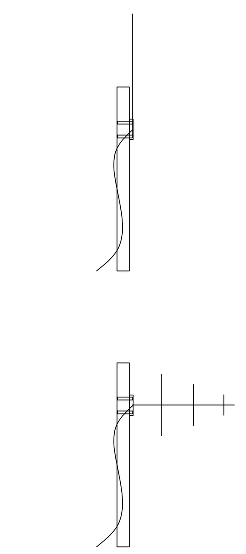
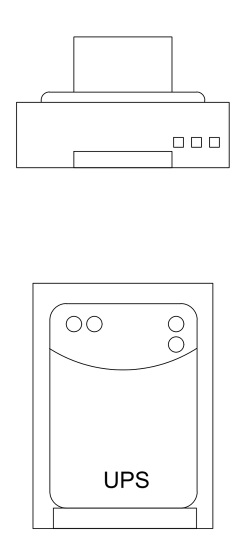
MISCELLANEOUS SYSMBOLS

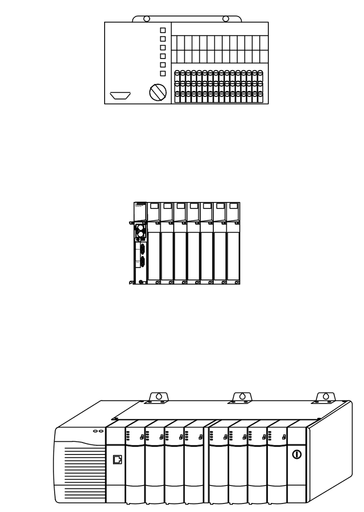



OMNI ANTENNA	PTZ CAMERA
YAGI ANTENNA	FIXED CAMERA
COLOR GRAPHICS PRINTER	REPORT PRINTER
UNINTERRUPTIBLE POWER SOURCE	

LINE SYMBOLS

—— CAT6 ——	CATEGORY 6 CABLE
—— FO ——	FIBER OPTIC CABLE
—— PA ——	PROFIBUS PA
—— DP ——	PROFIBUS DP
—— FF ——	FOUNDATION FIELDBUS

PLC AND RIO SYMBOLS

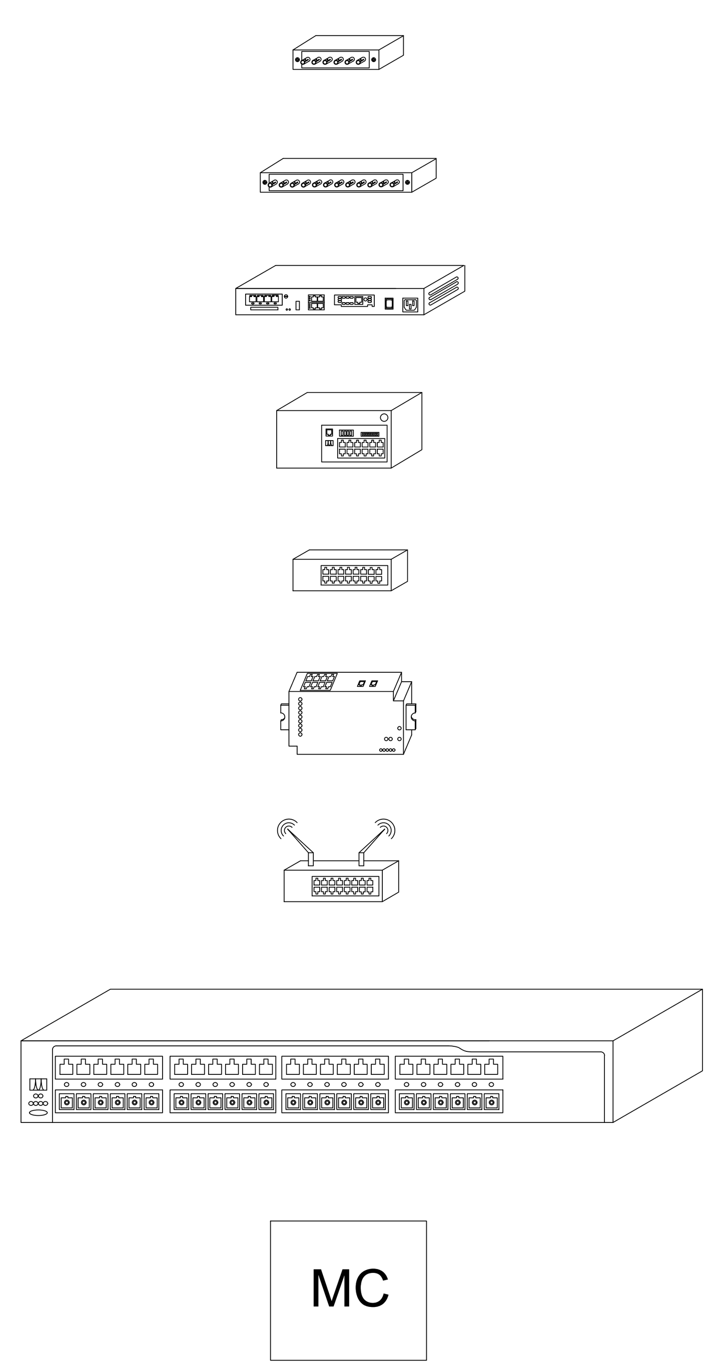


COMPACT LOGIX PLC

SLC505

CONTROL LOGIX PLC

NETWORK SYMBOLS



6 PORT FIBER PATCH PANEL

12 PORT FIBER PATCH PANEL

FRAME RELAY ROUTER

PANEL MOUNTED SWITCH

PANEL MOUNTED SWITCH

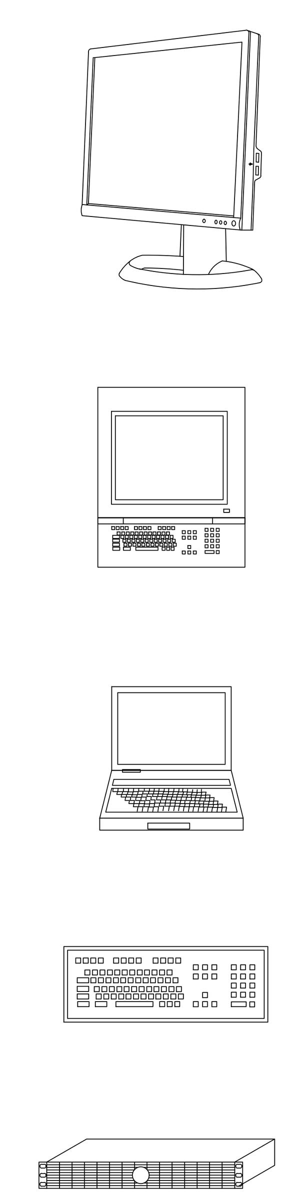
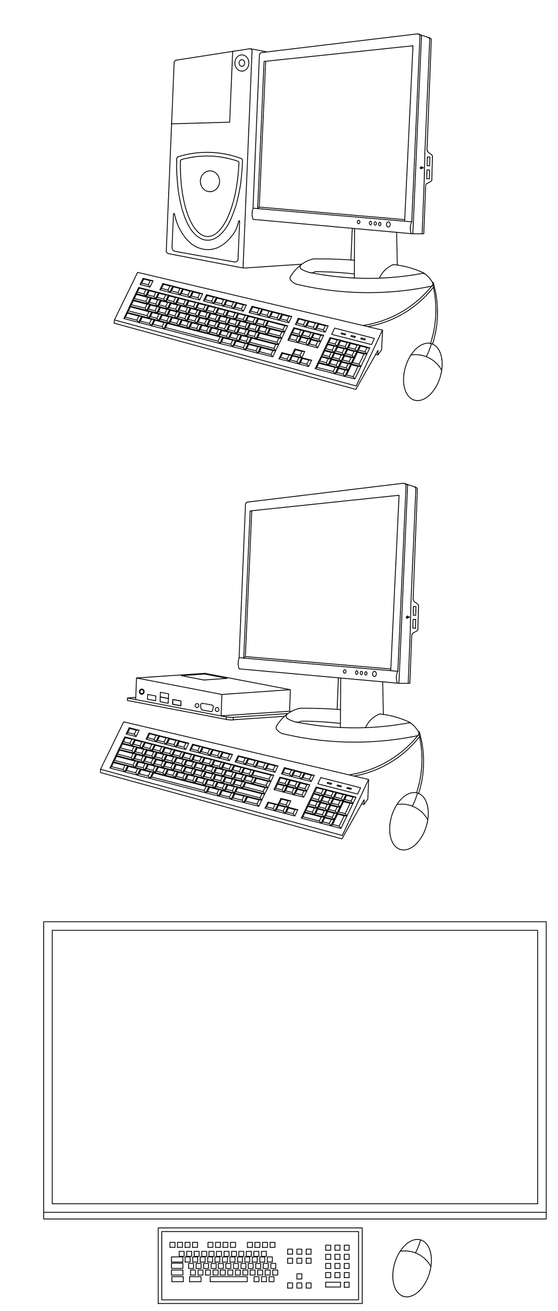
PANEL MOUNTED ETHERNET SWITCH

WIRELESS NETWORK ACCESS POINT

ENTERPRISE ROUTING SWITCH

MEDIA CONVERTER

COMPUTERS, MONITORS, AND WORKSTATION SYMBOLS

FLATSCREEN MONITOR	WORKSTATION COMPUTER
OPERATOR INTERFACE TERMINAL	THIN CLIENT WORKSTATION
LAPTOP	
KEYBOARD	DISPLAY WITH OPERATOR INTERFACE
RACK-MOUNTED SERVER COMPUTER	

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BLACK & VEATCH

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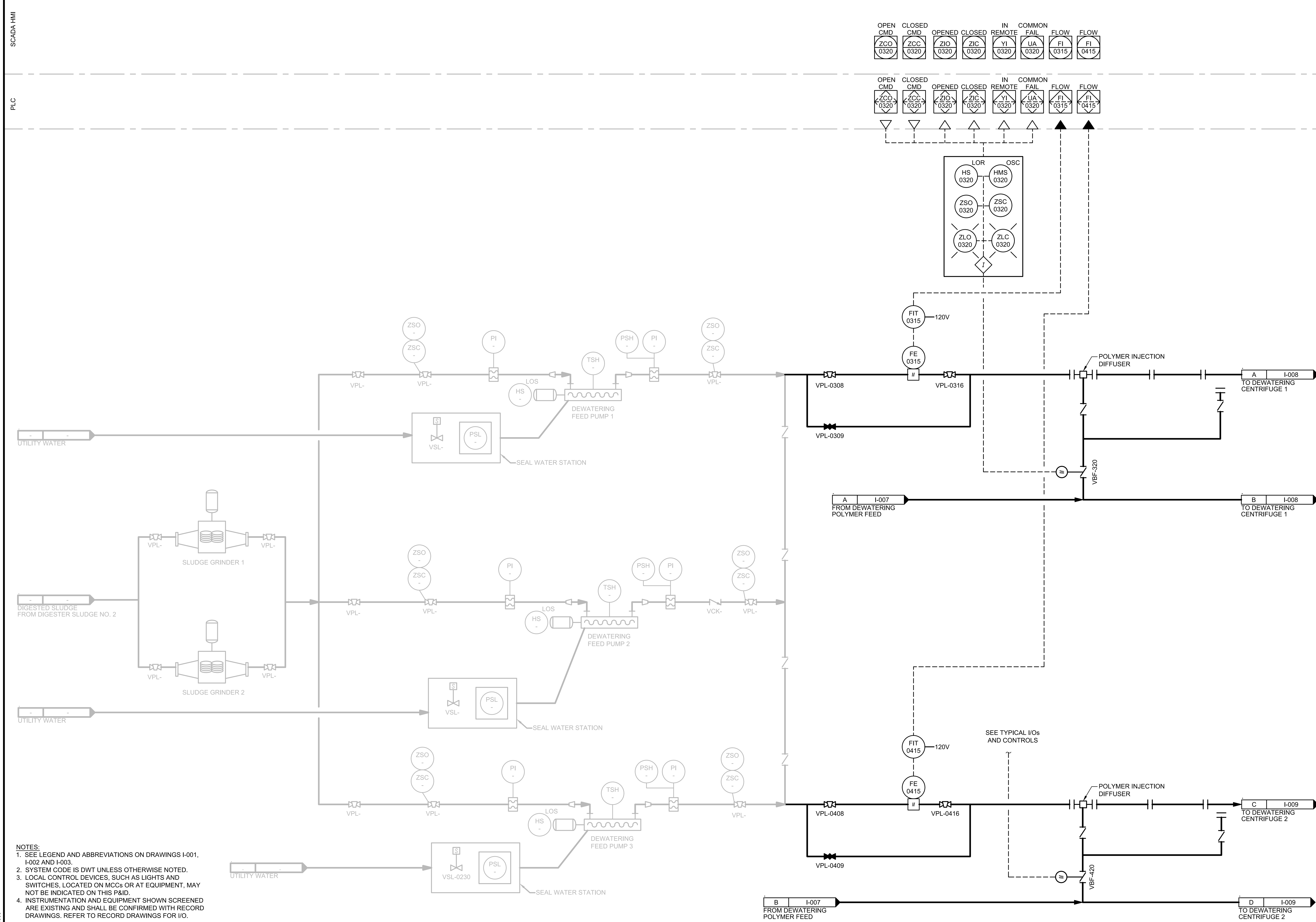
INSTRUMENTATION

LEGEND & ABBREVIATIONS CONTROL BLOCK DIAGRAM

I-004

20 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS DWT UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.
4. INSTRUMENTATION AND EQUIPMENT SHOWN SCREENED ARE EXISTING AND SHALL BE CONFIRMED WITH RECORD DRAWINGS. REFER TO RECORD DRAWINGS FOR I/O.

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(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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San Marcos, California

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SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

PRELIMINARY NOT FOR CONSTRUCTION

REVISIONS AND RECORD OF ISSUE

DESIGNED:	AA
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DATE:	05/28/21
PROJECT NO.:	407556

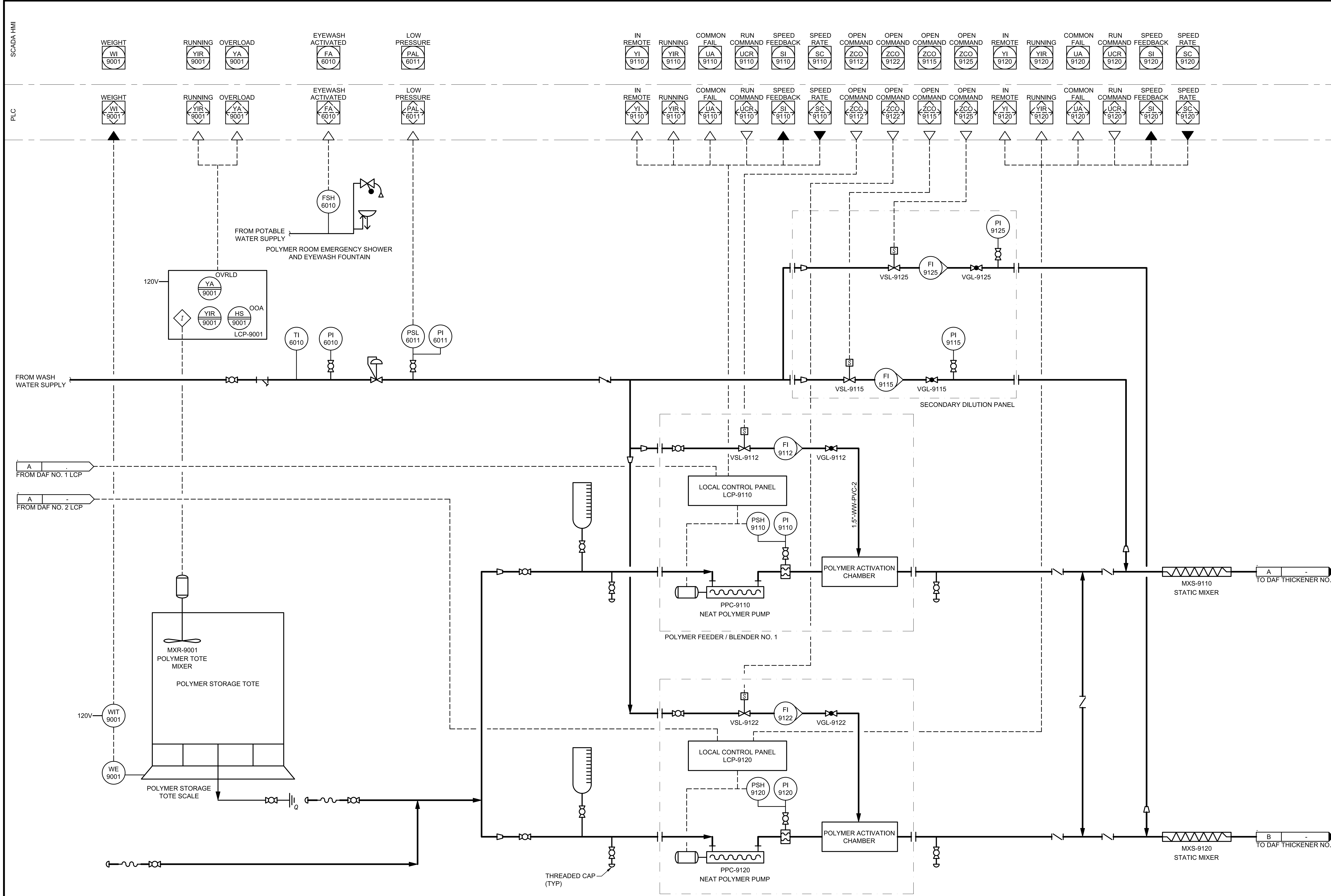
DEWATERING

INSTRUMENTATION

DEWATERING FEED PUMPS

I-005

21 OF 29



NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS POLY UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.

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PROJECT NO.:	407556

THICKENING POLYMER

INSTRUMENTATION

THICKENING POLYMER STORAGE AND FEED

I-006

22 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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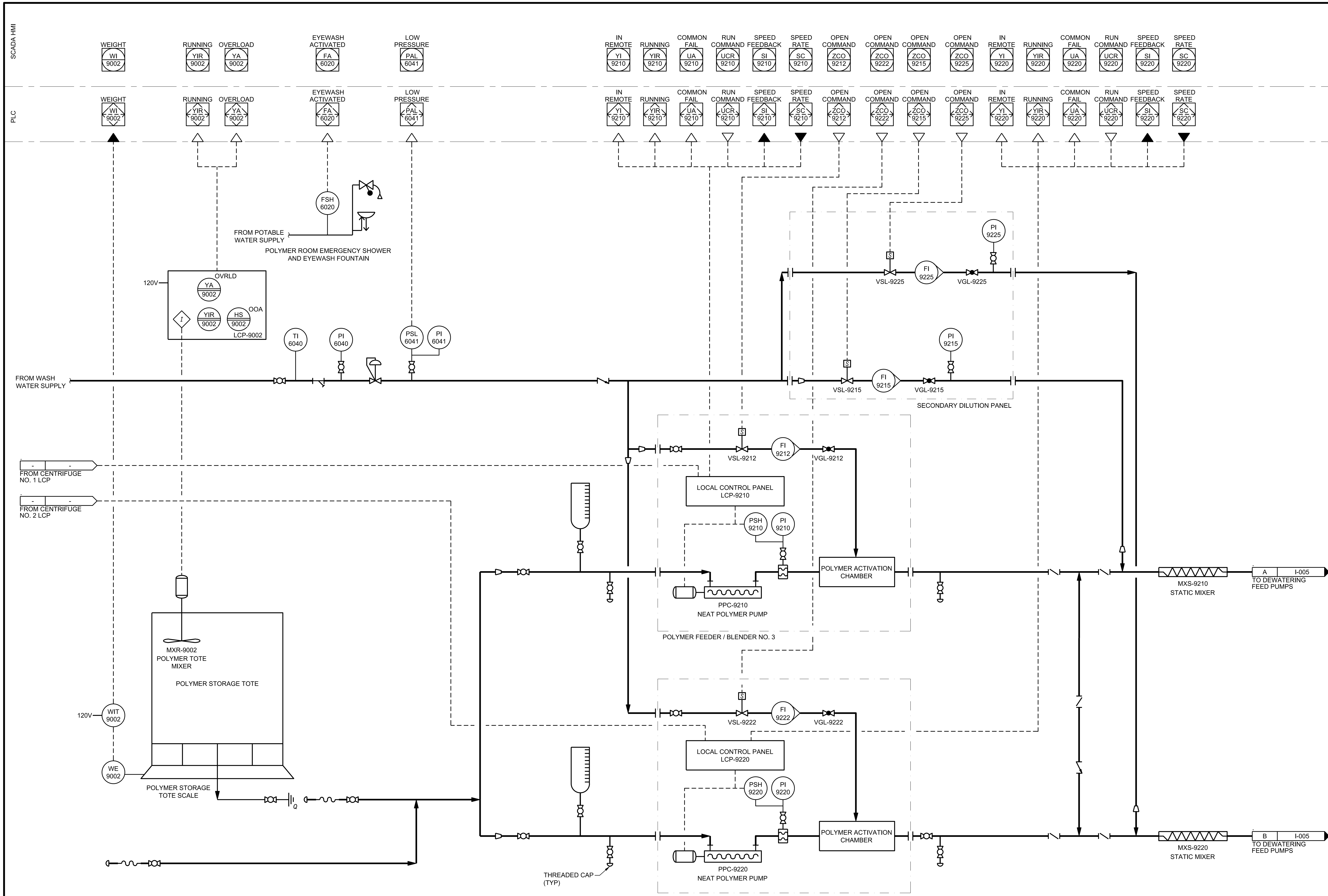

NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWING I-001, I-002 AND I-003.
2. SYSTEM CODE IS POLY UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.

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PROJECT NO.:	407556

DEWATERING POLYMER

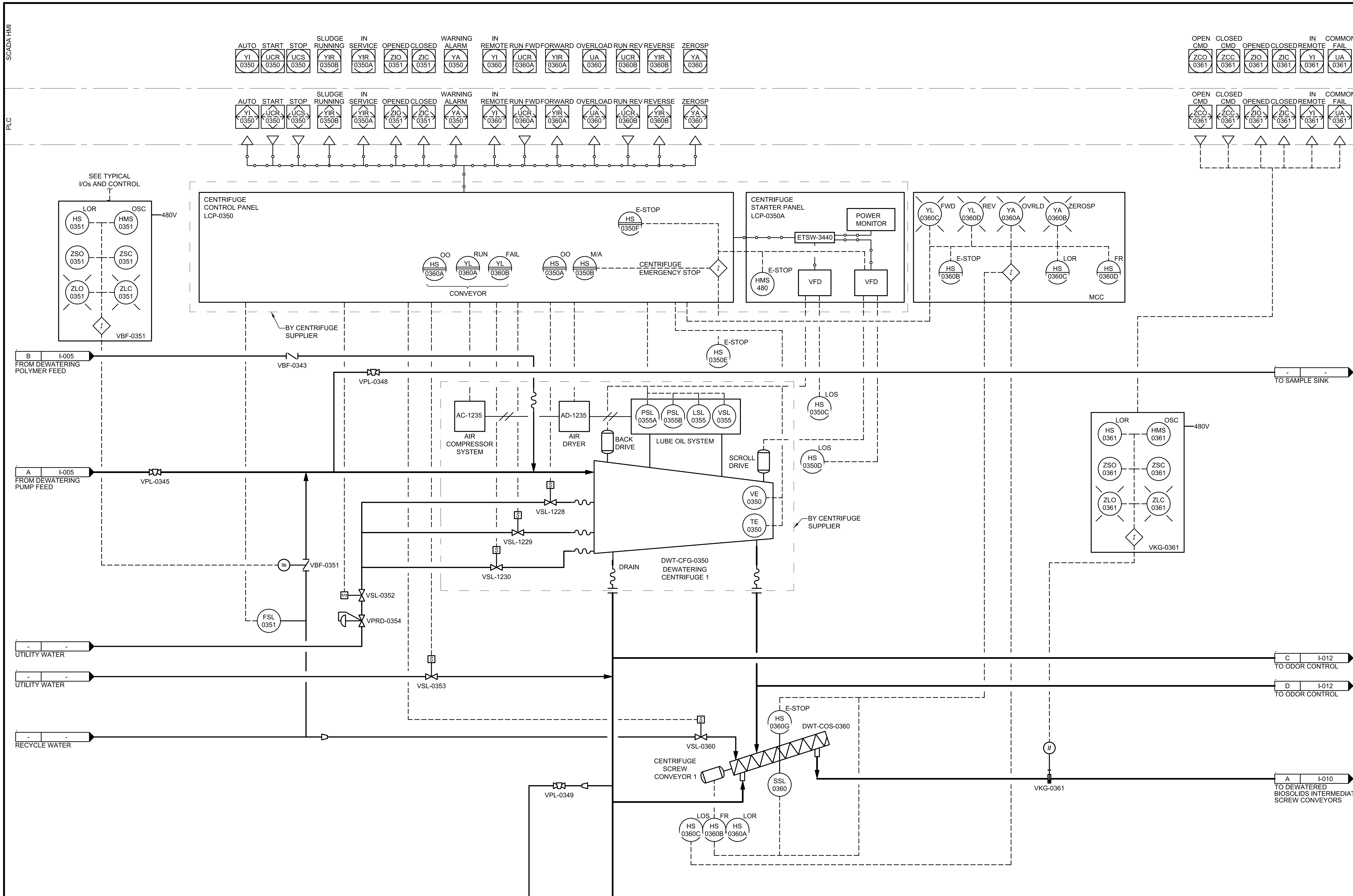
INSTRUMENTATION

DEWATERING POLYMER STORAGE AND FEED

I-007

23 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS DWT UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.

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DEWATERING

INSTRUMENTATION

DEWATERING CENTRIFUGE NO. 1

I-008

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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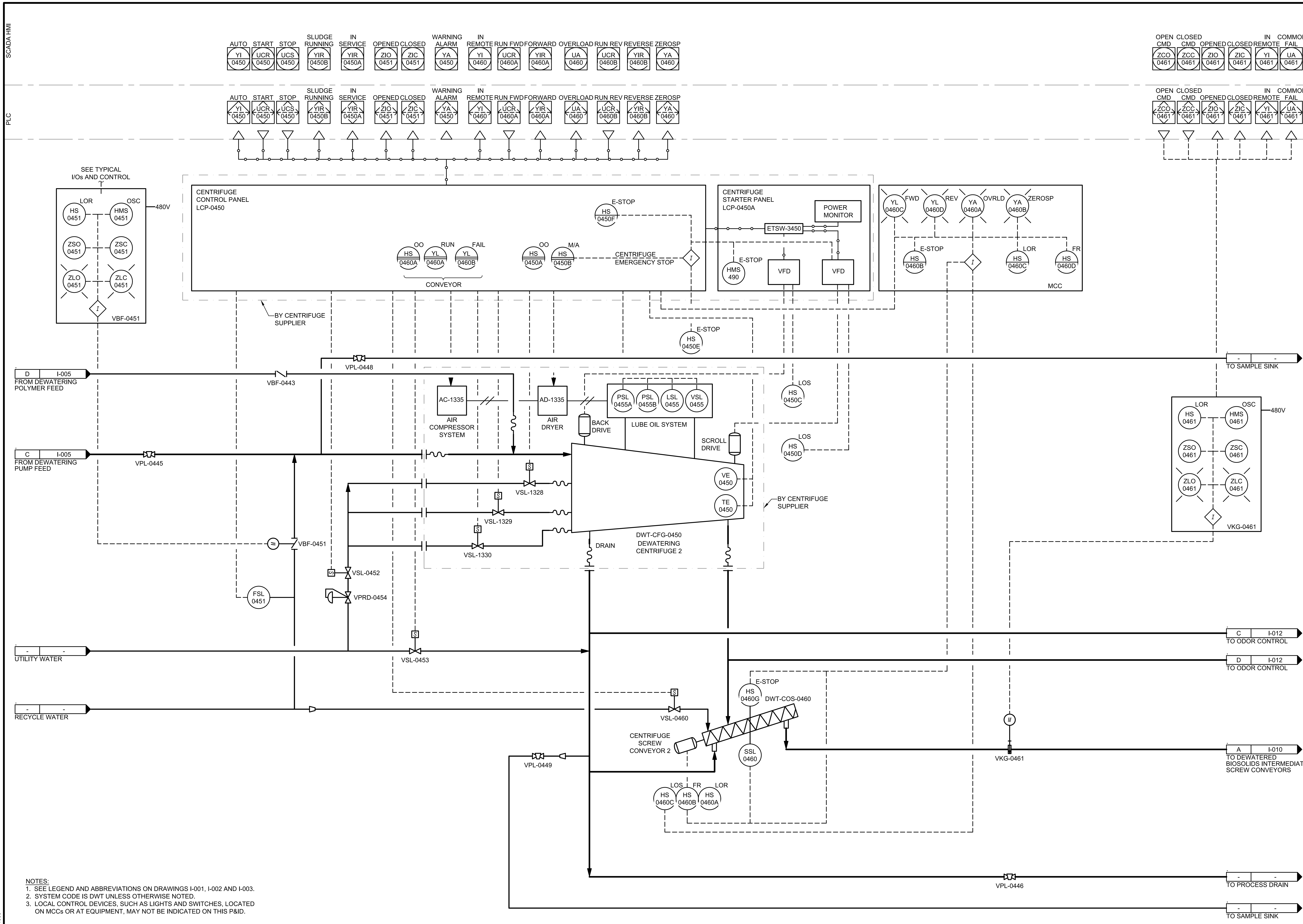

NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS DWT UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.

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DEWATERING

INSTRUMENTATION

DEWATERING CENTRIFUGE NO. 2

I-009

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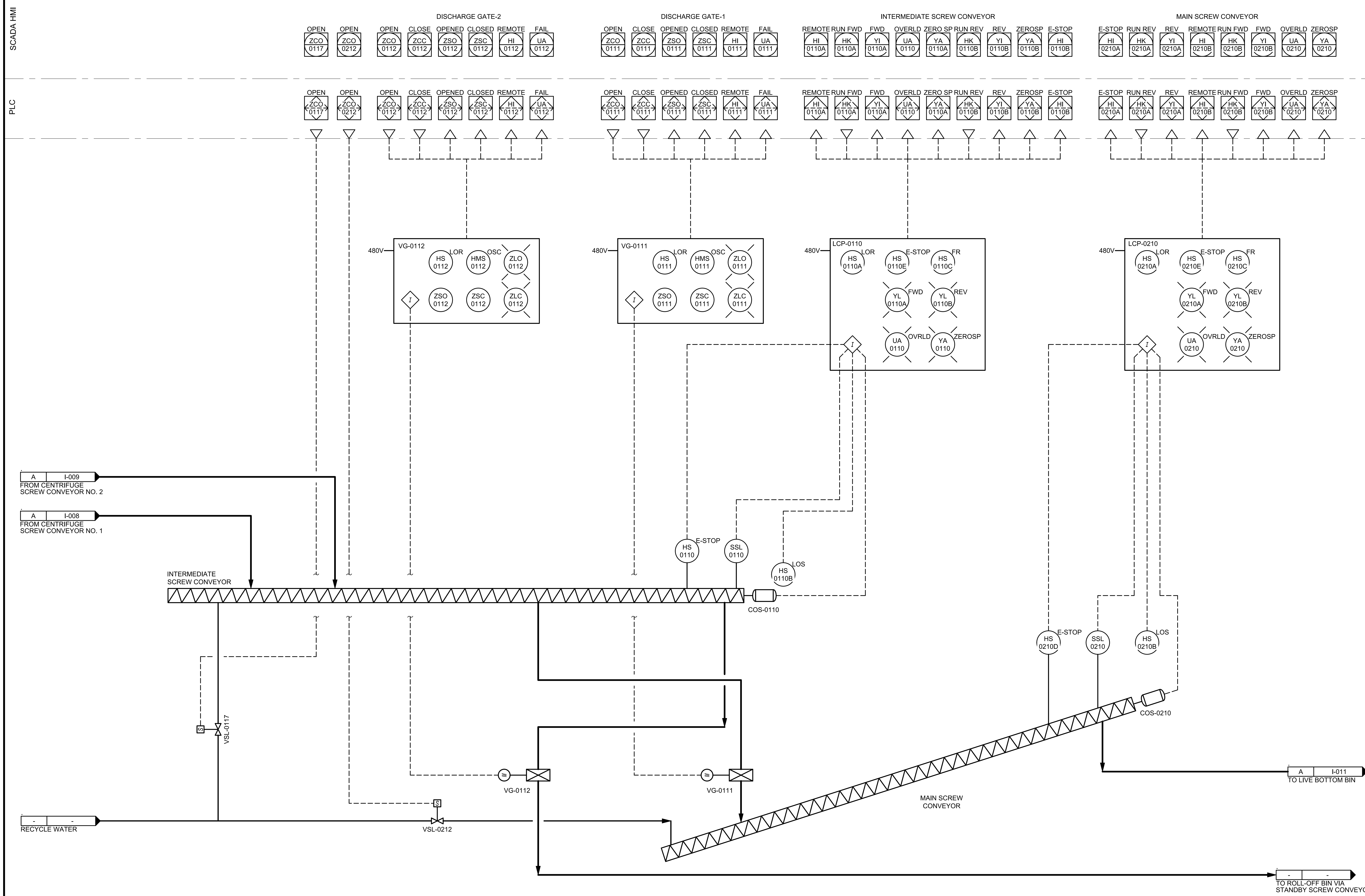

NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS DWT UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.

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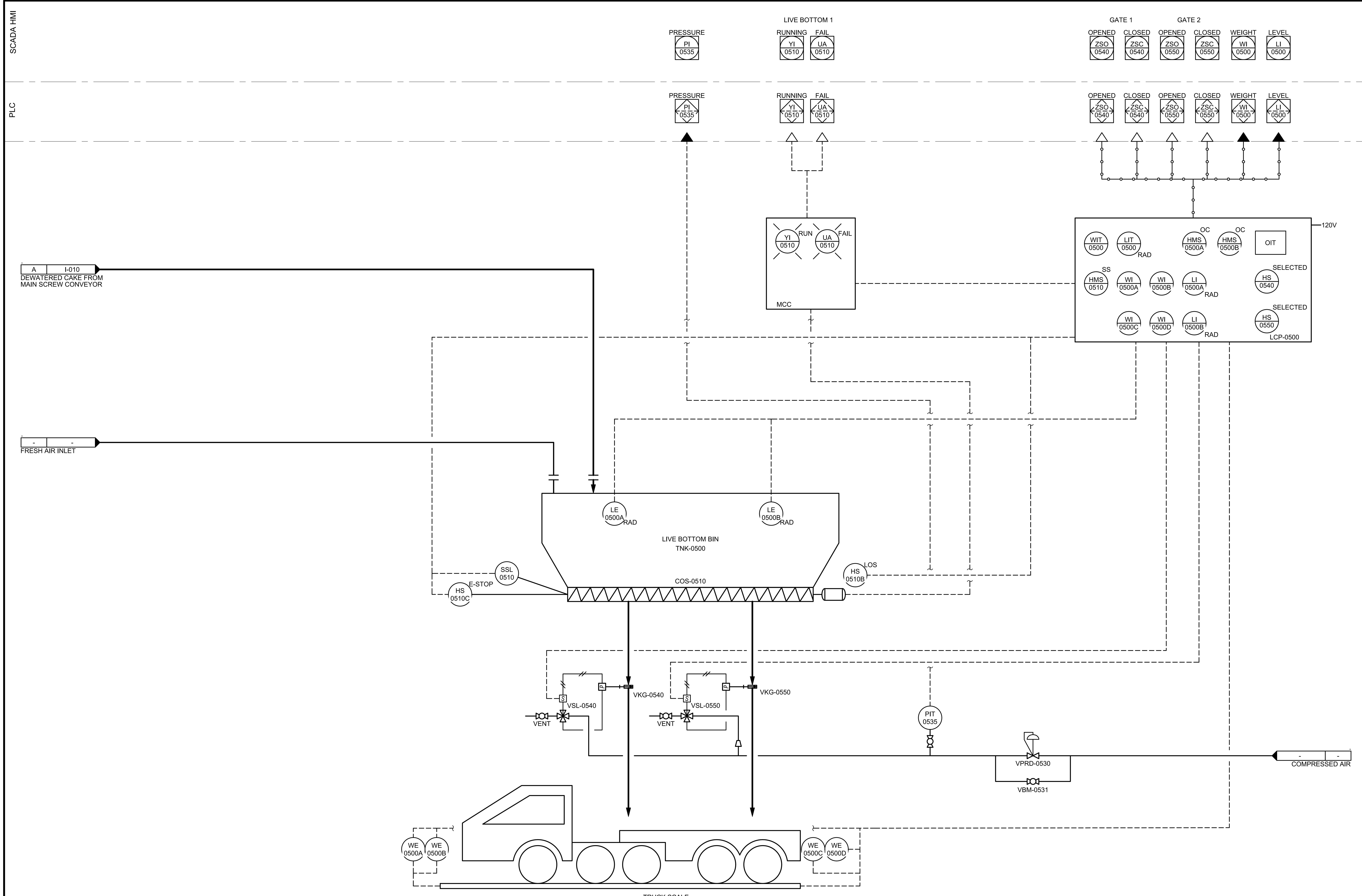
CAKE CONVEYOR

INSTRUMENTATION

DEWATERED CAKE CONVEYOR AND TRUCK LOADING - SHEET 1 OF 2

I-010

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4



NOTES:
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002 AND I-003.
2. SYSTEM CODE IS DWT UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATION ON THIS P&ID.

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(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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SAN ELIJO WATER RECLAMATION FACILITY - SLUDGE DEWATERING FACILITIES UPGRADES

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CAKE CONVEYOR

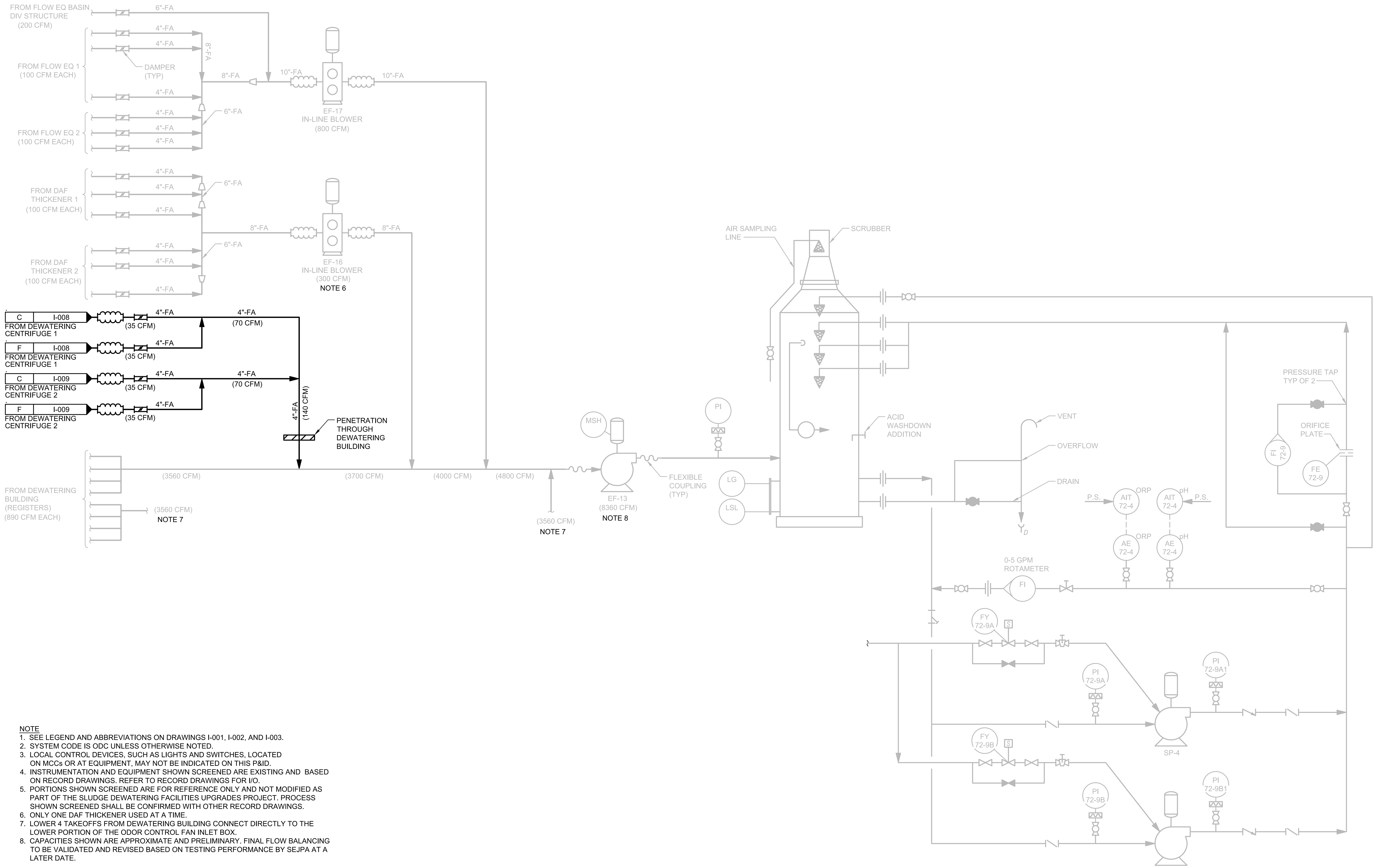
INSTRUMENTATION

DEWATERED CAKE CONVEYOR AND TRUCK LOADING - SHEET 2 OF 2

I-011

SCADA HMI

PLC



NOTE
1. SEE LEGEND AND ABBREVIATIONS ON DRAWINGS I-001, I-002, AND I-003.
2. SYSTEM CODE IS ODC UNLESS OTHERWISE NOTED.
3. LOCAL CONTROL DEVICES, SUCH AS LIGHTS AND SWITCHES, LOCATED ON MCCs OR AT EQUIPMENT, MAY NOT BE INDICATED ON THIS P&ID.
4. INSTRUMENTATION AND EQUIPMENT SHOWN SCREENED ARE EXISTING AND BASED ON RECORD DRAWINGS. REFER TO RECORD DRAWINGS FOR I/O.
5. PORTIONS SHOWN SCREENED ARE FOR REFERENCE ONLY AND NOT MODIFIED AS PART OF THE SLUDGE DEWATERING FACILITIES UPGRADES PROJECT. PROCESS SHOWN SCREENED SHALL BE CONFIRMED WITH OTHER RECORD DRAWINGS.
6. ONLY ONE DAF THICKENER USED AT A TIME.
7. LOWER 4 TAKEOFFS FROM DEWATERING BUILDING CONNECT DIRECTLY TO THE LOWER PORTION OF THE ODOR CONTROL FAN INLET BOX.
8. CAPACITIES SHOWN ARE APPROXIMATE AND PRELIMINARY. FINAL FLOW BALANCING TO BE VALIDATED AND REVISED BASED ON TESTING PERFORMANCE BY SEJPA AT A LATER DATE.

SCADA HMI

PLC

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ODOR CONTROL

INSTRUMENTATION

VENTILATION AND ODOR CONTROL SYSTEM

I-012

28 OF 29

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

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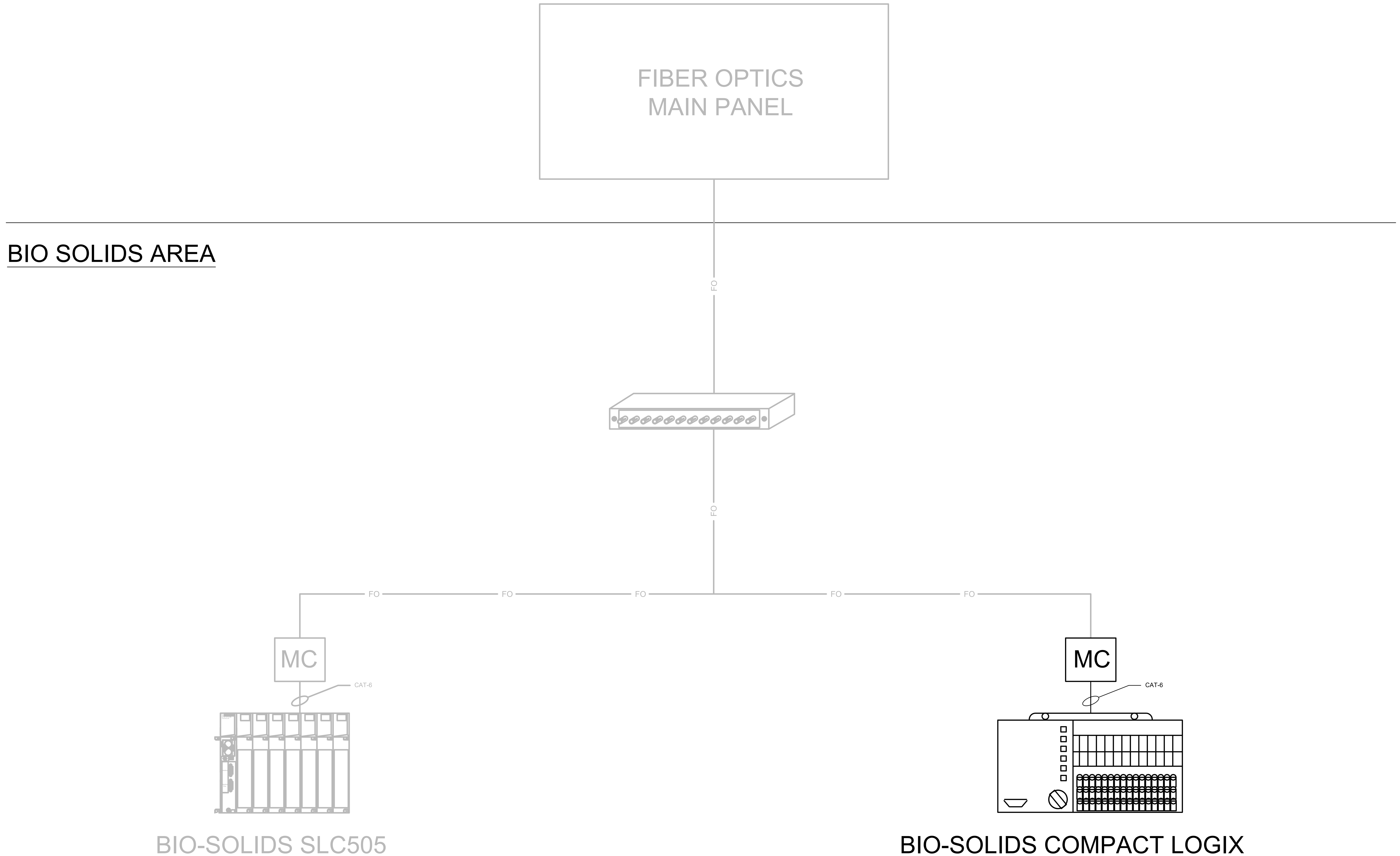

NOTE:

1. SEE LEGEND ON DRAWING I-004.

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PROJECT NO.:	407556

INSTRUMENTATION

CONTROL SYSTEM BLOCK DIAGRAM

I-013

(SCALE BAR IS 4" AT FULL SCALE) 0 1/2 1 2 3 4

Appendix C – Life Cycle Cost Analysis of BFPs vs. Centrifuges

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 1.a
BDP 2-belt (2VP) Belt Filter Presses, 1.5m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	21%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	30

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$413,500	$827,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$249,250	$249,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,301,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$325,000			
Sitework (NA)				$0			
Subtotal B				$1,626,000			
Insurance (2% of B)				$33,000			
Subtotal C				$1,659,000			
Mobilization & Bonds (8% of C)				$133,000			
Overhead & Profit (10% of C)				$166,000			
Subtotal D				$1,958,000			
Contingency (30% of D)				$587,000			
Subtotal E				$2,545,000			
Engineering, Legal, and Administration (20% of D)				$509,000			
TOTAL				**$2,545,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit	Units Operating	Annual Qty	Unit	Unit Cost	Total Cost*
	(kW)				($/unit)	($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	12	2	37,440	kWh	$0.14	$5,000
Receiving Conveyors	2.8	2	8,736	kWh	$0.14	$1,000
Polymer Feed	2.8	2	8,736	kWh	$0.14	$1,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 4 hr/shift)			1,040	hr	$30.00	$31,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			5,214	wt	$47.50	$248,000
Subtotal for O&M per year						**$443,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,545,000
Present Value (P) of Remaining Value (F)	0.3769		$0
Present Value (P) of Annual O&M (A)		12.4622	$5,521,000
TOTAL			**$8,066,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 1.a
BDP 2-belt (2VP) Belt Filter Presses, 1.5m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	21%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	30

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$413,500	$827,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$249,250	$249,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,301,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$325,000			
Sitework (NA)				$0			
Subtotal B				$1,626,000			
Insurance (2% of B)				$33,000			
Subtotal C				$1,659,000			
Mobilization & Bonds (8% of C)				$133,000			
Overhead & Profit (10% of C)				$166,000			
Subtotal D				$1,958,000			
Contingency (30% of D)				$587,000			
Subtotal E				$2,545,000			
Engineering, Legal, and Administration (20% of D)				$509,000			
TOTAL				**$2,545,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit	Units Operating	Annual Qty	Unit	Unit Cost	Total Cost*
	(kW)				($/unit)	($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	12	2	37,440	kWh	$0.14	$5,000
Receiving Conveyors	2.8	2	8,736	kWh	$0.14	$1,000
Polymer Feed	2.8	2	8,736	kWh	$0.14	$1,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 4 hr/shift)			1,040	hr	$30.00	$31,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			5,214	wt	$47.50	$248,000
Subtotal for O&M per year						**$443,000**

*Rounded to nearest $1,000

**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,545,000
Present Value (P) of Remaining Value (F)	0.3769		$0
Present Value (P) of Annual O&M (A)		12.4622	$5,521,000
TOTAL			**$8,066,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: 5/24/2021

Alternative 1.b
BDP 3-belt (3DP) Belt Filter Presses, 1.0m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	22%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	40

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit ($/unit)	Total ($)	Remaining Value of Buildings and Equipment: Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$388,500	$777,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$236,750	$237,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,239,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$310,000			
Sitework (NA)				$0			
Subtotal B				$1,549,000			
Insurance (2% of B)				$31,000			
Subtotal C				$1,580,000			
Mobilization & Bonds (8% of C)				$126,000			
Overhead & Profit (10% of C)				$158,000			
Subtotal D				$1,864,000			
Contingency (30% of D)				$559,000			
Subtotal E				$2,423,000			
Engineering, Legal, and Administration (20% of D)				$485,000			
TOTAL				**$2,423,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	13	2	54,080	kWh	$0.14	$8,000
Receiving conveyors	2.8	2	11,648	kWh	$0.14	$2,000
Polymer Feed	2.8	2	11,648	kWh	$0.14	$2,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 5 hr/shift)			1,300	hr	$30.00	$39,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,977	wt	$47.50	$236,000
Subtotal for O&M per year						**$444,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,423,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,533,000
TOTAL			**$7,956,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 1.b
BDP 3-belt (3DP) Belt Filter Presses, 1.0m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	22%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	40

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

	Qty	Unit	Unit ($/unit)	Total ($)	Remaining Value of Buildings and Equipment: Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$388,500	$777,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$236,750	$237,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,239,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$310,000			
Sitework (NA)				$0			
Subtotal B				$1,549,000			
Insurance (2% of B)				$31,000			
Subtotal C				$1,580,000			
Mobilization & Bonds (8% of C)				$126,000			
Overhead & Profit (10% of C)				$158,000			
Subtotal D				$1,864,000			
Contingency (30% of D)				$559,000			
Subtotal E				$2,423,000			
Engineering, Legal, and Administration (20% of D)				$485,000			
TOTAL				**$2,423,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	13	2	54,080	kWh	$0.14	$8,000
Receiving conveyors	2.8	2	11,648	kWh	$0.14	$2,000
Polymer Feed	2.8	2	11,648	kWh	$0.14	$2,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 5 hr/shift)			1,300	hr	$30.00	$39,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,977	wt	$47.50	$236,000
Subtotal for O&M per year						**$444,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,423,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,533,000
TOTAL			**$7,956,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 1.c
BDP 3-belt (3DP) Belt Filter Presses, 1.5m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	22%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	25

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit ($/unit)	Total ($)	Remaining Value of Buildings and Equipment: Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$444,000	$888,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$264,500	$265,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,378,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$345,000			
Sitework (NA)				$0			
Subtotal B				$1,723,000			
Insurance (2% of B)				$34,000			
Subtotal C				$1,757,000			
Mobilization & Bonds (8% of C)				$141,000			
Overhead & Profit (10% of C)				$176,000			
Subtotal D				$2,074,000			
Contingency (30% of D)				$622,000			
Subtotal E				$2,696,000			
Engineering, Legal, and Administration (20% of D)				$539,000			
TOTAL				**$2,696,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	16	2	41,600	kWh	$0.14	$6,000
Receiving conveyors	2.8	2	7,280	kWh	$0.14	$1,000
Polymer Feed	2.8	2	7,280	kWh	$0.14	$1,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 3 hr/shift)			780	hr	$30.00	$23,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control **			2,736	cfm	$30.00	$82,000
Cake Disposal			4,977	wt	$47.50	$236,000
Subtotal for O&M per year						**$424,000**

*Rounded to nearest $1,000

**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,696,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,284,000
TOTAL			**$7,980,000**

Present Worth: To find P, given F

$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A

$$(P/A, i, n) \qquad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$$

SEJPA
Dewatering Assessment

Date: 5/24/2021

Alternative 1.c
BDP 3-belt (3DP) Belt Filter Presses, 1.5m

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	22%
Polymer Dosage (lb/dt)	17
Operating Hours per Week (hrs, each unit)	25

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit ($/unit)	Total ($)	Remaining Value of Buildings and Equipment: Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
BFPs*	2	ea	$444,000	$888,000	20	0	0
BFP Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$264,500	$265,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$20,000	$20,000			
Allowance for Concrete (Washwater Curb / Pedestals)	1	ls	$10,000	$10,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,378,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (25% of A)				$345,000			
Sitework (NA)				$0			
Subtotal B				$1,723,000			
Insurance (2% of B)				$34,000			
Subtotal C				$1,757,000			
Mobilization & Bonds (8% of C)				$141,000			
Overhead & Profit (10% of C)				$176,000			
Subtotal D				$2,074,000			
Contingency (30% of D)				$622,000			
Subtotal E				$2,696,000			
Engineering, Legal, and Administration (20% of D)				$539,000			
TOTAL				**$2,696,000**			

*Includes local control panels, master control panel, wash water booster pumps, odor control hood, start up service, and freight. Costs based on 304 SST belt press frame.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
BFPs (includes hydraulic unit, feedbox, belt drives, and washwater pumps)	16	2	41,600	kWh	$0.14	$6,000
Receiving conveyors	2.8	2	7,280	kWh	$0.14	$1,000
Polymer Feed	2.8	2	7,280	kWh	$0.14	$1,000
Polymer (dose from input data)			18,615	lb	$2.50	$47,000
Labor						
Operations (assume 3 hr/shift)			780	hr	$30.00	$23,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
BFPs (based on information from a similar project)			2	ea	$10,000.00	$20,000
Odor Control**			2,736	cfm	$30.00	$82,000
Cake Disposal			4,977	wt	$47.50	$236,000
Subtotal for O&M per year						**$424,000**

*Rounded to nearest $1,000

**Air flow based on treating foul air from the building space (I.e. equipment not to be fully enclosed). The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,696,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,284,000
TOTAL			**$7,980,000**

Present Worth: To find P, given F

$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A

$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 2.a
Centrisys Centrifuge CS18-4

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	45

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$323,000	$646,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$55,000	$110,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$241,500	$242,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,308,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$392,000			
Sitework (NA)				$0			
Subtotal B				$1,700,000			
Insurance (2% of B)				$34,000			
Subtotal C				$1,734,000			
Mobilization & Bonds (8% of C)				$139,000			
Overhead & Profit (10% of C)				$173,000			
Subtotal D				$2,046,000			
Contingency (30% of D)				$614,000			
Subtotal E				$2,660,000			
Engineering, Legal, and Administration (20% of D)				$532,000			
TOTAL				**$2,660,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.
**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	25	2	117,000	kWh	$0.14	$17,000
Receiving conveyors	2.8	2	13,104	kWh	$0.14	$2,000
Polymer Feed	2.8	2	13,104	kWh	$0.14	$2,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 2 hr/shift)			520	hr	$30.00	$16,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$29,000.00	$29,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$437,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,660,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,446,000
TOTAL			**$8,106,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 2.a
Centrisys Centrifuge CS18-4

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	35

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$323,000	$646,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$55,000	$110,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$241,500	$242,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,308,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$392,000			
Sitework (NA)				$0			
Subtotal B				$1,700,000			
Insurance (2% of B)				$34,000			
Subtotal C				$1,734,000			
Mobilization & Bonds (8% of C)				$139,000			
Overhead & Profit (10% of C)				$173,000			
Subtotal D				$2,046,000			
Contingency (30% of D)				$614,000			
Subtotal E				$2,660,000			
Engineering, Legal, and Administration (20% of D)				$532,000			
TOTAL				**$2,660,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.
**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit	Units Operating	Annual Qty	Unit	Unit Cost	Total Cost*
	(kW)				($/unit)	($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	25	2	91,000	kWh	$0.14	$13,000
Receiving conveyors	2.8	2	10,192	kWh	$0.14	$1,000
Polymer Feed	2.8	2	10,192	kWh	$0.14	$1,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 2 hr/shift)			520	hr	$30.00	$16,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$29,000.00	$29,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$431,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth
			($)
Initial Capital			$2,660,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,371,000
TOTAL			**$8,031,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 2.b
Centrisys Centrifuge CS21-4

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	25

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$347,000	$694,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$60,000	$120,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$256,000	$256,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,380,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$414,000			
Sitework (NA)				$0			
Subtotal B				$1,794,000			
Insurance (2% of B)				$36,000			
Subtotal C				$1,830,000			
Mobilization & Bonds (8% of C)				$146,000			
Overhead & Profit (10% of C)				$183,000			
Subtotal D				$2,159,000			
Contingency (30% of D)				$648,000			
Subtotal E				$2,807,000			
Engineering, Legal, and Administration (20% of D)				$561,000			
TOTAL				**$2,807,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.
**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit	Units Operating	Annual Qty	Unit	Unit Cost	Total Cost*
	(kW)				($/unit)	($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	44	2	113,750	kWh	$0.14	$16,000
Receiving conveyors	2.8	2	7,280	kWh	$0.14	$1,000
Polymer Feed	2.8	2	7,280	kWh	$0.14	$1,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 2 hr/shift)			520	hr	$30.00	$16,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$31,000.00	$31,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$436,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,807,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,434,000
TOTAL			**$8,241,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA

Dewatering Assessment

Date: **5/24/2021**

Alternative 2.b
Centrisys Centrifuge CS21-4

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	20

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$347,000	$694,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$60,000	$120,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$256,000	$256,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,380,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$414,000			
Sitework (NA)				$0			
Subtotal B				$1,794,000			
Insurance (2% of B)				$36,000			
Subtotal C				$1,830,000			
Mobilization & Bonds (8% of C)				$146,000			
Overhead & Profit (10% of C)				$183,000			
Subtotal D				$2,159,000			
Contingency (30% of D)				$648,000			
Subtotal E				$2,807,000			
Engineering, Legal, and Administration (20% of D)				$561,000			
TOTAL				**$2,807,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.

**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	44	2	91,000	kWh	$0.14	$13,000
Receiving conveyors	2.8	2	5,824	kWh	$0.14	$1,000
Polymer Feed	2.8	2	5,824	kWh	$0.14	$1,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 1 hr/shift)			260	hr	$30.00	$8,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$31,000.00	$31,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$425,000**

*Rounded to nearest $1,000

**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,807,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,296,000
TOTAL			**$8,103,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 2.c
Alfa-Laval Centrifuge Aldec 75

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	35

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$275,000	$550,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$55,000	$110,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$217,500	$218,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,188,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$356,000			
Sitework (NA)				$0			
Subtotal B				$1,544,000			
Insurance (2% of B)				$31,000			
Subtotal C				$1,575,000			
Mobilization & Bonds (8% of C)				$126,000			
Overhead & Profit (10% of C)				$158,000			
Subtotal D				$1,859,000			
Contingency (30% of D)				$558,000			
Subtotal E				$2,417,000			
Engineering, Legal, and Administration (20% of D)				$483,000			
TOTAL				**$2,417,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.
**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit	Units Operating	Annual Qty	Unit	Unit Cost	Total Cost*
	(kW)				($/unit)	($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	32	2	116,480	kWh	$0.14	$17,000
Receiving conveyors	2.8	2	10,192	kWh	$0.14	$1,000
Polymer Feed	2.8	2	10,192	kWh	$0.14	$1,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 2 hr/shift)			520	hr	$30.00	$16,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$26,000.00	$26,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$432,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,417,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,384,000
TOTAL			**$7,801,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\dfrac{(1+i)^n - 1}{i(1+i)^n}\right]$

SEJPA
Dewatering Assessment

Date: **5/24/2021**

Alternative 2.c
Alfa-Laval Centrifuge Aldec 75

INPUT DATA*

Design Average Annual Solids Production (dtpd)	3.0
Cake Solids Concentration (% TS)	23%
Polymer Dosage (lb/dt)	20
Operating Hours per Week (hrs, each unit)	25

*input values highlighted in yellow vary depending on the equipment option.

Interest Rate	5.00%
Full Study Period, yrs	20
Power Cost ($/kwh)	$0.144
Polymer Cost ($/lb active)	$2.50
Operator Labor Cost ($/hr)	$30.00
Maintenance Labor Cost ($/hr)	$30.00
Cake Disposal Cost ($/wt)	$47.50
Odor Control O&M ($/cfm/yr)	$30.00

INITIAL COSTS

			Unit	Total	Remaining Value of Buildings and Equipment		
			($/unit)	($)	Projected Life (yrs)	% Remaining	($)
Direct Costs							
Equipment							
Centrifuges*	2	ea	$275,000	$550,000	20	0	0
Operating Platform with Overhead Monorail Crane and Hoist	2	ea	$55,000	$110,000			
Centrifuge Feed Pumps	2	ea	$40,000	$80,000			
Polymer Feeder Blenders	2	ea	$20,000	$40,000			
Sludge Grinders	2	ea	$20,000	$40,000			
Receiving Conveyors (2 @ 10 ft each)	20	lf	$2,500	$50,000			
Equipment Installation (25% of equipment costs)	1	ls	$217,500	$218,000			
Allowance for Odor Control and Ventilation Improvements	1	ls	$60,000	$60,000			
Allowance for Concrete (Pedestals)	1	ls	$15,000	$15,000			
Allowance for Demolition of Presses	1	ls	$25,000	$25,000			
Subtotal A				$1,188,000			**0**
Indirect Costs							
Electrical & Instrumentation/Controls (30% of A)**				$356,000			
Sitework (NA)				$0			
Subtotal B				$1,544,000			
Insurance (2% of B)				$31,000			
Subtotal C				$1,575,000			
Mobilization & Bonds (8% of C)				$126,000			
Overhead & Profit (10% of C)				$158,000			
Subtotal D				$1,859,000			
Contingency (30% of D)				$558,000			
Subtotal E				$2,417,000			
Engineering, Legal, and Administration (20% of D)				$483,000			
TOTAL				**$2,417,000**			

*Includes local control panels, master control panel, start up service, and freight. Costs based on 304 SST construction.
**A higher percentage assumed compared to the BFP options for potential upsizing of bus tie-breaker and other modifications required to the existing MCC due to higher electrical loads.

OPERATION & MAINTENANCE COSTS FOR 20-YEAR STUDY PERIOD

Item Description	Average Draw/unit (kW)	Units Operating	Annual Qty	Unit	Unit Cost ($/unit)	Total Cost* ($/yr)
Power						
Centrifuges (includes main drive and hydraulic scroll drive system)	32	2	83,200	kWh	$0.14	$12,000
Receiving conveyors	2.8	2	7,280	kWh	$0.14	$1,000
Polymer Feed	2.8	2	7,280	kWh	$0.14	$1,000
Polymer (dose from input data)			21,900	lb	$2.50	$55,000
Labor						
Operations (assume 2 hr/shift)			520	hr	$30.00	$16,000
Maintenance / Electronics Labor (assume 5 hrs/wk)			260	hr	$30.00	$8,000
Equipment Maintenance						
Replacement of Wear Parts for Centrifuges and Associated Equipment Listed Above (3% of equipment)			1	ls	$26,000.00	$26,000
Odor Control*			2,736	cfm	$30.00	$82,000
Cake Disposal			4,761	wt	$47.50	$226,000
Subtotal for O&M per year						**$427,000**

*Rounded to nearest $1,000
**Air flow based on treating foul air from the building space and the equipment. The input value to be updated upon determination of the odor control and the building ventilation approach.

LIFE CYCLE COSTS

	P/F Factor	P/A Factor	Total Present Worth ($)
Initial Capital			$2,417,000
Present Value of Remaining Value	0.3769		$0
Present Value of Annual O&M		12.4622	$5,321,000
TOTAL			**$7,738,000**

Present Worth: To find P, given F
$(P/F, i, n)$ $\quad P = F(1+i)^{-n}$

Series Present Worth: To find P, given A
$(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

Dewatering Equipment Options - 1.5% TS Feed

Target Operating Condition @ 1.5% TS = **1316 lb/hr (System Solids Throughput)**
175 gpm (System Hydraulic Throughput)
5 days/wk
7 hrs/day

Alternative	Mfr	Model	Manufacturer Maximum Rated Capacity per Unit[1]	Design Throughput per Unit[2]	Operating Time[3] days/wk	Operating Time[3] hrs/day	Units Operating	Capital Cost ($)[4]	Annual O&M Cost ($)	Present Worth of O&M Cost ($)	Life Cycle Cost ($)	% Cake Solids	Polymer Use (active lb/ton)	Washwater Use (gal/week)
Belt Filter Presses														
1.a	BDP	2VP (2 belt) 1.5m	1,351 lb/hr 180 gpm	844 lb/hr 113 gpm	5 7	6 8	2 1	$2,545,000	$443,000	$5,521,000	$8,066,000	~20-22 %	15 – 25	270,000
1.b	BDP	3DP (3-belt) 1.0m	2,000 lb/hr 300 gpm	638 lb/hr 85 gpm	5 7	8 11	2 1	$2,423,000	$444,000	$5,533,000	$7,956,000	~21-23 %	15 – 25	240,000
1.c	BDP	3DP (3-belt) 1.5m	3,000 lb/hr 450 gpm	957 lb/hr 127 gpm	5 7	5 7	2 1	$2,696,000	$424,000	$5,284,000	$7,980,000	~21-23 %	15 - 25	225,000
Centrifuges														
2.a	Centrisys	CS18	751 lb/hr 100 gpm	563 lb/hr 75 gpm	5 7	9 12	2 1	$2,660,000	$437,000	$5,446,000	$8,106,000	~22-24 %	15 – 30	30,000
2.b	Centrisys	CS21	1,314 lb/hr 175 gpm	985 lb/hr 131 gpm	5 6	5 8	2 1	$2,807,000	$436,000	$5,434,000	$8,241,000	~22-24 %	15 – 30	52,500
2.c	Alfa Laval	Aldec 75	976 lb/hr 130 gpm	732 lb/hr 98 gpm	5 7	7 9	2 1	$2,417,000	$432,000	$5,384,000	$7,801,000	~22-24 %	15 – 30	39,000

Notes:

1. The maximum rated capacity per unit based on the information provided by the manufacturer. This value is not intended to be a design loading rate.
2. The basis of design capacity assumption and the recommended design throughput for BFPs based on BV's experience to optimize performance are:

Basis of Design Capacity - with 1.5% TS

Belt Filter Presses

For 2-belt units =	100 gpm/m	(hydraulically limited @ 1.5% TS)
For 3-belt units =	850 lb/hr/m	(solids limited @ 1.5% TS)
Recommended Design Throughput @	75%	of the Design Capacity
For 2-belt units =	75 gpm/m	(hydraulically limited @ 1.5% TS)
For 3-belt units =	638 lb/hr/m	(solids limited @ 1.5% TS)

Centrifuges

The recommended design throughput for centrifuges = 75% of the manufacturer's rated capacity based on BV's experience to optimize performance (all are hydraulically limited @ 1.5% to 2.0% TS)

3. Green values denote that the target operating condition being met. Target operating conditions were developed with SEJPA staff.
4. Includes demolition of the existing BFPs, installation of new dewatering equipment, access platform with a monorail assembly (for the centrifuge options only), sludge feed pumps, polymer feeder blenders, receiving screw conveyors, and associated electrica and I&C improvements. See cost calculation tab for each alternative for additional information. Costs of downstream equipment (main screw conveyor, live bottom bin, and truck scale), piping, or architectural improvements not included (same costs for all dewatering equipment alternatives). Only includes structural costs related to dewatering equipment installation (i.e. concrete pedestals and washwater curb). Other structural costs related to building improvements (i.e. demolition of the mezzanine level, rehabilitation of steel components, door framing modifications, etc.) not included.

Dewatering Equipment Options - 2% TS Feed

Target Operating Condition @ 2.0% TS =	1316 lb/hr	(System Solids Throughput)
	132 gpm	(System Hydraulic Throughput)
	5 days/wk	
	7 hrs/day	

Alternative	Mfr	Model	Manufacturer Maximum Rated Capacity per Unit[1]	Design Throughput per Unit[2]	Operating Time[3] days/wk	Operating Time[3] hrs/day	Units Operating	Capital Cost ($)[4]	Annual O&M Cost ($)	Present Worth of O&M Cost ($)	Life Cycle Cost ($)	% Cake Solids	Polymer Use (active lb/ton)
Belt Filter Presses													
1.a	BDP	2VP (2 belt) 1.5m	1,500 lb/hr 150 gpm	845 lb/hr 84 gpm	5 7	6 8	2 1	$2,545,000	$443,000	$5,521,000	$8,066,000	~20-22 %	15 – 25
1.b	BDP	3DP (3-belt) 1.0m	2,000 lb/hr 300 gpm	638 lb/hr 64 gpm	5 7	8 11	2 1	$2,423,000	$444,000	$5,533,000	$7,956,000	~21-23 %	15 – 25
1.c	BDP	3DP (3-belt) 1.5m	3,000 lb/hr 450 gpm	957 lb/hr 96 gpm	5 7	5 7	2 1	$2,696,000	$424,000	$5,284,000	$7,980,000	~21-23 %	15 - 25
Centrifuges													
2.a	Centrisys	CS18	1,001 lb/hr 100 gpm	751 lb/hr 75 gpm	5 7	7 9	2 1	$2,660,000	$431,000	$5,371,000	$8,031,000	~22-24 %	15 – 30
2.b	Centrisys	CS21	1,751 lb/hr 175 gpm	1,314 lb/hr 131 gpm	5 5	4 8	2 1	$2,807,000	$425,000	$5,296,000	$8,103,000	~22-24 %	15 – 30
2.c	Alfa Laval	Aldec 75	1,301 lb/hr 130 gpm	976 lb/hr 98 gpm	5 6	5 8	2 1	$2,417,000	$427,000	$5,321,000	$7,738,000	~22-24 %	15 – 30

Notes:

1. The maximum rated capacity per unit based on the information provided by the manufacturer. This value is not intended to be a design loading rate.
2. The basis of design capacity assumption and the recommended design throughput for BFPs based on BV's experience to optimize performance are:

Basis of Design Capacity - with 1.5% TS

Belt Filter Presses

For 2-belt units =	750 lb/hr/m	(solids limited @ 2.0% TS)	@1.5% it was hydraulically limited
For 3-belt units =	850 lb/hr/m	(solids limited @ 2.0% TS)	
Recommended Design Throughput @	75%	of the Design Capacity	
For 2-belt units =	563 lb/hr/m	(solids limited @ 2.0% TS)	@1.5% it was hydraulically limited
For 3-belt units =	638 lb/hr/m	(solids limited @ 2.0% TS)	

Centrifuges

The recommended design throughput for centrifuges = 75% of the manufacturer's rated capacity based on BV's experience to optimize performance(all are hydraulically limited @ 1.5 to 2.0% TS)

3. Green values denote that the target operating condition being met. Target operating conditions were developed with SEJPA staff.
4. Includes demolition of the existing BFPs, installation of new dewatering equipment, access platform with a monorail assembly (for the centrifuge options only), sludge feed pumps, polymer feeder blenders, receiving screw conveyors, and associated electrica and I&C improvements. See cost calculation tab for each alternative for additional information. Costs of downstream equipment (main screw conveyor, live bottom bin, and truck scale), piping, or architectural improvements not included (same costs for all dewatering equipment alternatives). Only includes structural costs related to dewatering equipment installation (i.e. concrete pedestals and washwater curb). Other structural costs related to building improvements (i.e. demolition of the mezzanine level, rehabilitation of steel components, door framing modifications, etc.) not included.

Appendix D – Opinion of Probable Construction Cost Details

SEWRF Sludge Dewatering Facilities Upgrade

Feasibility Study Statement of Probable Cost

June 25, 2021

21-00616.00

Prepared for Black & Veatch

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EXECUTIVE SUMMARY

Introduction	The project scope of work includes the removal and replacement of dewatering equipment, associated pumps, conveyors, instrumentation and controls, truck scales, hoppers and other equipment at the San Elijo Water Reclamation Facility in Cardiff, CA. Also included are related improvements and modifications to the existing building envelope, architectural elements, HVAC, plumbing & electrical systems, as well as site / civil scopes of work.
Basis of Estimate	- This Feasibility Study Statement of Probable Cost is based upon the following: - Preliminary Design Report, dated 5/28/21, prepared by Black & Veatch - Preliminary Design Drawings, dated May 2021, prepared by Black & Veatch - Equipment / vendor quotes, various dates, provided by Black & Veatch - Discussions with the design team
Estimate Format	A component cost classification format has been used for the preparation of this estimate. It classifies costs by building system / element.
Cost Mark Ups	The following % mark ups have been included in each design option: - General Conditions (12.00% on direct costs) - General Requirements (2.50% compound) - Bonds & Insurance (1.50% compound) - Contractor's Fee (7.00% compound) - Design & Construction Contingency (30.00% compound) - Escalation to MOC, 07/02/23 (8.44% compound)
Escalation	All subcontract prices herein are reflective of current bid prices. Escalation has been included on the summary level to the stated mid point of construction.
Design & Construction Contingency	An allowance of 30.00% for undeveloped design details as well as a construction contingency has been included in this estimate. As the design of each system is further developed, details which historically increase cost become apparent and must be incorporated into the estimate while decreasing the % burden for the design contingency. It is also prudent for all program budgets to include a construction contingency allowance for change orders which occur during the construction phase. These change orders normally increase the cost of the project.
Construction Schedule	Costs included herein have been based upon a construction period of 12 months. Any costs for excessive overtime to meet accelerated schedule milestone dates are not included in this estimate. - Anticipated Start of Construction - January 1, 2023 - Anticipated Midpoint of Construction - July 2, 2023 - Anticipated Substantial Completion - January 1, 2024
Method of Procurement	The estimate is based on a design-bid-build delivery method.
Bid Conditions	This estimate has been based upon competitive bid situations (minimum of 4 bidders) for all items of subcontracted work.

EXECUTIVE SUMMARY

Basis For Quantities	Wherever possible, this estimate has been based upon the actual measurement of different items of work. For the remaining items, parametric measurements were used in conjunction with other projects of a similar nature.
Basis for Unit Costs	Unit costs as contained herein are based on current bid prices in San Diego, CA. Sub overheads and profit are included in each line item unit cost. Their overhead and profit covers each sub's cost for labor burden, materials, and equipment, sales taxes, field overhead, home office overhead, and profit. The general contractor's overhead is shown separately on the master summary.
Sources for Pricing	This estimate was prepared by a team of qualified cost consultants experienced in estimating construction costs at all stages of design. These consultants have used pricing data from Cumming's database for construction, updated to reflect current conditions in San Diego, CA.
Key Exclusions	The following items have been excluded from our estimate: - Professional fees, inspections and testing. - Plan check fees and building permit fees. - Furnishings, fixtures and equipment (FF&E), except where noted through the cost estimate. - Major site and building demolition unless noted in the body of the estimate. - Costs of hazardous material surveys, abatements and disposals - Costs of offsite construction unless noted in body of the estimate.
Items Affecting Cost Estimate	Items which may change the estimated construction cost include, but are not limited to: - Modifications to the scope of work included in this estimate. - Unforeseen sub-surface conditions. - Restrictive technical specifications or excessive contract conditions. - Any specified item of material or product that cannot be obtained from 3 sources. - Any other non-competitive bid situations. - Bids delayed beyond the projected schedule.
Statement of Probable Cost	Cumming has no control over the cost of labor and materials, the general contractor's or any subcontractor's method of determining prices, or competitive bidding and market conditions. This estimate is made on the basis of the experience, qualifications, and best judgement of a professional consultant familiar with the construction industry. Cumming, however, cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates. Cumming's staff of professional cost consultants has prepared this estimate in accordance with generally accepted principles and practices. This staff is available to discuss its contents with any interested party. Pricing reflects probable construction costs obtainable in the project locality on the target dates specified and is a determination of fair market value for the construction of this project. The estimate is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all sub and general contractors with a range of 3 - 4 bidders for all items of work. Experience and research indicates that a fewer number of bidders may result in higher bids. Conversely, an increased number of bidders may result in more competitive bid day responses.

EXECUTIVE SUMMARY

COVID-19 Disclosure

The outbreak of the novel Coronavirus (COVID-19), declared by the World Health Organization as a "Global Pandemic" on 11 March 2020, has impacted global financial markets.

Market activity is being impacted in many sectors and circumstances remain very fluid and variable in different jurisdictions. Accordingly, as of this date, we are concerned with the market related impacts on the deliverables we are furnishing to you as part of our Services including cost estimates, budgets, and schedules ("Deliverable(s)"). Indeed, the current response to this pandemic means that we are faced with an unprecedented set of circumstances on which to base a judgement of the effects on the availability of labor, materials, and access and other impacts, although we are monitoring those on a continuing basis. Particularly including productivity impacts as a result of the CDC directives regarding social distancing.

Our Deliverables must be regarded with a degree of 'material uncertainty, – and a higher degree of caution – than would normally be the case. Given the unknown future impact that the COVID-19 pandemic might have on the construction and real estate markets, we recommend that you keep the Deliverables of this project under frequent review. For your information, we have not added or considered a COVID19 additional contingency within this Deliverable"

Recommendations

Cumming recommends that the Owner and the Engineer carefully review this entire document to ensure it reflects their design intent. Requests for modifications of any apparent errors or omissions to this document must be made to Cumming within ten days of receipt of this estimate. Otherwise, it will be assumed that its contents have been reviewed and accepted. If the project is over budget or there are unresolved budget issues, alternate systems / schemes should be evaluated before proceeding into further design phases.

It is recommended that there are preparations of further cost estimates throughout design by Cumming to determine overall cost changes since the preparation of this preliminary estimate. These future estimates will have detailed breakdowns indicating materials by type, kind, and size, priced by their respective units of measure.

SUMMARY

Element	Area	Cost / SF	Total
Sludge Dewatering Facility Upgrades	2,080	$3,009.92	$6,260,643
Total Estimated Construction Cost	**2,080**	**$3,009.92**	**$6,260,643**

Sludge Dewatering Facility Upgrades

SUMMARY - SLUDGE DEWATERING FACILITY UPGRADES

Element	Subtotal	Total	Cost / SF	Cost / SF
A) Shell (1-5)		**$214,350**		**$103.05**
1 Foundations	$36,600		$17.60	
2 Vertical Structure	N/A		N/A	
3 Floor & Roof Structures	$57,200		$27.50	
4 Exterior Cladding	$60,550		$29.11	
5 Roofing and Waterproofing	$60,000		$28.85	
B) Interiors (6-7)		**$45,800**		**$22.02**
6 Interior Partitions, Doors and Glazing	$17,500		$8.41	
7 Floor, Wall and Ceiling Finishes	$28,300		$13.61	
C) Equipment and Vertical Transportation (8-9)		**$2,200,780**		**$1,058.07**
8 Function Equipment and Specialties	$2,200,780		$1,058.07	
9 Stairs and Vertical Transportation	N/A		N/A	
D) Mechanical and Electrical (10-13)		**$757,707**		**$364.28**
10 Plumbing Systems	$42,574		$20.47	
11 Heating, Ventilation and Air Conditioning	$186,078		$89.46	
12 Electrical Lighting, Power and Communications	$529,055		$254.35	
13 Fire Protection Systems	N/A		N/A	
E) Site Construction (14-16)		**$343,370**		**$165.08**
14 Site Preparation and Demolition	$209,835		$100.88	
15 Site Paving, Structures & Landscaping	$118,535		$56.99	
16 Utilities on Site	$15,000		$7.21	
Subtotal		$3,562,007		$1,712.50
General Conditions	12.00%	$427,441		$205.50
Subtotal		$3,989,447		$1,918.00
General Requirements	2.50%	$99,736		$47.95
Subtotal		$4,089,183		$1,965.95
Bonds & Insurance	1.50%	$61,338		$29.49
Subtotal		$4,150,521		$1,995.44
Contractor's Fee	7.00%	$290,536		$139.68
Subtotal		$4,441,058		$2,135.12
Design & Construction Contingency	30.00%	$1,332,317		$640.54
Subtotal		$5,773,375		$2,775.66
Escalation to MOC, 07/02/23	8.44%	$487,268		$234.26
TOTAL ESTIMATED CONSTRUCTION COST		**$6,260,643**		**$3,009.92**

Total Area: 2,080 SF

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
1 Foundations				
Patch & repair to existing concrete slab on grade, allowance	2,080	sf	$7.50	$15,600
Miscellaneous modifications to existing building foundations, allowance	1	ls	$7,500.00	$7,500
Miscellaneous modifications & supplemental foundations for conveyors, allowance	1	ls	$10,000.00	$10,000
Equipment pad for switchgear room, allowance	1	ls	$3,500.00	$3,500
Total - Foundations				**$36,600**
3 Floor & Roof Structures				
Steel strongback / supplemental framing at new wall openings	2	ea	$3,000.00	$6,000
Miscellaneous structural modifications & rehabilitation at existing building, allowance	2,080	sf	$15.00	$31,200
Miscellaneous structural modifications & rehabilitation at existing truck loading structure, allowance	1	ls	$20,000.00	$20,000
Total - Floor & Roof Structures				**$57,200**
4 Exterior Cladding				
Exterior Walls				
Infill exterior wall openings	48	sf	$75.00	$3,600
Patch, repair & paint to exterior walls	3,680	sf	$7.50	$27,600
Patch, repair & paint to exterior walls at switchgear room, allowance	1	ls	$5,000.00	$5,000
Exterior Doors				
HM door, frame & hardware, single	3	ea	$2,500.00	$7,500
HM door, frame & hardware, pair	3	ea	$4,200.00	$12,600
Service & repair to existing roll-up door at switchgear room, allowance	1	ea	$1,750.00	$1,750
Exterior Glazing				
Fixed windows at existing wall opening - 2' x 2'	4	ea	$400.00	$1,600
Operable windows at existing wall openings - 2' x 2'	2	ea	$450.00	$900
Total - Exterior Cladding				**$60,550**
5 Roofing and Waterproofing				
Demo & cut back, patch & repair to existing roofing systems / flashings, allowance	1	ls	$10,000.00	$10,000
New removable acrylic skylights, incl. curbs & flashings - 10'-8" x 19'-6"	2	ea	$25,000.00	$50,000
Total - Roofing and Waterproofing				**$60,000**

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
6 Interior Partitions, Doors and Glazing				
Interior Walls				
Miscellaneous patch & repair to existing walls, allowance	1	ls	$10,000.00	$10,000
Interior Doors				
HM door, frame & hardware, single	3	ea	$2,500.00	$7,500
Total - Interior Partitions, Doors and Glazing				**$17,500**
7 Floor, Wall and Ceiling Finishes				
Miscellaneous patch & repair to existing finishes, allowance	2,080	sf	$10.00	$20,800
Miscellaneous patch & repair to existing finishes at switchgear room, allowance	1	ls	$7,500.00	$7,500
Total - Floor, Wall and Ceiling Finishes				**$28,300**
8 Function Equipment and Specialties				
Building Specialties				
Code signage, allowance	2,080	sf	$1.00	$2,080
Exterior ladder to low roof w/security cage	1	ea	$6,500.00	$6,500
Miscellaneous specialties, allowance	2,080	sf	$2.50	$5,200
Equipment				
Hoisting for removal of existing & installation of new equipment, allowance	1	ls	$60,000.00	$60,000
Truck scale, incl. steel deck, scales, rub rails, load cells, controls, installed, 1 ea Quote per Fairbanks Scales, undated, received 5/27/21	1	ea	$111,000.00	$111,000
Screw conveyors, incl. slide gates, motors, hoppers, supports, installed, 2 ea Quote per Custom Conveyor, dated 3/3/21	1	ls	$400,000.00	$400,000
Decanter centrifuge units, installed, 2 ea Quote per Centrisys, dated 1/25/21	1	ls	$1,120,000.00	$1,120,000
Polymer feeder blender unit, 4 ea, incl. chemical totes & portable mixer, installed Quote per The Coombs-Hopkins Company, dated 7/27/16 (escalated)	1	ls	$246,000.00	$246,000
Instrumentation and controls, 15% of equipment costs, allowance	1	ls	$220,000.00	$220,000
Miscellaneous supplemental structural steel framing, brackets, anchors, etc. for new equipment, allowance	1	ls	$30,000.00	$30,000
Total - Function Equipment and Specialties				**$2,200,780**

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
10 Plumbing Systems				
Plumbing Demolition				
Remove fixtures, cap lines	1	ea	$371.60	$372
General Plumbing Equipment				
Water heater, elec, point of use, commercial, 6 gal	1	ea	$1,306.00	$1,306
Expansion tank	1	ea	$604.40	$604
Sanitary Fixtures				
Floor drain, FD-1	1	ea	$327.30	$327
Hose bibb, HB-1	1	ea	$170.70	$171
Emergency shower/eye face wash station	1	ea	$2,015.00	$2,015
Rough-Ins				
Local rough-in at fixture	3	ea	$755.50	$2,267
Domestic Water				
HW/CW connect to emergency eyewash	1	ea	$667.10	$667
3/4" pipe, cu type L, in bldg	150	lf	$39.41	$5,912
Pipe insulation, 3/4" pipe	150	lf	$12.06	$1,809
Waste / Vent				
Rough-in at floor sink or floor drain	1	ea	$1,184.00	$1,184
4" pipe, ci, no-hub, below grade	125	lf	$44.35	$5,544
Trench excavate, backfill, compact	93	cy	$68.05	$6,329
Sand bedding in trench	93	cy	$18.40	$1,711
2" pipe, ci, no-hub, in bldg	50	lf	$55.96	$2,798
Condensate Drainage				
Trap and equipment connect	1	ea	$535.20	$535
3/4" pipe, cu type M, in bldg	75	lf	$41.06	$3,080
Pipe insulation, 3/4"	75	lf	$12.06	$905
Miscellaneous Plumbing				
Test / clean plumbing	16	hr	$113.63	$1,818
Start-up/check-out	4	hr	$136.35	$545
Commissioning assist	8	hr	$119.61	$957
Piping identification	8	ea	$33.53	$268
Seismic bracing	1	ls	$1,451.00	$1,451
Total - Plumbing Systems				**$42,574**
11 Heating, Ventilation and Air Conditioning				
HVAC Demolition				
Remove ductwork, exhaust fans, splits system and accessories	1	ls	$17,220.00	$17,220

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
Refrigerant Piping				
3/8" pipe, acr, type L	100	lf	$37.74	$3,774
7/8" pipe, acr, type L	100	lf	$46.12	$4,612
Pipe insulation, 3/8" pipe	100	lf	$13.71	$1,371
Pipe insulation, 7/8" pipe	100	lf	$14.93	$1,493
DX Fancoils/splits				
Split AC, ductless, ceiling, 3 ton, 1200 cfm (Dewatering Bldg Elect Room)	1	ea	$6,930.00	$6,930
Condensing unit, 3 tons (MS-2 Switchgear Room)	1	ea	$4,233.00	$4,233
Fans				
Supply fan	6,800	cfm	$2.24	$15,232
Smoke detector	1	ea	$915.50	$916
VFDs	5	hp	$385.10	$1,926
Air Distribution				
Ductwork				
Ductwork, galv, self-fab'd, incl shop OH	1,005	lb	$19.25	$19,346
Ductwork, fiberglass reinforced plastic (FRP)	225	lf	$269.00	$60,525
Grilles and diffusers				
Louvers	6	sf	$150.40	$902
Miscellaneous				
Test / balance HVAC	32	hr	$131.21	$4,199
Start-up/check-out	24	hr	$119.28	$2,863
Commissioning assist	12	hr	$119.28	$1,431
MEP Coordination	12	hr	$119.28	$1,431
Seismic bracing, duct	1	ls	$4,685.00	$4,685
Hoisting and rigging	1	ls	$7,579.00	$7,579
HVAC Controls				
DDC controls, split AC/HP	1	ea	$4,455.00	$4,455
DDC controls, specialty exhaust fan	1	ea	$4,455.00	$4,455
DDC controls, controls workstation	1	ea	$16,500.00	$16,500
Total - Heating, Ventilation and Air Conditioning				**$186,078**
12 Electrical Lighting, Power and Communications				
Electrical Systems				
Demolition				
Electrical demolition / safe-off	1	ls	$15,000.00	$15,000
Distribution Equipment				
Metering package	1	ea	$2,958.94	$2,959
Existing duct bank interception / splicing / termination	1	ea	$36,320.22	$36,320
Existing panels modification	1	ea	$3,471.24	$3,471
E-stop / controls	1	ea	$4,671.24	$4,671

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
8 Section, 480V, 600A motor control center	1	ea	$70,515.43	$70,515
5 Section, 480V, 1600A metal-clad switchgear	1	ea	$211,239.14	$211,239
Feeder, 20 amp, grc	135	lf	$21.42	$2,891
Feeder, 600 amp, grc	155	lf	$205.32	$31,825
Feeder, 1600 amp, grc	100	lf	$504.66	$50,466
Pull box, 24x24x8 N3R	1	ea	$556.78	$557
HVAC and Equipment Connections				
HVAC and equipment connections 0 - 10 HP	12	ea	$212.90	$2,555
HVAC and equipment connections 25 HP	2	ea	$285.92	$572
Disconnect switch, 60/3 fused N3R	2	ea	$1,061.11	$2,122
Conduit, 1 1/4" grc	200	lf	$23.69	$4,738
Conduit, 1 1/4" liquid-tight	120	lf	$14.58	$1,750
Conduit, 3/4" grc	600	lf	$15.30	$9,181
Copper wire, #4 XHHW-2	1,056	lf	$2.15	$2,265
Copper wire, #10 XHHW-2	352	lf	$0.88	$310
Copper wire, #10 XHHW-2	1,980	lf	$0.88	$1,746
Convenience Power				
Double duplex receptacle, 20 amp GFCI	8	ea	$182.31	$1,458
Conduit, 3/4" grc	360	lf	$15.30	$5,508
Copper wire, #12 thhn	1,188	lf	$0.71	$838
Lighting and Lighting Controls				
Lighting fixtures explosion rated	31	ea	$1,061.36	$32,902
Conduit, 3/4" grc	880	lf	$15.30	$13,465
Copper wire, #12 thhn	2,904	lf	$0.71	$2,049
Miscellaneous Electrical Requirements	2,080	sf	$8.50	$17,680
Total - Electrical Lighting, Power and Communications				**$529,055**
14 Site Preparation and Demolition				
Site Preparation				
Temporary protection measures	1	ls	$7,500.00	$7,500
Erosion control measures	1	ls	$5,000.00	$5,000
Temporary Facilities				
Sludge processing with outdoor trailers - rental, 6 months incl. mobilization / demobilization	1	ls	$95,000.00	$95,000
Site Demolition				
Demo existing polymer storage containment area	132	sf	$25.00	$3,300
Demo existing site slab on grade & foundations	357	sf	$15.00	$5,355
Demo existing retaining wall & foundations	21	lf	$50.00	$1,050
Miscellaneous site demolition, allowance	1	ls	$3,500.00	$3,500

DETAIL ELEMENTS - SLUDGE DEWATERING FACILITY UPGRADES

Element	Quantity	Unit	Unit Cost	Total
Building Demolition				
Demo exterior doors, frames & hardware	5	ea	$250.00	$1,250
Demo exterior window louvers / screens, 2' x 2'	8	ea	$150.00	$1,200
Sawcut / demo exterior walls for new door openings	117	sf	$15.00	$1,755
Demo existing skylights	416	sf	$10.00	$4,160
Demo interior doors, frames, & hardware	3	ea	$200.00	$600
Demo interior access ladder	1	ea	$350.00	$350
Demo interior mezzanine, incl. guardrails, structure	833	sf	$20.00	$16,660
Demo concrete pedestals & washwater curbs	33	lf	$35.00	$1,155
Demo equipment, incl. scales, enclosures, plates, conveyors, control panels, hopper, belt filter press, feed equip & piping, complete	1	ls	$50,000.00	$50,000
Miscellaneous building demolition, allowance	1	ls	$5,000.00	$5,000
Earthwork				
Rough & fine grading, cut & fill, based on balanced site	2,000	sf	$3.50	$7,000
Total - Site Preparation and Demolition				**$209,835**
15 Site Paving, Structures & Landscaping				
Hardscape				
New concrete pavement	546	sf	$12.50	$6,825
New concrete slab at truck scale approach ramps	661	sf	$35.00	$23,135
Miscellaneous patch & repair to existing hardscape, allowance	1	ls	$3,500.00	$3,500
Landscape				
Miscellaneous landscape & irrigation patch, repair & restoration, allowance	1	ls	$7,500.00	$7,500
Site Amenities / Structures				
New polymer storage structure, incl. foundations, slab on grade, covered canopy, grating	420	sf	$100.00	$42,000
Bollards, allowance	10	ea	$1,000.00	$10,000
New CMU retaining wall, incl. foundations	35	lf	$445.00	$15,575
Miscellaneous site amenities, allowance	1	ls	$10,000.00	$10,000
Total - Site Paving, Structures & Landscaping				**$118,535**
16 Utilities on Site				
Miscellaneous utility modifications, allowance	1	ls	$15,000.00	$15,000
Total - Utilities on Site				**$15,000**