Hannegan Properties

Fish Processing Wastewater System

DAF Upgrade Engineering Report

29 March 2023

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STATE OF WASHINGTON
36849
REGISTERED
PROFESSIONAL ENGINEER

29 Mar. 2023

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IES

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PROJECT BACKGROUND

Hannegan Properties, LLC (Hannagan) operates a wastewater treatment and disposal system for fish processing wastewater at the Hannegan properties. The treatment system is organically overloaded and effluent quality has not met target limits. Inboden Environmental Services (IES) has been hired by Hannegan to provide engineering oversight for improvements to the process wastewater treatment system.

The existing treatment system consists of screening (2 stages) followed by an oil and grease separator and finAlly aerobic treatment in sequencing batch reactor (SBR). Treated effluent is stored in an effluent lagoon and is sprayed on grass fields for disposal. IES has reviewed the existing treatment system with specific objective of adding a Dissolved Air Flotation SEPARATION (DAF) process after the wastewater screening to reduce the loading to the SBR.

IES believes that the treatment system performance will be significantly improved from installation of the DAF. However, this may not be sufficient improvement to meet target effluent quality. The type and amount additional treatment necessary will depend on the performance of the DAF unit. Therefore, IES will evaluate system performance after the DAF is operational and develop a plan for further improvements at that time.

PROJECTED WASTEWATER CHARACTERISTICS

Wastewater Flow

Process wastewater is generated from processing salmon residuals (byproducts) to create pet food and other products. Three different tenants on the property as listed below.

1. Fat Cat Fish
2. Pelican Packers
3. American Canadian Fisheries

These tenants are engaged in similar processing activities and all process wastewater is combined into one stream before treatment.

The processing activities of the tenants vary by season. The July through November period has increased processing activity and thus increased wastewater flows. Reduced processing in the December through April period results in lower processing wastewater flows. For design purposes, IES, used flow information from the higher production season (high season) for purposes of this evaluation.

Based on 2022 high season flow data, the median wastewater flow rate is 26,000 gpd with occasional peak flows up to 43,000 gpd were observed flow data from May -Aug 2022. The Hannegan Properties management stated that they are working on measures to reduce peak flows and expect these to be reduced significantly.

Process wastewater generation follows a fairly regular schedule determined by the activity within the processing facility. From 8am to 4pm, approximately 30% of the daily wastewater is generated at a fairly steady rate. From 4pm to 5pm, cleaning operations generate a surge in flow and this hour accounts for about 30% of the daily flow. Table 1 is a summary of the daily wastewater flow estimated volumes generated during the time periods outlined above.

Table 1. Process Wastewater Flow for Critical Periods

Time period	Flow Fraction (% of Total)	High Season Flow (a)	
		Median Flow (Gal.)	Peak Flow (Gal.)
Total Daily Flow	100%	**26,000**	**43,000**
Diurnal High Flows 8 AM- 4 PM	30%	7,800	12,900
4-5 PM Flow Surge	30%	7,800	12,900
Remaining Flow; 5PM -8 AM	40%	10,400	17,200

(a) Based on measured flows during peak production season

Constituent Concentrations & Loading

The primary screening process is working well and will remain in place so the wastewater flowing from these screens will be further treated in the DAF unit. Hannegan evaluated wastewater quality downstream of the primary screening process using composite samples that were collected Cesco Solutions, Ltd. Table 2 is a summary of critical design characteristics for screened process wastewater. Appendix A includes the report on the wastewater evaluation and coagulant testing to simulate the DAF performance. Results from Edge Analytical Laboratories are also included in Appendix A

Table 2: DAF Design Wastewater Characteristics (a)

	Screened Wastewater Flow/Load (a)			Post DAF Estimated Flow /Load (b)		
Parameter	Conc., mg/L	Median	Maximum (c)	Conc., mg/L	Median	Maximum (c)
Flow, gpd	-	26,000	36,000	-	26,000	36,000
COD,	8,200	1,775 lb/d	2,450 lb/d	2,520	505 lb/d	700 lb/d
TSS	2,585	561 lb/d	778 lb/d	328	71 lb/d	490 lb/d
TKN	502	110 lb/d	151 lb/d	345	75 lb/d	103 lb/d

(a) Design characteristics after primary screening from analyses. Flow from Table 1.
(b) Estimated characteristics after DAF process based on Cesco report and analytical results (Appendix B) with flows defined in Table 1.
(c) Maximum expected sustained flows for DAF Design.

PROPOSED WASTEWATER TREATMENT SYSTEM

The treatment system will be composed of both existing and new components. The main components are listed below in the sequence of flow. Basic drawings of the proposed system are included as Appendix B; Sheet 1 is a simple schematic showing flow path and major process components.

1. An existing Primary coarse screen.
2. An existing Primary fine screen.
3. An existing grease interceptor.
4. An existing influent lift station.
5. A new flow equalization tank.
6. A new containerized DAF system.
7. A new DAF effluent pump station.

8. An existing Sequencing Batch Reactor (SBR).
9. A new DAF sludge storage tank.
10. An existing odor biofilter.
11. An existing effluent storage lagoon.
12. An existing irrigation pumping system.
13. Existing crop field for spray irrigation with effluent.

This phase of modifications involves the addition of a DAF system for pretreatment of the wastewater prior to biological treatment in the SBR. The existing primary screening and grease interceptor components and the effluent dispersal system remain unchanged.

Primary Treatment

Primary treatment starts with solids removal in a rotary fine screen followed by a parabolic microscreen. The screened wastewater then flows to a below grade, oil and grease interceptor tank. Effluent from the interceptor flows into the existing influent pump station. This primary treatment process is working well and will remain unchanged.

Influent lift station

The existing lift station pumps effluent from the grease interceptor up into the SBR. To incorporate the new DAF system the following changes will be made:

1. A backup pump will be added to increase redundancy. This pump will be hung above the existing pump and equipped with a piggy-back float switch.
2. The pumped flow pipe to the SBR will become a manual bypass pipe and will be equipped with a shut-off valve (normally closed).
3. A new branching pipe with shut-off valve (normally open) will be routed to the new Flow Equalization tank.

New DAF Capacity and Flow Equalization Tank

The new DAF is to be supplied as an integrated system housed in a container. The specifics of the DAF unit are described further in a subsequent subsection. The DAF unit has a rated capacity of 44 gallons/minute (GPM) maximum hydraulic capacity. The flocculating system upstream of the DAF requires a minimum flow of 26 gpm. The capacity range GPM, gal/hour (GPH) and gallons per day (GPD) are listed in Table 2. Because process wastewater generation rates are quite variable, flow equalization head of the DAF unit is required.

The Flow Equalization (Flow Eq.) tank is intended to limit the flow rate through the DAF to a maximum flow of 44 gpm and ideally keep it as low as possible. The DAF will have better performance flows at lower allowable flow rate. IES calculated Flow Equalization volumes required for the range of hydraulic loading capacities and presents this information in Table 3.

Table 3: Rated flow capacity of the DAF Unit and Flow Eq. Volume

DAF Flow Parameter (a)	Minimum Flow	Medium Flow	Maximum Flow
DAF Influent, GPM	26	35	44
DAF Influent, GPH	1,560	2,100	2,640
DAF Influent, GPD	37,440	50,400	63,360
EQ. Volume Required	**Volume Stored in Flow. Eq. Tank (Inflow to Eq. Tank-Outflow to DAF)**		
At Average wastewater generation (26,000 gpd)	With Minimum DAF Flow	With Medium DAF Flow	With Maximum DAF Flow
8am-4pm Flow, Gal. 4-5pm Flow Surge, Gal.	0 6,240	0 5,700	0 5,160
At PEAK Wastewater generation (43,000 gpd)			With Maximum DAF Flow
8am-4pm Flow, Gal. 4-5pm Flow Surge, Gal.			0 10,260

(a) DAF design min. and max. flow are from manufacturer information sheet (Appendix C).

The flow equalization volume required at average process wastewater flow is about 5,700 gal. at a flow through the DAF unit of 35 gpm (medium flow). This volume is considered a reasonable flow equalization volume for the vast majority of processing days. An overflow in the Eq. Tank will allow flow to spill into the SBR if necessary. This should only occur on rare occasions at extra high influent flow rates. The amount of influent bypassing the DAF on these occasions will be a small portion of the flow through the DAF and will be adequately treated in the SBR.

Eq. Tank Details

To meet the minimum volume requirement, a previously purchased outdoor-rated polyethylene tank will be placed on grade to serve as a Flow Eq. tank prior to the DAF system. This tank will receive wastewater from the Influent Lift Station. The approximate operating volume of the tank is 6,000 gallons (nominal volume is 6,600 gallons).

Under normal operation, the DAF feed pump located in the DAF container will draw out of the Flow Eq. via a flooded suction pipe. This withdrawal will occur at a constant steady rate until the pump is disabled by a low-level float switch. A gravity high-water level overflow pipe will discharge directly into the SBR in case the DAF system is off-line or the Flow Eq. overfills up during peak flows. The headspace of the Flow Eq. tank is vented to the SBR through the gravity overflow pipe.

After the wastewater treatment system is operational with the 6,000 gal. Eq. Tank, flow equalization needs will be further evaluated. If surge flows are higher than expected, or the performance of the DAF impacted by surge flows, an additional equalization tank could be added and bottom-connected to the first Flow Eq. Tank.

Initial pH Adjustment

The Flow Eq. Tank will also serve as the mix tank for pH adjustment prior to the DAF. The wastewater tends to have a pH of around 10. This will be adjusted to 5.5 using Sulfuric Acid that is injected into the influent pipe to the tank. The Flow Eq. tank will be mixed to ensure good dispersion. Details of the pH adjustment chemical dosing and control will be provided by Cesco who will also supply the components chemicals.

New DAF Separator System

DAF System Overview

The DAF separator is a horizontal flow rectangular unit that is integrated into a complete system housed in a steel shipping container. The DAF system is assembled by H2Flow Equipment Inc. with design information details provided in Appendix C. The DAF system includes the following main components:

- Intake Pump
- Chemical storage and injection.
- Flocculator
- Air compressor
- DAF separators – Model Alpha 10
- Sludge Pump
- Flow, pH and other sensors connected to Control Panel
- Ventilation System

Sheet 2 in Appendix C is a simple layout diagram of the DAF system in the container. The manufacturer, (H2Flow) will provide start-up and adjustment services for the DAF system once it has been fully installed and connected.

Effluent from the DAF is by gravity and will flow to a new DAF Effluent Pump Station located outside of the DAF enclosure.

Containerized DAF system Details

The containerized DAF system will house the following listed below. The:

1. Controls system – The PLC-based control system has an HMI for adjustments and status.
2. DAF feed pump – The DAF feed pump draws from the Flow Eq. tank and is disabled by a low-level float switch located there.
3. Flow meter – The influent flow meter measures flow from the DAF feed pump.
4. Initial Coarse pH adjustment system – This pH adjustment system will feed Sulfuric Acid into the influent pipe to the Flow Eq. tank to bring the pH down enough for the fine pH adjustment system to be effective. This system is not included in the current containerized package, but will be added after the fact.
5. Fine pH adjustment system – A fine pH adjustment system doses acid into the DAF influent line.

6. Coagulant feed system – The coagulant feed system injects the chemical into a plug flow contactor to flocculator colloidal proteins.
7. Acid and coagulant solution storage – There is room for an IBC tote of Sulfuric Acid for pH adjustment and an IBC tote for coagulant.
8. Polymer make down and feed system – The polymer system diluted concentrated polymer and doses the DAF to promote solids flocculation.
9. Air compressor – The air compressor supplies the DAF unit with air to generate dissolved air which coalescences on particle surfaces.
10. The DAF unit – Wastewater enters one end, air is dissolved and introduced in the bottom of the unit. Sludge is skimmed off of the top. Treated water exits the unit and the container to be pumped to the SBR.
11. DAF sludge pump -This pump moves sludge skimmed from the DAF unit to the new Sludge Storage tank.
12. Final pH adjustment system – This pH adjustment system will be added to the container to neutralize the pH of the effluent from the DAF system to at least 7 S.U. If improved nitrification is required, the pH may be increased up to 8 S.U. This system is not included in the current containerized package, but will be added after the fact.

This DAF system is projected to produce wastewater with average constituent concentrations listed in Table 4.

Table 4: Design DAF Effluent Concentrations

Parameter	Target
Average flow	28,000 gpd
COD	2,520 mg/L
BOD (a)	1,658 mg/L
TSS	328 mg/L
TKN	345 mg/L
FOG (Fat, Oil & Grease)	<50 mg/L
pH	7- 9

(a) Estimated as 70% of COD

New DAF Effluent Pump Station

This new pump station will receive effluent from the DAF process by gravity. A primary pump on a piggyback float switch will move the effluent to the existing DAF inlet (downstream of the influent bypass valve). This pump station will have a backup pump that will activate at a high water level and will discharge into the main pump discharge piping.

New DAF Sludge (Solids) Tank

A new 21,000-gallon nominal volume "Frac" tank will be placed adjacent to the DAF container to receive sludge skimmed from the DAF process. This sludge will be thickened, if possible, by manually decanting supernatant. The solids will be periodically removed to be disposed of at a regional treatment plant or at a biogas generation facility. Supernatant from the DAF Sludge tank will be pumped back to the SBR.

Existing SBR

The existing SBR will remain in service with no significant modifications at this time. The SBR will typically receive only wastewater that has been pretreated by the DAF system. Once the DAF is fully operational, a sampling plan will be put in place to evaluate influent and effluent to the SBR. This will allow for a more precise design of upgrades to the SBR to treat the remainder of COD and nitrify the TKN.

At this time, IES is proposing to design a side-stream oxygenation system which would use pure oxygen injected into a device similar to a Speece cone, specifically an OxyFlow unit by France Oxygenation. This is necessary because the SBR is too small to accommodate the amount of aeration required to transfer adequate oxygen using compressed air.

As part of these modifications, controls will be modified to provide one or more anoxic phases for denitrification. Optionally, an initial pre-anoxic phase can be initiated for a set amount of time. The oxygenation recirculation pump could operate without any oxygen injection to mix the SBR.

Effluent Storage and Irrigation System

Effluent that is decanted from the SBR is discharged into the storage lagoon. The lagoon is aerated by a surface aerator. The need for additional aeration and/or mixing will be evaluated once the improved treatment process is fully functional.
The DAF will alleviate some of the burden on the SBR and the improved effluent quality will reduce the buildup of sludge in the effluent storage lagoon. The accumulated sludge was removed from the lagoon in early 2023. This will improve effluent quality and reduce algal growth. As long as SBR improvements are implemented relatively soon, there will not be enough time for significant sludge to accumulate.

It is likely that the lagoon will provide some degree of denitrification to supplement the nitrogen removal in the treatment process. This should reduce the final effluent to the irrigation system to below the warning levels for the discharge permit.

Appendix A:

Cesco Evaluation Report and Analytical Laboratory Results

CESCO SOLUTIONS INC

The Science of Success: Custom Industrial Chemistries

Cesco – AmCan Wastewater Program Evaluation

December 12, 2022

Background

Dennis Stahl of Cesco acquired two discrete composite wastewater samples (Table 1) from the post-screening pit at Hannegan Properties. Sampling periods spanned daytime production hours on Wednesday, December 7th and Thursday, December 8th respectively. Samples were brought to the Cesco Laboratory where our chemists began refining the previously proposed DAF chemistry program, evaluating solids removal via TSS and COD reduction. The purpose of this study was to provide additional data for evaluation of the DAF's potential performance at Hannegan Properties, as well as to optimize chemical usage. Lab work was performed Thursday, December 8th through Friday, December 9th

AmCan Wastewater Treatment Procedure

AmCan currently treats wastewater using a combination of screening to remove large particulate and an aerated biological reactor to partially remove TSS and BOD. Effluent is pumped to a lagoon to settle solids. The settled water can be pumped out of the lagoon to irrigation lines for use as a fertilizer or ~~discharged to the municipality~~. Coagulants and flocculants to aid in clarifying are not being used to treat the effluent.

Experimental Procedure

Sample	Date	Sampling Start	Sampling End	Frequency (ml/hr)
Composite 1	12/07/2022	7:00 AM	4:00 PM	500
Composite 2	12/08/2022	9:00 AM	6:00 PM	500

Table 1. Sampling parameters for composite samples taken by Dennis Stahl at Hannegan Properties

The samples were collected after the final screen before the biological tank, at sampling periods chosen to best represent the maximum solids load which might be encountered by a DAF. These samples were treated with varying combinations of Cesco Protect 1043 coagulant, and Cesco PF 622CH flocculant to determine the optimal treatment program through jar testing. Samples of raw wastewater and clarified aliquots were sent to Edge Analytical to gather removal efficiencies of each, as well as chlorides and TKN before and after treatment. Composites 1 and 2 were clarified in the Cesco Laboratory on December 8th and 9th respectively. Results from both composites were averaged and presented in Table 2.

Discussion

Table 2 illustrates an average solids removal efficiency within which the DAF is expected to consistently perform. Treatment with approximately 500 ppm Cesco Protect 1043 coagulant and 36 ppm Cesco PF 622CH flocculant, consistently produced well clarified aliquots from both composite samples. Samples saw an average solids removal rate of approximately 84 % accompanied by an average reduction in COD of 73%. These results are in strong agreement with COD and TSS reduction rates commonly observed at food processing facilities running similar DAF chemistry. In similar processing environments, strong performance at the DAF will typically yield 80-90% TSS reduction accompanied by 50-60% COD reduction before biological treatment. Based on these results, we expect Cesco's proposed DAF program to provide high reduction rates in both suspended solids and COD; we feel confident targeting 80-90% solids removal and 50-60% COD removal before biological treatment with our program. Furthermore, reducing the oxygen demand and FM ratio coming into the SBEACR will ultimately lead to greater overall effluent quality.

Parameter	Untreated (mg/L)	Treated (mg/L)	Reduction Rate (%)
TSS	2250	362	83.9
COD	8638	2326	73.0

Table 2. Average solids removal and COD reduction rates achieved across composites 1 and 2 spanning laboratory work carried out on December 8th and 9th 2022.

EDGE ANALYTICAL

Burlington, WA *Corporate Laboratory (a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212

Portland, OR *Microbiology/Chemistry (c)*
9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

Data Report

Client Name: CESCO Solutions
2227 Midway Lane
Bellingham, WA 98226

Reference Number: **22-39975**
Project: Fat Cat

Report Date: 1/7/23

Date Received: 12/8/22
Approved by: bj,ljh,tjb
Authorized by:

Lawrence J Henderson, PhD
Director of Laboratories, Vice President

Sample Description: Cesco Untreated Bellingham — Matrix WW — Sample Date: 12/8/22 7:00 am
Lab Number: 78689 — Sample Comment: — Collected By: Dennis Stahl

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
16887-00-6	**CHLORIDE**	5020	10	8.	mg/L	100.0	300.0	a	12/9/22	JWN	IC06_221209A	
E-10264	**TOTAL KJELDAHL NITROGEN as N**	544	50	14.625	mg/L	250.0	351.2	a	12/28/22	MSO	351.2_221228	
E-10162	**TOTAL SUSPENDED SOLIDS**	2340	40		mg/L	20.0	I-3765-85	a	12/13/22	SPM2	TSS_221213	
E-10117	**CHEMICAL OXYGEN DEMAND**	8000	2000	349.72	mg/L	100.0	SM5220 D	a	12/22/22	TJB	COD_221222	

Sample Description: Cesco Treated Bellingham — Matrix WW — Sample Date: 12/8/22 7:00 am
Lab Number: 78690 — Sample Comment: — Collected By: Dennis Stahl

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
16887-00-6	**CHLORIDE**	4920	10	8.	mg/L	100.0	300.0	a	12/9/22	JWN	IC06_221209A	
E-10264	**TOTAL KJELDAHL NITROGEN as N**	328	20	5.85	mg/L	100.0	351.2	a	12/28/22	MSO	351.2_221228	
E-10162	**TOTAL SUSPENDED SOLIDS**	360	20		mg/L	10.0	I-3765-85	a	12/13/22	SPM2	TSS_221213	
E-10117	**CHEMICAL OXYGEN DEMAND**	3100	1000	174.86	mg/L	50.0	SM5220 D	a	12/22/22	TJB	COD_221222	

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

If you have any questions concerning this report contact us at the above phone number.

EDGE ANALYTICAL

Burlington, WA *Corporate Laboratory (a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

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9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

Data Report

Client Name: CESCO Solutions
2227 Midway Lane
Bellingham, WA 98226

Reference Number: **22-40043**
Project: Fat Cat Fish

Report Date: 1/7/23

Date Received: 12/9/22
Approved by: bj,ljh,tjb
Authorized by:

Lawrence J Henderson, PhD
Director of Laboratories, Vice President

Sample Description: Cesco Untreated Fat Cat Fish — Matrix WW — Sample Date: 12/9/22 7:00 am
Lab Number: 78822 — Sample Comment: — Collected By: Dennis Stahl

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
16887-00-6	**CHLORIDE**	153	10	8.	mg/L	100.0	300.0	a	12/10/22	JWN	IC06_221209A	
E-10264	**TOTAL KJELDAHL NITROGEN as N**	460	50	14.625	mg/L	250.0	351.2	a	12/28/22	MSO	351.2_221228	
E-10162	**TOTAL SUSPENDED SOLIDS**	2830	40		mg/L	20.0	I-3765-85	a	12/14/22	SPM2	TSS_221214	
E-10117	**CHEMICAL OXYGEN DEMAND**	8320	500	87.43	mg/L	25.0	SM5220 D	a	12/22/22	TJB	COD_221222	

Sample Description: Cesco Treated Fat Cat Fish — Matrix WW — Sample Date: 12/9/22 7:00 am
Lab Number: 78823 — Sample Comment: — Collected By: Dennis Stahl

CAS ID#	Parameter	Result	PQL	MDL	Units	DF	Method	Lab	Analyzed	Analyst	Batch	Comment
16887-00-6	**CHLORIDE**	380	1	0.8	mg/L	10.0	300.0	a	12/10/22	JWN	IC06_221209A	
E-10264	**TOTAL KJELDAHL NITROGEN as N**	221	10	2.925	mg/L	50.0	351.2	a	12/28/22	MSO	351.2_221228	
E-10162	**TOTAL SUSPENDED SOLIDS**	295	20		mg/L	10.0	I-3765-85	a	12/15/22	SPM2	TSS_221215	
E-10117	**CHEMICAL OXYGEN DEMAND**	1940	40	6.9944	mg/L	2.0	SM5220 D	a	12/22/22	TJB	COD_221222	

Notes:

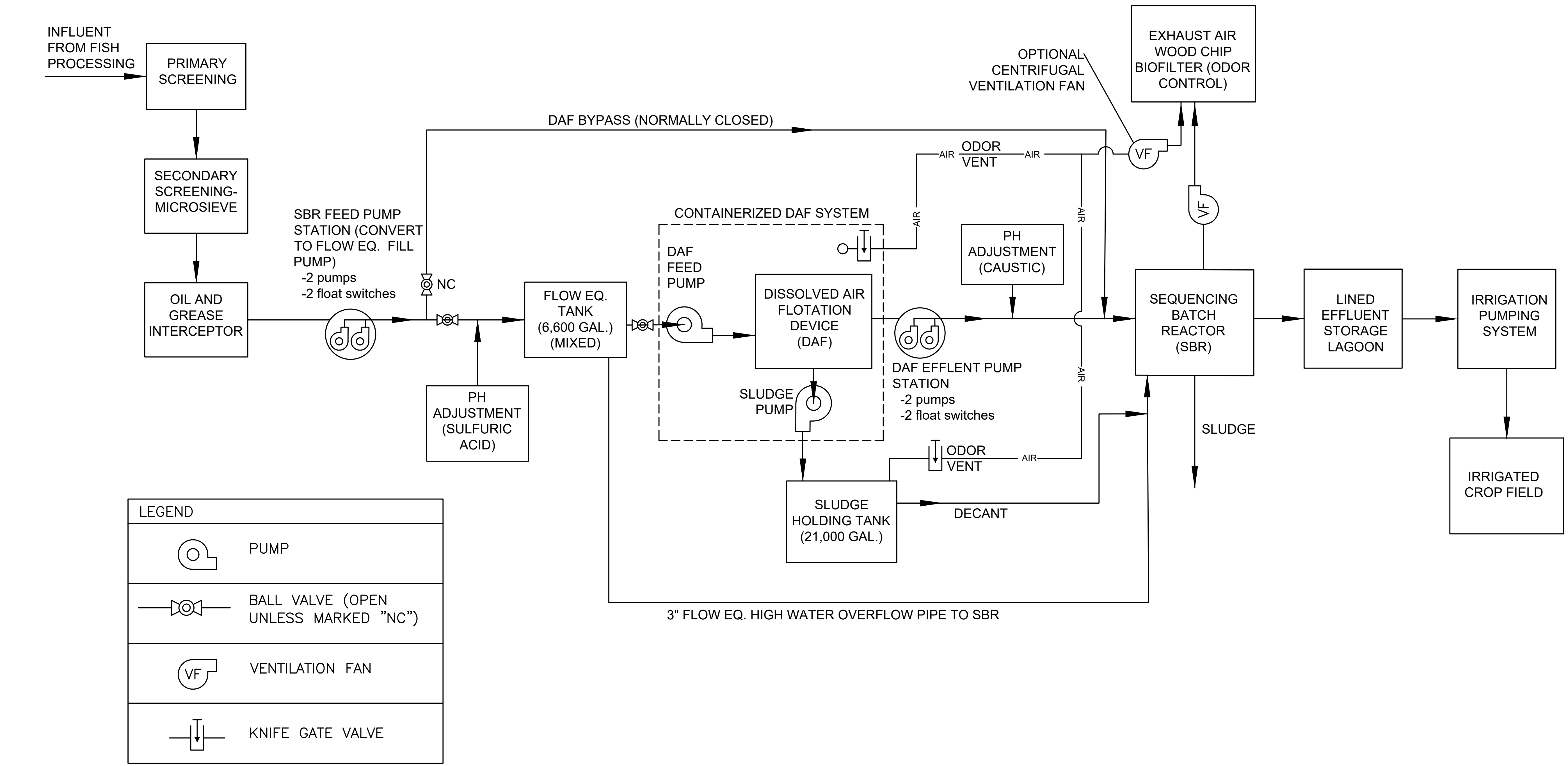
ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

If you have any questions concerning this report contact us at the above phone number.

Appendix B:

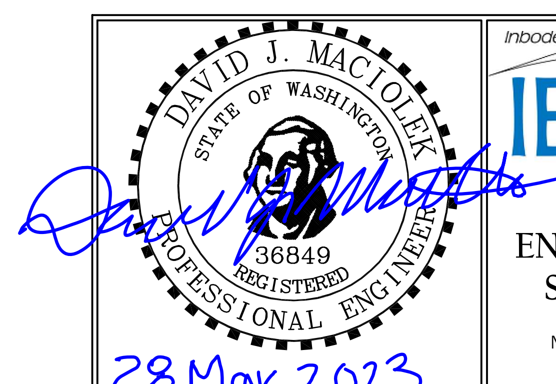
Wastewater Treatment System Drawings by Inboden Environmental Services, Inc.

UPGRADED SYSTEM BLOCK DIAGRAM



NOTES:

1. PROJECT LOCATION IS 2825 ROEDER AVE, BELLINGHAM, WA 98225
2. FOR MORE DETAIL ON CONTAINERIZED DAF SYSTEM, REFER TO DOCUMENTATION SUPPLIED BY H2FLOW.



Inboden Environmental Services, Inc.
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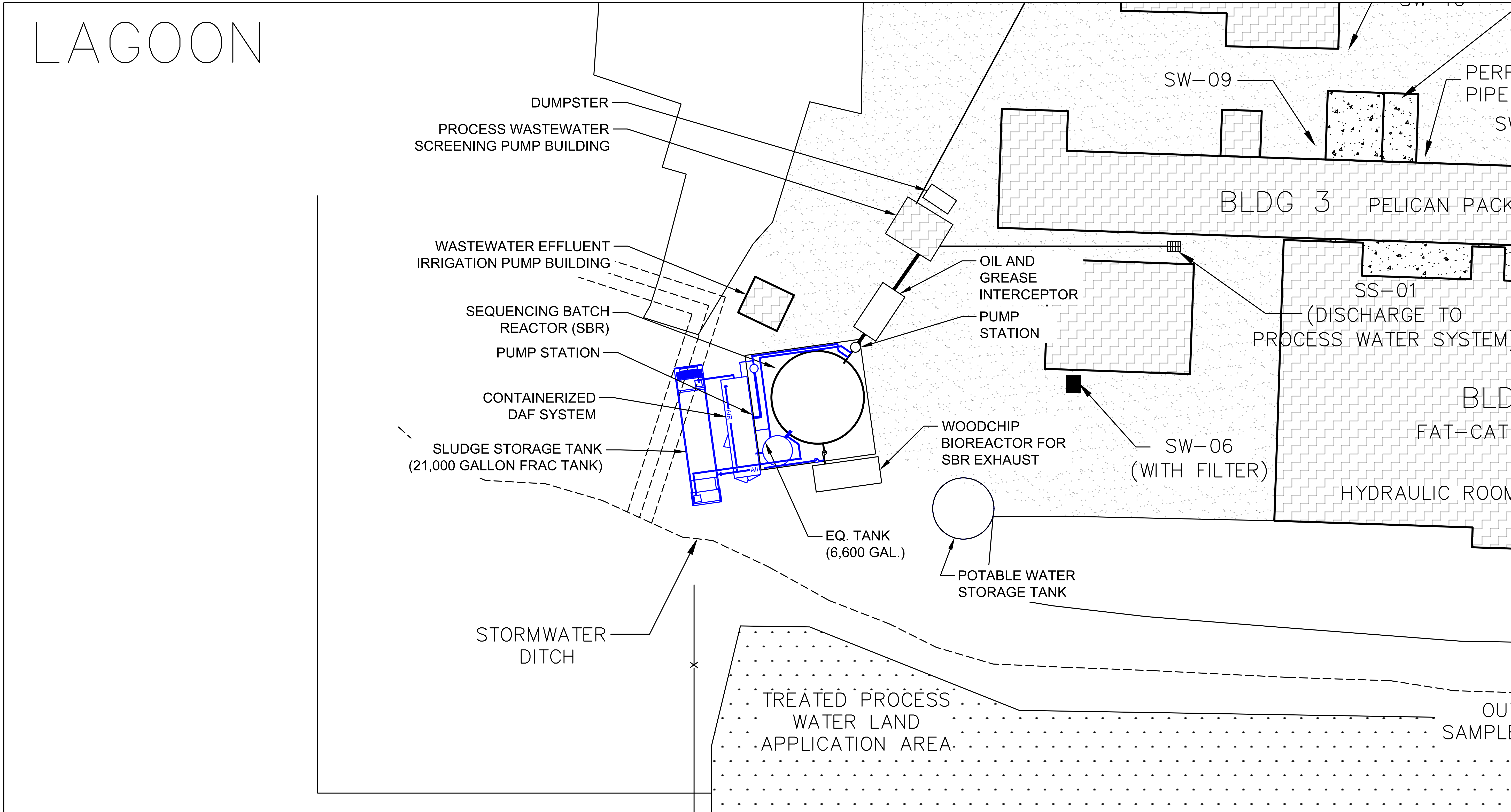
MT. JACKSON, VA 22842
phone: (540) 477-3300
web: 4ies.com

HANNEGAN PROPERTIES, LLC
WASTEWATER TREATMENT SYSTEM UPGRADE

DESIGNED BY	DRAWN BY	ISSUE DATE	REVISION DATE
DJM	CBH	02/08/2023	03/28/2023

MODIFIED SYSTEM BLOCK DIAGRAM
SHEET# 1



0 15 30 60
SCALE: 1" = 30'

N

NOTES:
1. NEW COMPONENTS ARE SHOWN IN BLUE. EXISTING COMPONENTS INDICATED WITH ASTERISK.
2. THIS DRAWING IS INTENDED ONLY TO SHOW THE APPROXIMATE LOCATION AND ROUTING OF UTILITIES. CONTRACTOR SHALL FIELD VERIFY ACTUAL LOCATIONS OF EXISTING PIPING AND COORDINATE NEW PIPING WITH ENGINEER BEFORE INSTALLATION.
3. ALL PIPING SHALL BE BACKFILLED ACCORDING TO DETAIL ON SHEET 10 WITH PIPE BEDDING AND COVER COMPACTED TO MIN. 90% RELATIVE COMPACTION.
4. DISTURBED SITE SOILS SHALL BE SEEDED TO PREVENT EROSION.
5. POTABLE WATER AND SEWER PIPES SHALL BE BURIED WITH ADEQUATE VERTICAL AND/OR HORIZONTAL SEPARATION TO PREVENT ACCIDENTAL CONTAMINATION.

LEGEND:
- - - - - EXISTING STRUCTURE TO BE DECOMMISSIONED
——— EXISTING STRUCTURE TO REMAIN IN USE
—OHU— OVERHEAD ELECTRIC POWER
—x— EXISTING FENCE

DAVID J. MACIOLEK
STATE OF WASHINGTON
36849
REGISTERED
PROFESSIONAL ENGINEER
28 Mar. 2023

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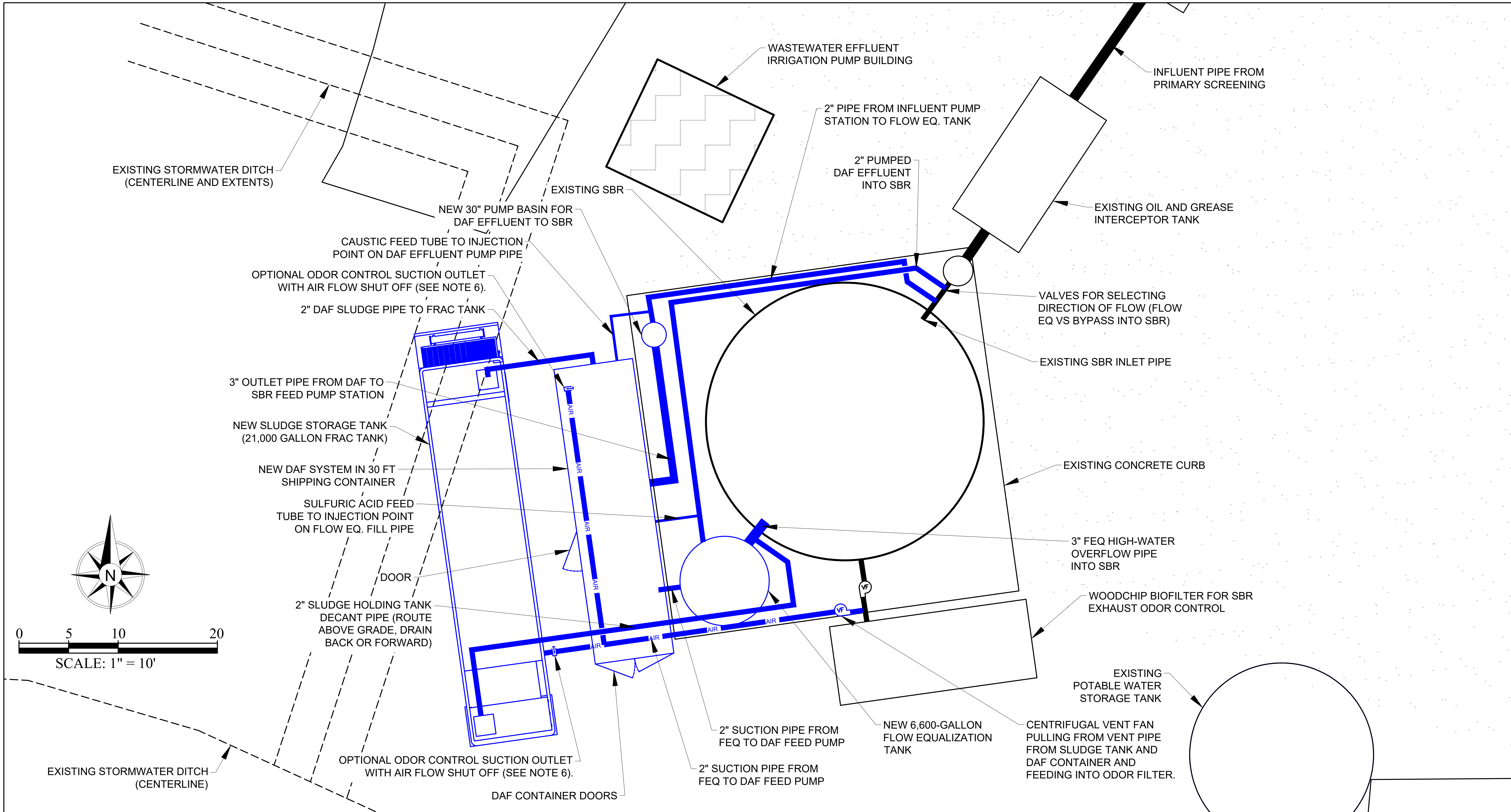
HANNEGAN PROPERTIES, LLC
WASTEWATER TREATMENT SYSTEM UPGRADE

DESIGNED BY	DRAWN BY	ISSUE DATE	REVISION DATE
DJM	CBH	02/08/2023	03/28/2023

OVERALL SITE LAYOUT
SHEET# 2



NOTES:

1. NEW COMPONENTS ARE SHOWN IN BLUE.
2. THIS DRAWING IS INTENDED ONLY TO SHOW THE APPROXIMATE LOCATION AND ROUTING OF UTILITIES. CONTRACTOR SHALL FIELD VERIFY ACTUAL LOCATIONS OF EXISTING PIPING AND COORDINATE NEW PIPING WITH ENGINEER BEFORE INSTALLATION.
3. ALL PIPING SHALL BE BACKFILLED WITH MIN. 18" COVER AND WITH BEDDING COMPACTED TO MIN. 90% RELATIVE COMPACTION.
4. DISTURBED SITE SOILS SHALL BE SEEDED TO PREVENT EROSION.
5. POTABLE WATER AND SEWER PIPES SHALL BE BURIED WITH ADEQUATE VERTICAL AND/OR HORIZONTAL SEPARATION TO PREVENT ACCIDENTAL CONTAMINATION.
6. INSTALL PVC KNIFE GATE VALVES TO SHUTOFF VENTILATION SUCTION. SLOPE VENT PIPE FROM DAF CONTAINER FORWARD TO JUNCTION WITH SLUDGE TANK VENT. SLOPE SLUDGE TANK VENT TO DRAIN BACK TO TANK.

LEGEND:

———	EXISTING STRUCTURE TO REMAIN IN USE
—OHU—	OVERHEAD ELECTRIC POWER
— —UE—	UNDERGROUND ELECTRIC POWER

DAVID J. MACIOLEK
STATE OF WASHINGTON
36849
REGISTERED
PROFESSIONAL ENGINEER

28 Mar. 2023

Inboden Environmental Services, Inc.
IES
INBODEN ENVIRONMENTAL SERVICES, INC.
5790 MAIN STREET
MT. JACKSON, VA 22842
phone: (540) 477-3300
web: 4ies.com

HANNEGAN PROPERTIES, LLC
WASTEWATER TREATMENT SYSTEM UPGRADE

DESIGNED BY	DRAWN BY	ISSUE DATE	REVISION DATE
DJM	CBH	02/08/2023	03/28/2023

REPLACEMENT SYSTEM LAYOUT
SHEET# 3

Appendix C:

DAF System Design Information and Detailed Drawings

SCOPE OF SUPPLY.

CONTAINERIZED DAF TREATMENT SYSTEM

DAF Unit Components

Qty. One (1) DAF feed pump with cable float (loose)

Qty. One (1) In-line Magnetic flowmeter

Qty (1) Air relief valve

Qty. One (1) Chemical Dosing Package, including;
- One (1) pH Sensor
- One (1) pH controller
- One (1) Neutralizer Dosing Pump (Caustic or Acid dosing)
- One (1) Coagulant Dosing Pump
- One (1) Liquid polymer makedown system

Qty. One (1) Pipe Flocculator – PF 10 complete with:

- Pipe flocculator constructed in PVC/PP pipe complete with mixing zone, injections ports, and sample ports

***** MIN FLOW FOR PF10 IS 26 GPM**

Qty. One (1) Dissolved Air Flotation Unit, model ALPHA 10 complete with:

- DAF separator tank vessel made of 304 stainless steel
- Maximum hydraulic capacity: 10 m^3/hour (44 usgpm)
- Sludge float skimmer arrangement mounted on the DAF separator. Skimmer rakes are constructed of 304 stainless steel with FRP blades, plastic sprockets and drive chains, stainless steel shafts.
- Sediment valve complete with pneumatic actuator
- Skimmer drive reducer complete with motor kW
- Recirculation pump complete with motor and pressure relief valve
- Inlet flange, Outlet flange, float discharge, bottom sludge
- Set of removable covers
- Pneumatic panel in an FRP enclosure, factory-mounted on the DAF unit, and which is complete with:

- Two (2) pressure switches
- Two (2) solenoid valves
- Two (2) pressure regulators
- One (1) moisture trap
- One (1) airflow rotameter
- Three (3) stainless steel pressure
- One (1) check valve (air outlet)

580 OSTER LANE, VAUGHAN, ONTARIO L4K 2C1 CANADA TEL (905) 660-9775 / FAX (905) 660-9744
Email: info@h2flow.com www.h2flow.com

REV	DESCRIPTION	DATE	BY	APP'D
1	AS PER CUSTOMER REQUIRMENTS	01/09/2020	DM	LB

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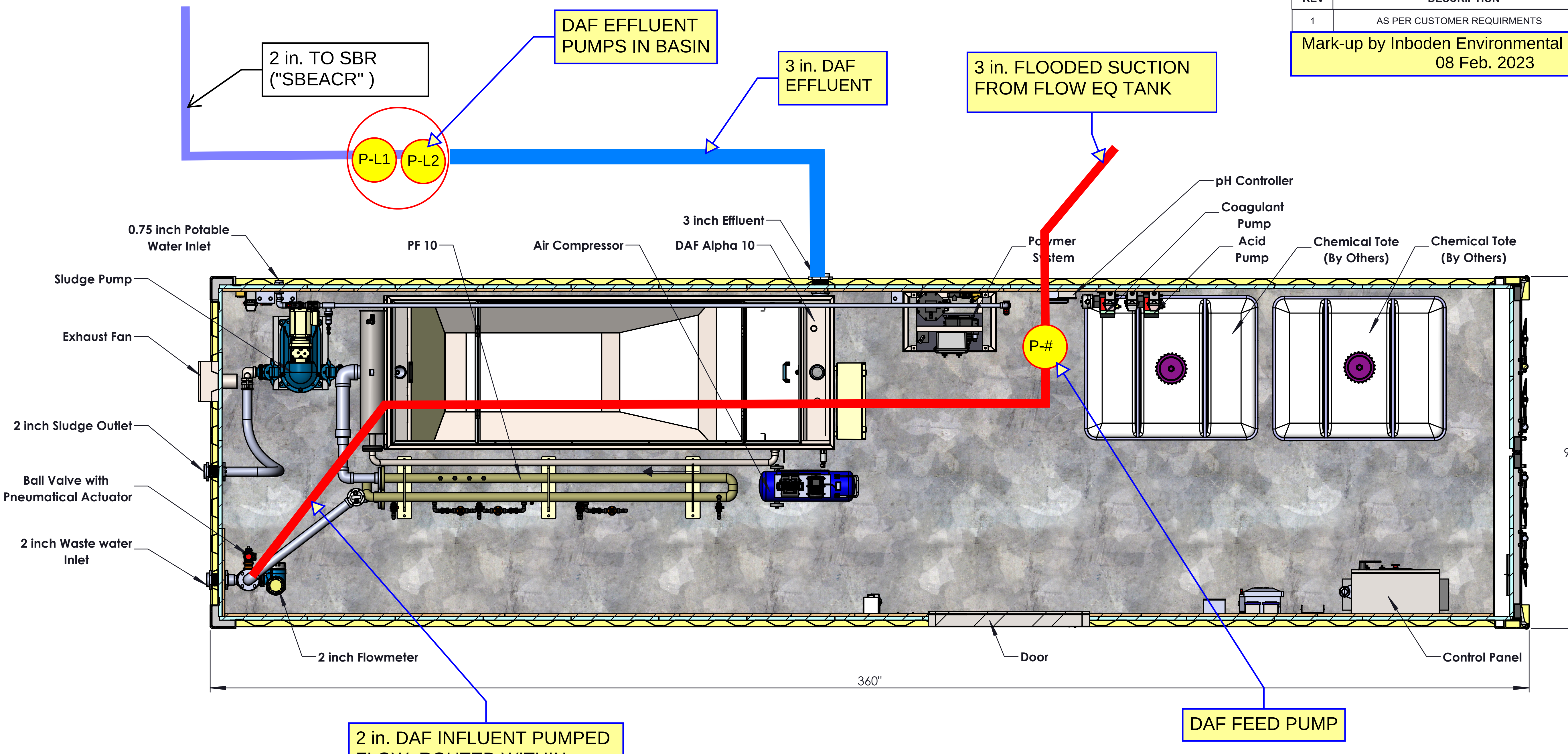
08 Feb. 2023



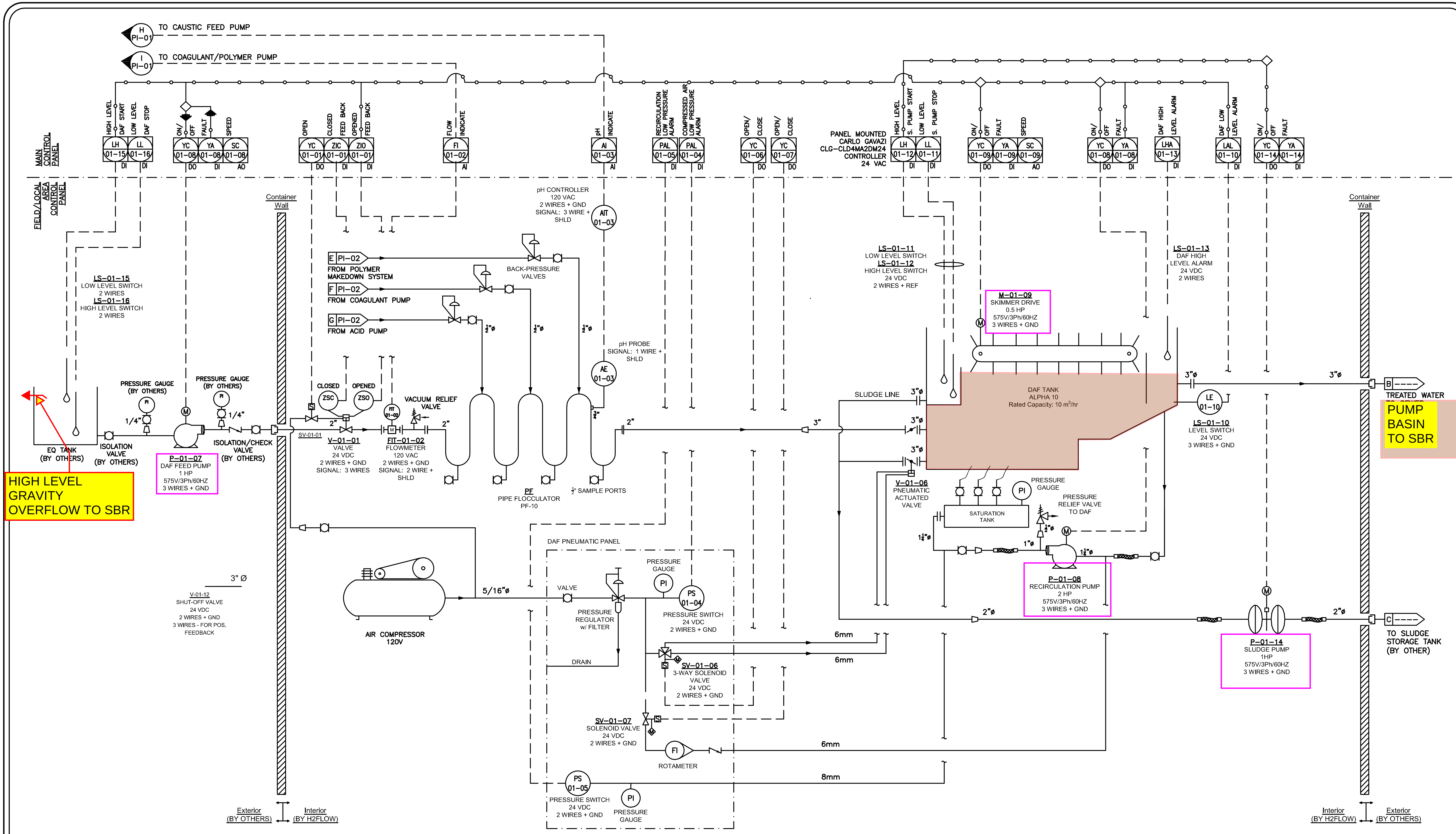
PLAN VIEW SECTION

Mark-up by Inboden Environmental Services, Inc.
08 Feb. 2023

H2FLOW EQUIPMENT INC.

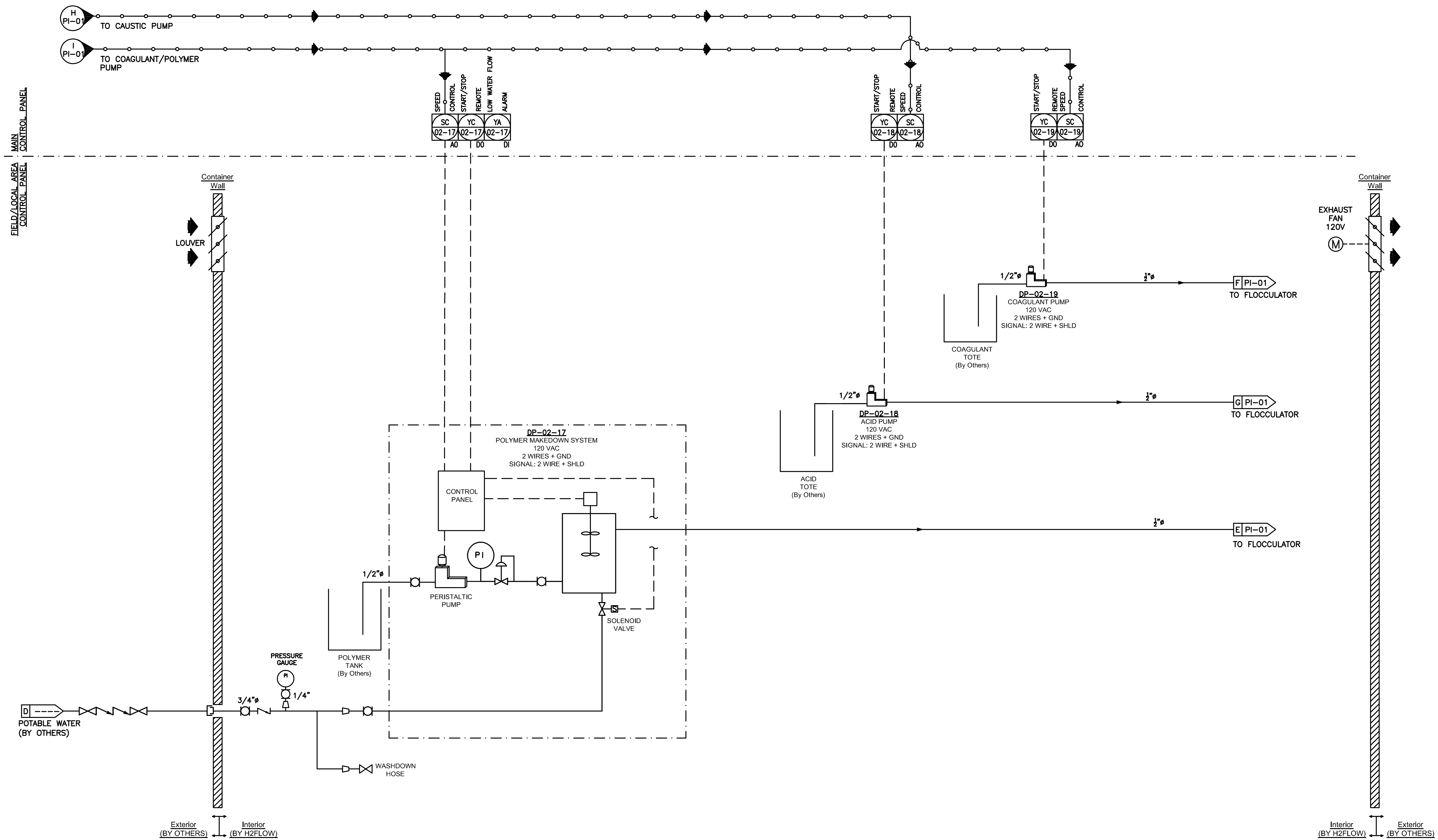
WATER AND WASTEWATER TREATMENT EQUIPMENT
580 OSTER LANE, CONCORD, ON L4K 2C1 CANADA
TEL: (905) 660-9775 FAX: (905) 660-9744
www.h2flow.com

DRAWN BY DM	DATE 12/06/2019	PROJECT NAME HANNEGAN PROPERTIES, LLC	TITLE GENERAL ARANGEMENT	
APP'D BY JC	DATE 12/06/2019		DRAWING No. Q-10418-10-01	REV 1
SCALE NTS		ALL DIMENSION ARE IN INCHES UNLESS OTHERWISE SPECIFIED	SHEET 1 OF 4	



APPENDIX C - DAF SEPARATOR PROCESS DIAGRAM

REV.	DESCRIPTION	DATE	BY						
4				DRAWN BY JC	DATE 12/17/19	H2FLOW EQUIPMENT INC. *WATER AND WASTEWATER TREATMENT EQUIPMENT* 580 OSTER LANE, VAUGHAN, ON. L4K 2C1 CANADA TEL: (905) 660-9775 FAX: (905) 660-9744 www.h2flow.com	REFERENCE INFORMATION	PROJECT NAME: CONTAINERIZED ALPHA 10 DAF TREATMENT SYSTEM	TITLE: PROCESS INSTRUMENTATION DIAGRAM — REV 1
3				CHECKED BY LB	DATE 12/17/19				
2									DRAWING No. Q-10418-20-00 — PI-01
1	ADDED LEVEL SWITCH ON EFFLUENT HOPPER	02/10/20	JC	SCALE N.T.S			DRAWING APPROVAL		SHEET 1 OF 2



APPENDIX C - DAF SEPARATOR PROCESS DIAGRAM 2 of 2

REV.	DESCRIPTION	DATE	BY
4			
3			
2			
1	ADDED LEVEL SWITCH ON EFFLUENT HOPPER	02/10/20	JC

DRAWN BY: JC — DATE: 12/17/19
CHECKED BY: LB — DATE: 12/17/19
SCALE: N.T.S

H2FLOW EQUIPMENT INC.
WATER AND WASTEWATER TREATMENT EQUIPMENT
580 OSTER LANE,VAUGHAN, ON. L4K 2C1 CANADA
TEL: (905) 660-9775 FAX: (905) 660-9744
www.h2flow.com

REFERENCE INFORMATION

DRAWING APPROVAL

PROJECT NAME: CONTAINERIZED PILOT ALPHA 10 DAF TREATMENT SYSTEM

TITLE: PROCESS INSTRUMENTATION DIAGRAM

REV 1

DRAWING No. Q-10418-20-00

PI-02