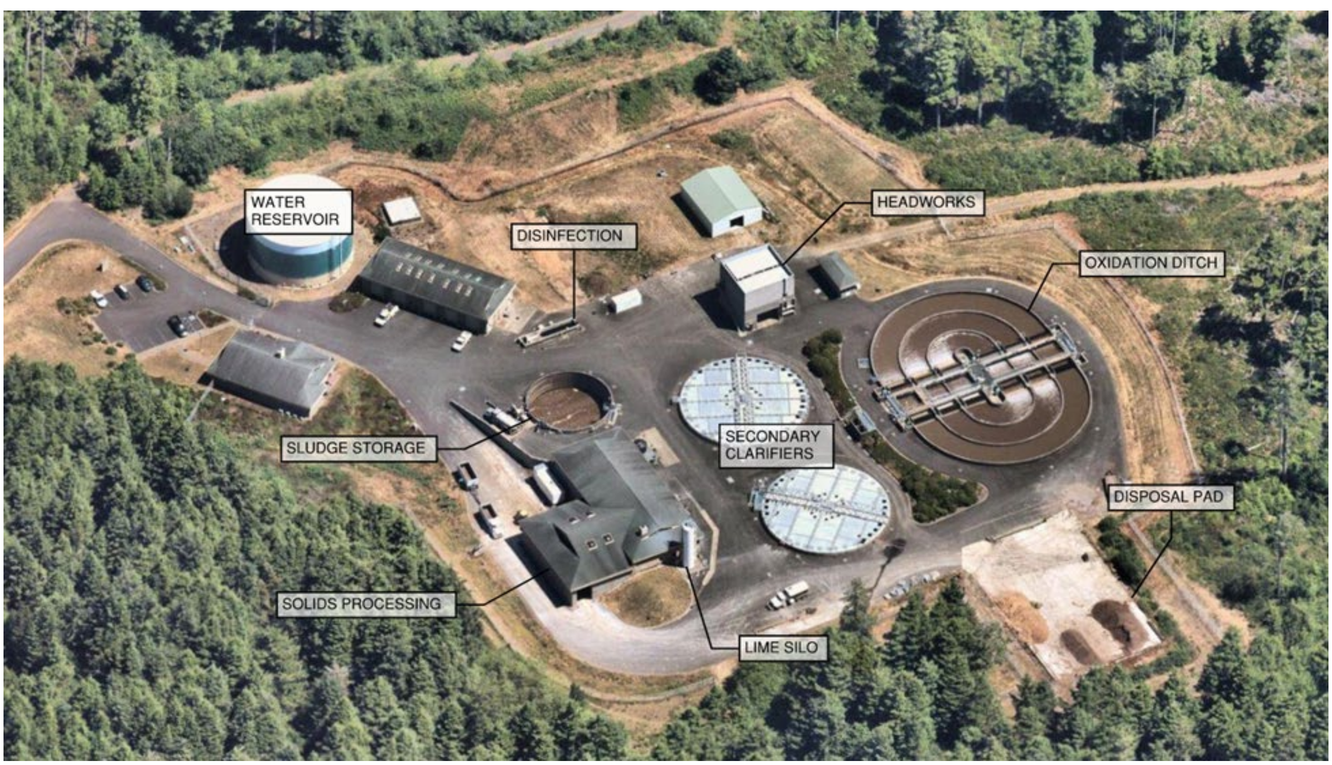
Brown AND Caldwell

FINAL REPORT | Prepared for
City of Newport, Oregon

Wastewater Treatment Master Plan

Phase II: Alternatives Development and Evaluation

September 2023



Newport Wastewater Treatment Master Plan Phase II: Alternatives Development and Evaluation

To: Aaron Collett, City of Newport

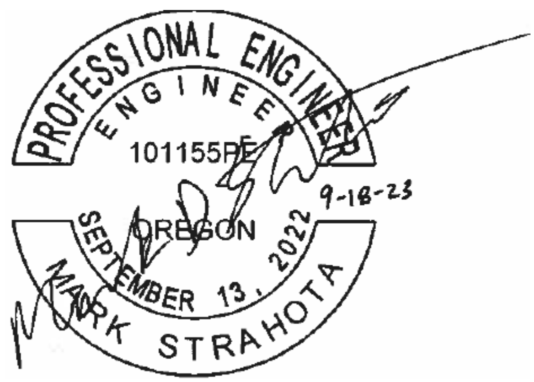
From: Mark Strahota, Brown and Caldwell

Copy to: Andrew Grant, SolidsDude Solutions
Mark Walter, Waterdude Solutions, LLC
Clare Paul, City of Newport

Prepared by: Jennifer Kersh, Brown and Caldwell
Adam Klein, Brown and Caldwell
Ben Bosse, Kennedy Jenks
Mark Cullington, Kennedy Jenks

Reviewed by: Mark Strahota, Brown and Caldwell
Project Manager

Reviewed by: Tim Mills, Brown and Caldwell
Accountable Approver



EXPIRES JULY 30, 2024

Brown AND Caldwell
Kennedy Jenks

6500 S Macadam Avenue, Suite 200
Portland, OR 97239

T: 503.244.7005

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List of Abbreviations

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
AACE	Association (for the) Advancement of Cost Engineering
APLR	Annual Pollutant Loading Rate
As	arsenic
BC	Brown and Caldwell
BOD	biological oxygen demand
BOD_5	5-day biochemical oxygen demand
CASP	covered aerated static pile
CCL	Ceiling Concentration Limits
Cd	cadmium
CF	cubic feet
CFM	cubic feet per minute
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
City	City of Newport
CPLR	Cumulative Pollutant Loading Rate
Cu	copper
CY	cubic yard
d	day(s)
DEQ	(Oregon) Department of Environmental Quality
DO	dissolved oxygen
ea	each
EQ	Exceptional Quality
ERU	equivalent residential units
EPA	U.S. Environmental Protection Agency
ft	feet
FTE	full-time employee
FY	fiscal year
gal	gallon(s)
gpd	gallon(s) per day
H_2S	hydrogen sulfide
Hg	mercury
HMSC	Hatfield Marine Science Center
hp	horsepower
IPS	influent pump station
kg	kilogram(s)
KJ	Kennedy Jenks
kW-hr	kilowatt hour
lb(s)	pound(s)
MCRT	mean cell residence time
MG	million gallons
mg/L	milligram(s) per liter
mgd	million gallon(s) per day
mL	milliliter(s)
mL/g	milliliter(s) per gram
MLSS	mixed liquor suspended solids
mm	millimeter(s)
MMBTU	million British Thermal Unit
Mo	molybdenum
MPN	Most Probable Number
NFPA	National Fire Protection Association
Ni	nickel
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NSPS	Northside Pump Station
OHA	Oregon Health Authority
O&M	operations and maintenance
OPCC	Opinion of Probable Construction Cost
Pb	lead
PCL	Pollutant Concentration Limits
PFAS	per- and polyfluoroalkyl substances
PFRP	Process Further Reduce Pathogens
ppm	parts per million
PS	pump station
PSRP	Process (to) Significantly Reduce Pathogens
PSU	Portland State University
RAS	return activated sludge
Rogue	Rogue Brewery
RDT	rotary drum thickener
SCADA	supervisory control and data acquisition
Se	selenium
SOUR	specific oxygen uptake rate
SRT	solids retention time
SVI	sludge volume index
TM	technical memorandum
TSS	total suspended solids
VAR	vector attraction reduction
VS	volatile solids
VSS	variable suspended solids
WAS	waste activated sludge
Waterdude	Waterdude Solutions
WWTMP	Wastewater Treatment Master Plan
WWTP	wastewater treatment plant
Zn	zinc

Executive Summary

Brown and Caldwell (BC) and Kennedy Jenks (KJ) prepared this Wastewater Treatment Master Plan (WWTMP) for the City of Newport (City) focusing on near-term improvements at the Vance Avery Wastewater Treatment Plant (WWTP). This report represents Phase II–Alternative Development and Evaluation, and includes updating Phase I flow projections, capacity assessments, and criticality evaluations. Improvements for WWTP headworks, liquid stream processes, solids processes, and Northside Pump Station (NSPS) are recommended along with descriptions of key alternatives and capital improvement planning.

Flow Projection Updates: New population projections prepared by Portland State University suggest population growth will be much slower than was anticipated in the Phase I efforts; flow projections have been adjusted accordingly. Previous analyses suggested tourism is the main driver for flow variability; however, recent flow data revealed storm events show a higher degree of correlation than population spikes during holiday weekends. Loadings from Rogue Brewery have decreased by more than 50 percent following new pretreatment regulations.

Capacity Assessment Updates: Key processes continue to operate at higher than design capacity including:

- Influent screens: The influent screens continue to be a capacity limitation, with firm capacity already exceeded.
- Dewatering centrifuges: The dewatering centrifuges are operating with no redundancy, and firm capacity of the system is exceeded at average load conditions.
- Lime pasteurization: The lime pasteurization system continues to exceed its design throughput. While this does not affect the plant's capacity to process solids, it impairs reliability and increases risk, as the system has less downtime for maintenance and repairs.
- Secondary treatment: The secondary process consists of a single oxidation ditch and two secondary clarifiers, which provides no redundancy.
  - Due to capacity limitations, the oxidation ditch is typically operated at maximum overflow level, which is not ideal.
  - Mixed liquor suspended solids (MLSS) concentration in the oxidation ditch is maximized at 3,000 milligrams per Liter (mg/L). With current flows and loads and an solids retention time (SRT) of 8-10 days, the WWTP cannot operate at an MLSS concentration below 3,000 mg/L. Operating at a longer SRT, as is common practice with this type of ditch, would overload the secondary clarifiers.
  - Secondary clarifier capacity: At recommended operating condition in the winter, capacity of the system is approximately 3.2 million gallons per day (mgd). The current maximum month flow is 3.3 mgd. By this measure, the plant is at capacity.
  - This combination of limited capacity and inadequate redundancy will limit the timeframe between repairs in the future and increase operational risk.

Condition and Criticality Updates: Waterdude Solutions (Waterdude) provided an update to the 2018 Condition Assessment in 2021, which revealed further deterioration of process equipment since 2018. Facilities most at-risk from deteriorating conditions are the NSPS, headworks, septage screening, and solids handling.

Headworks Recommendations: Multi-rake bar screens are recommended to replace the two existing rotary screens, which are at the end of their useful life. A third screen is recommended to be installed in one of the unoccupied screening channels to increase process capacity and redundancy. Hydrogen sulfide (H_2S) concentrations are also very high and pose a safety risk to personnel working in this facility. Accordingly, odor control and building ventilation upgrades are recommended.

Liquids Process Recommendations: A second oxidation ditch is recommended to provide additional capacity and redundancy for the existing aging oxidation ditch. A third secondary clarifier will be sufficient to address downstream capacity issues. Disinfection pump replacements are needed.

Solids Process Recommendations: Aerobic digestion should be incorporated to stabilize sludge prior to dewatering and disposal. Other recommended processes are a packaged hauled waste receiving station, continued use of WAS storage tank, mechanical thickening, centrifuge dewatering, and a Class A compost facility.

Solids drying and composting were the last two alternatives to be compared during the WWTMP. The Class A compost facility is projected to have significantly lower capital and annual operation and maintenance (O&M) costs compared to the Class A dryer–more than $10 million lower in total net present worth. The differences in capital costs are largely due to the dryer equipment costs, costs for constructing the new Dryer Building, and the need to install a new natural gas pipeline to the plant for firing the dryer furnace. The dryer also has higher annual O&M costs than composting, mainly due to the high energy use associated with drying biosolids. For these reasons, and because there is available land at the WWTP, the Class A compost facility is recommended.

Northside Pump Station Recommendations: Immediate improvements are required at the existing pump station located inside a geodesic dome structure due to health and safety concerns and aging equipment. When additional funding is secured, a new buildout facility is recommended adjacent to the existing facility.

Capital Improvements Plan: Figure ES-1 shows the estimated total yearly funding required for applicable projects occurring during each fiscal year.

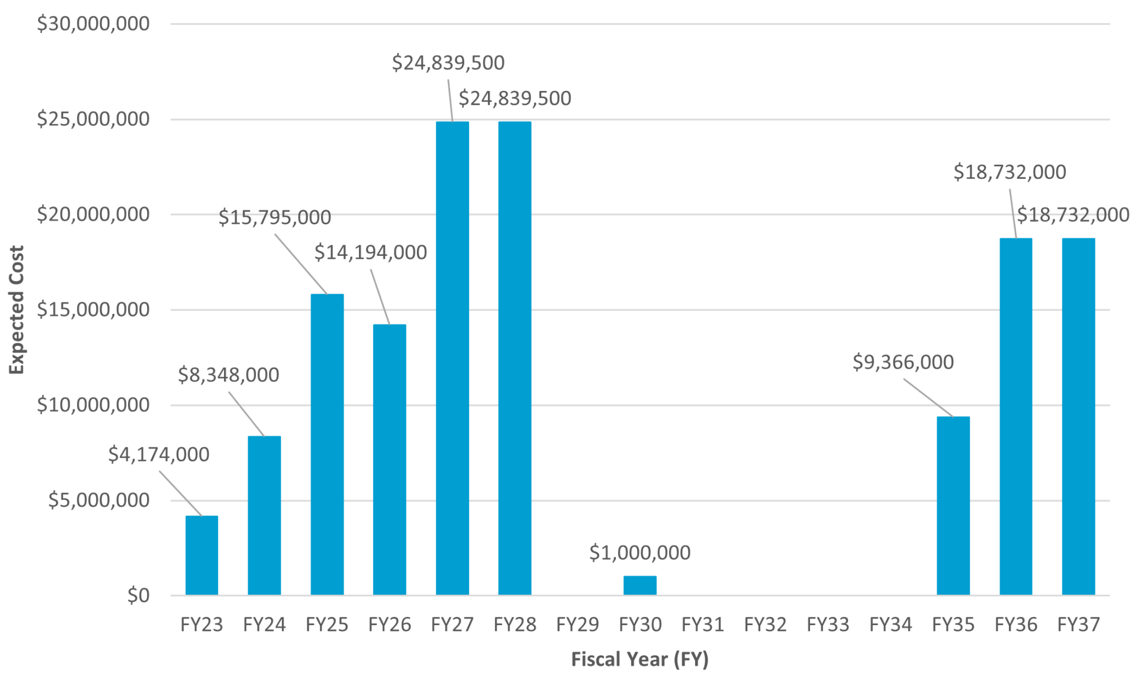

Figure ES-1. Capital cost distribution by year

Section 1

Introduction

The City of Newport (City) contracted with Brown and Caldwell (BC) to perform Phase II of their Wastewater Treatment Master Plan (WWTMP). The goal of the WWTMP is to evaluate existing infrastructure, operational procedures, equipment performance, projected population growth, future flows and loads, anticipated future regulations, and financial planning and develop a Capital Improvement Program (CIP) to address both current needs and plan for needs for the next 20 years.

In 2018, Phase I of the WWTMP was completed, which included an assessment of existing conditions and flows and loads, an equipment condition assessment, flow and load forecasts, and a plant capacity assessment. A key finding of Phase I was that industrial users contributed a significant portion of headworks loads. Based in part on this finding, the City elected to pause the planning process to voluntarily implement a pretreatment program. Once the program was established, Phase II of the WWTMP was started.

The focus of the WWTMP is the Vance Avery Wastewater Treatment Plant (WWTP) but is informed by the previous planning for the collection system. This report summarizes an alternatives evaluation for upgrades to the WWTP and presents a CIP for the proposed improvements. The CIP will inform future efforts to follow including Facility Planning and Rate Structure analyses.

1.1 Background

Newport is located in Lincoln County on the central Oregon coast about 55 miles west of Corvallis. The population of the city is just over 10,000 but can draw nearly 30,000 to 40,000 visitors during the tourist season. The City indicated a significant contribution of wastewater is attributable to residents from outside the city commuting for work.

Newport is home to industries and businesses (e.g., breweries, fisheries, restaurants, and hotels, etc.) including the Oregon Brewing Company's Rogue Brewery. The National Oceanic and Atmospheric Administration (NOAA) bases four research vessels in Yaquina Bay and the Hatfield Marine Science Center (HMSC) is located on the south side of the bay.

Surface water is the city's primary water supply via the Big Creek Reservoirs but is supplemented in the summer with water pumped from the Siletz River. Drinking water is treated via membrane filtration at the 7 million gallons per day water treatment plant (WTP) located at the base of the lower dam. Residual waste produced by the WTP is discharged to the sewer system and eventually makes its way to the WWTP. The WTP generates an average of 5 million gallons of residual waste per month and pumps into the sewer system, when operating, at a rate of 600 gallons per minute.

Wastewater is conveyed to the Vance Avery WWTP for treatment before being discharged to the Pacific Ocean off Nye Beach. The City owns and operates the Vance Avery WWTP located on the south side of Yaquina Bay at 5525 SE 50th Place in Newport. The WWTP and influent pump station (IPS), commissioned in 2003, replaced the old WWTP located at the current Northside Pump Station (NSPS) at NW Nye Street and NW 3rd Street, approximately 3 miles north.

1.2 Objectives

The objectives of this report include the following:

1. Update key findings from previous efforts, including flow and load projections, capacity assessments, and criticality evaluations.
2. Develop treatment alternatives and summarize alternative criteria and scoring.
3. Estimate high-level costs for each alternative.
4. Present site plan alternatives for the WWTP.
5. Recommend a single alternative for implementation, guided by discussions with the City.
6. Discuss alternative development for NSPS and recommend path forward.
7. Present a Capital Improvement Plan for 20-year improvements.

Section 2

Flow Projection Updates

2.1 Population Projection

A 2017 capacity study presented a set of flow and load projections that were derived from a combination of Portland State University (PSU) population forecasts and water use data from 2004 through 2017. Population projections for Newport and Lincoln County are periodically developed by PSU. PSU's 2017 projection estimated a 0.91 percent annual growth rate for the city between 2017 and 2067. From 2004 to 2017, water use within the city increased at an annual rate of approximately 0.1 percent. While some of this reflects water conservation, the water-use data suggested that PSU projections could overestimate development. As a compromise, the 2017 capacity study used a set of projections with a 0.45 percent annual growth rate. However, PSU updated its population forecasts in 2021. The new forecasts were much lower than those developed in 2017. The 2021, PSU projections forecast an overall reduction in population within the city from 2020 to 2070, and only a small incremental increase (0.2 percent annual growth) in Lincoln County as a whole. Actual population growth within the city averaged 0.96 percent between 2000 and 2020, with a 1.39 percent annual growth rate from 2010 to 2020.

A new set of population projections were developed for this study to rationalize the available data. The new projections start with the 2000-2020 annual growth rate of 0.96 percent and gradually reduce to 0.03 percent, which is the annual growth rate projected for Lincoln County after 2040 in the PSU 2021 forecast. Figure 2-1 presents the new projections alongside those from the 2017 capacity report, the two PSU projections, and the historical population for Newport.

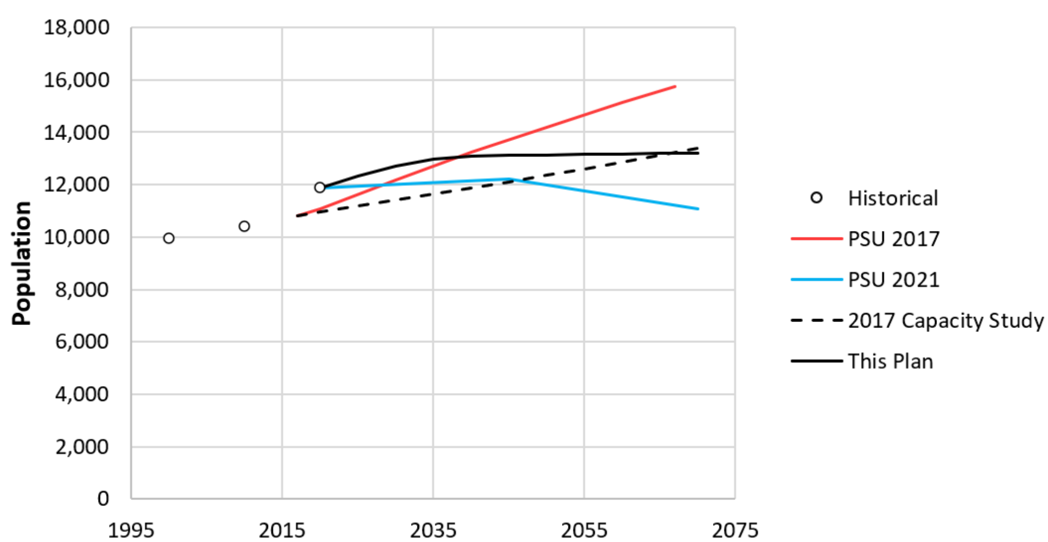

Figure 2-1. Population projections for Newport

The new projections end up with a similar population to those used in the 2017 capacity report. In total, the city population is projected to increase by 1,330 (11 percent) between 2020 and 2070.

2.2 Current Flows

Wastewater flow at the City follows a seasonal trend due to wet weather impacts, with high flows in the rainy winter months and low flows during the summer. Figure 2-2 presents the daily flow record for the past 15 years.

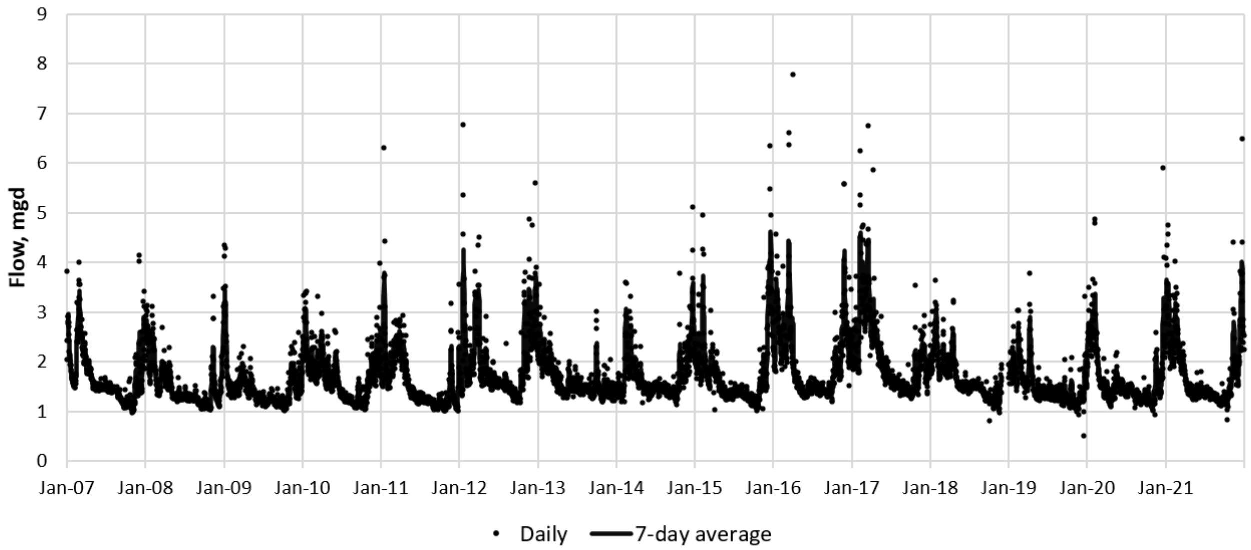

Figure 2-2. Daily flow at the Vance Avery WWTP

The base sanitary flow is defined as the 7-day minimum flow recorded each year, which approximates sanitary flow without impacts from inflow and infiltration. The base sanitary flow typically occurs near the end of the summer. Figure 2-3 presents the annual base sanitary flow from 2007-2021.

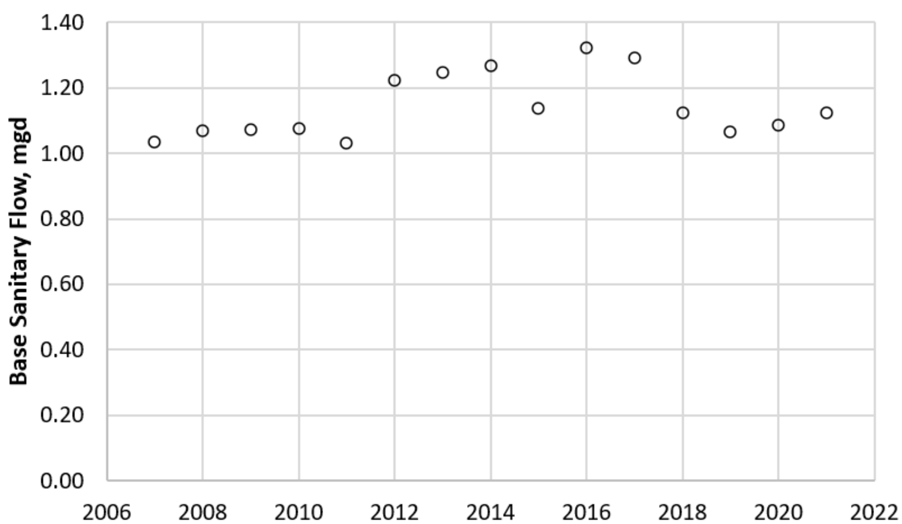

Figure 2-3. Annual base sanitary flow at the Vance Avery WWTP

Although some annual variation exists, the base flow has increased steadily between 2006 to 2021, and currently averages approximately 1.1 million gallons per day (mgd). The City is a tourist destination, particularly during the summer. However, the wastewater flow record exhibits only a marginal tourism component. Figure 2-4 presents average flows by the day of the year, from 2017 to 2021.

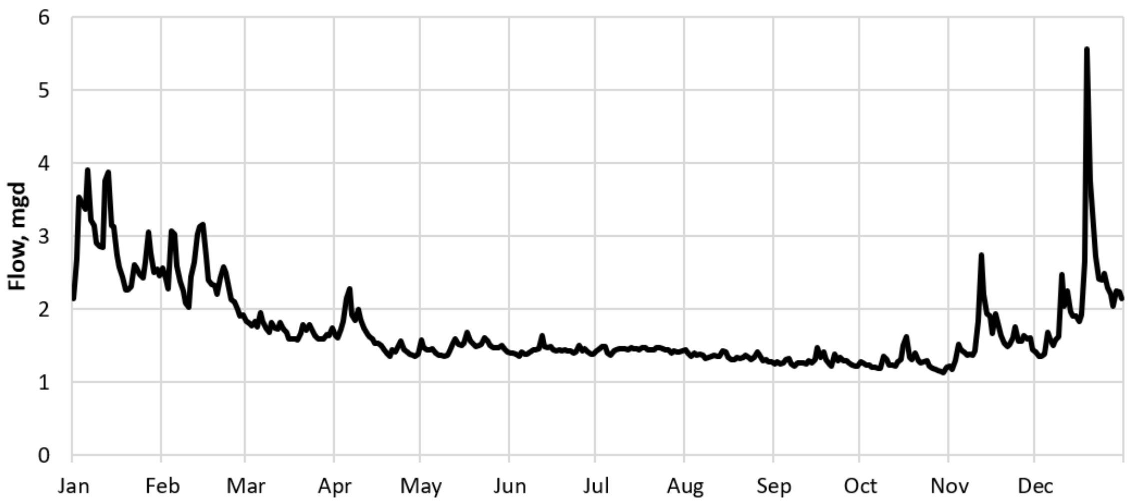

Figure 2-4. Average flow by day of the year, 2017-2021

Flow impacts from major holidays such as Independence Day, Labor Day, and Memorial Day are negligible according to the data. Instead, seasonal inflow and infiltration result in winter flows averaging 1 to 2 mgd higher than summer flows. The spikes on Figure 2-4 represent days on which major storm events occurred. The very large spike on December 20th reflects the coincidental arrival of major rainstorms on the same day in both 2020 and 2021.

A statistical analysis of the flow data from 2017 to 2021 is summarized in Table 2-1. The table presents current flows and peaking factors, which will be used as the basis for flow projections.

Table 2-1. Current Flows and Peaking Factors

Parameter	Flow (mgd)	Peaking (flow/base sanitary)
Base sanitary	1.10	1.00
Minimum month	1.15	1.05
Average	1.75	1.59
Maximum month	3.30	3.00
Maximum 14-days	3.75	3.41
Maximum day	6.50	5.91
Maximum hour a	13.9	12.68
Summer average	1.40	1.27
Winter average	2.10	1.91

a. Peak hour flows are not tracked. The data in Table 2-1 were applied to the Oregon Department of Environmental Quality (DEQ) method of determining wet weather and peak flow projections to estimate an average peak hourly flow of 13.9 mgd. Plant operators have reported that flows up to 15 mgd have been observed, although such flows are infrequent.

2.3 Current Loadings and Industrial Contributions

Influent loadings are presented on Figure 2-5. The figure shows the daily and 30-day average loadings for biological oxygen demand (BOD) and total suspended solids (TSS).

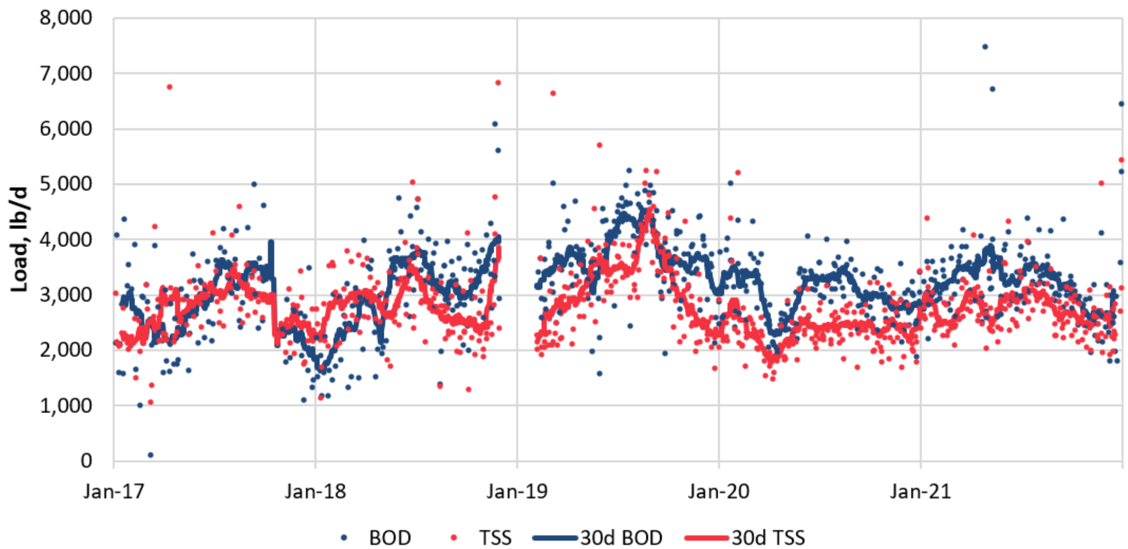

Figure 2-5. Daily and 30-day average influent BOD and TSS loadings

Although it is hard to visualize due to the scatter, the loadings demonstrate a seasonal component. Loadings are typically 10 to 15 percent higher in the summer, peaking in July. As was the case with flows, it is difficult to determine a tourism-related load. Figure 2-6 presents average BOD loadings by day of the year, from 2008 through 2021. While the summer increase is clear, specific holiday-related peaking is much less obvious.

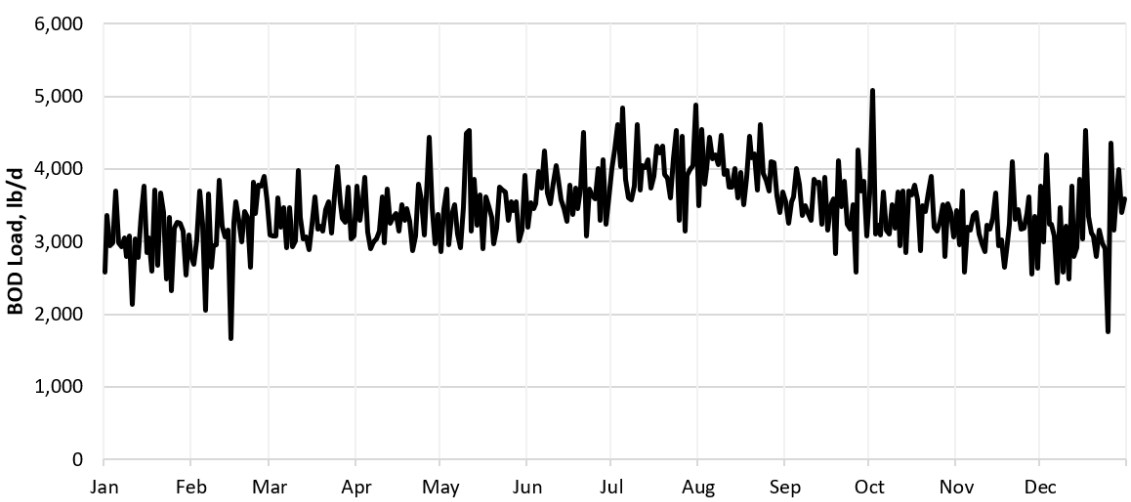

Figure 2-6. Average BOD loading by day of the year, 2008-2021

A key component of the influent loading is the Rogue Brewery (Rogue). Rogue currently contributes approximately 26,100 gallons per day (gpd) of flow, with a high BOD content (2,160 pounds [lb]/day[d]). Table 2-2 summarizes Rogue flows and loads since 2020, when the latest pretreatment regulations went into effect.

Table 2-2. Rogue Brewery contribution to Newport, 2020-2021			
Parameter	Rogue	Total	Rogue % of total
Flow, mgd			
Average	0.026	1.75	1.5%
Maximum month	0.031	3.30	0.9%
Maximum day	0.060	6.50	0.9%
BOD, lb/d			
Average	475	3,200	14.8%
Maximum month	700	4,250	16.5%
Maximum day	1,900	6,500	29.2%
TSS, lb/d			
Average	50	2,775	1.8%
Maximum month	120	4,000	3.0%
Maximum day	550	6,800	8.1%

Table 2-3 summarizes the current overall loadings, with peaking factors. BOD loadings have been adjusted to exclude the average Rogue loading of 475 lb/d. TSS loadings are unadjusted, as Rogue contributions are insignificant (less than 2 percent of the total at average load conditions). Adjusting the BOD loadings for Rogue ensures that per capita load generation rates and peaking factors are independent of Rogue, and Rogue loadings can be projected separately.

Table 2-3. Influent Loads and Peaking Factors		
Parameter (excludes Rogue)	Loading	Peaking (compared to average load)
BOD, lb/d		
Minimum month	1,925	0.71
Average	2,725	1.00
Maximum month	3,775	1.39
Maximum 14-day	4,125	1.51
Maximum day	6,500	2.39
TSS, lb/d		
Minimum month	1,900	0.68
Average	2,775	1.00
Maximum month	4,000	1.44
Maximum 14-day	4,600	1.66
Maximum day	6,800	2.45

2.4 Equivalent Residential Units

Equivalent residential units (ERUs) may be defined on the basis of flow or load. The current base flow of 1.1 mgd is divided by the current residential population of 11,882 to estimate an average per capital wastewater generation rate of 92.5 gallons/capita/day. Multiplying this by the average household size of 2.29 gives a flow-based generation rate of 212 gpd/ERU. By this measure, there are currently 5,188 ERUs in the City system.

The average BOD loadings can be used to develop load based ERUs. During the winter, the average BOD load is 2,625 lb/d, which excludes contributions from Rogue. Dividing this by the population of 11,882 gives a per capita loading of 0.22 lb/capita/d. Multiplying this by the average household size gives a load-based generation rate of 0.51 lb/d/ERU. The load basis may be used to project the number of additional ERUs observed during the summer (741), and ERUs associated with Rogue (939). In summary:

- Current ERUs: 5,188
- ERUs added during the summer: 741
- ERUs associated with Rogue: 939

2.5 Flow and Load Projections

Flow and load projections were derived by extrapolating current base flow and average loads into the future based on population forecasts (Figure 2-1). Peaking was derived from the peaking factors presented in Tables 2-1 and 2-3. Rogue flows and loads were assumed to remain constant, with the average BOD loading of 475 lb/d applied to all future projections. Table 2-4 summarizes the flow and load projections.

Table 2-4. Influent Flow and Load Projections

	2021	2030	2040	2050	2060	2070
Flow, mgd						
Base sanitary	1.10	1.19	1.25	1.26	1.26	1.27
Minimum month	1.15	1.24	1.30	1.32	1.32	1.33
Average	1.75	1.89	1.98	2.01	2.01	2.02
Maximum month	3.30	3.56	3.74	3.78	3.79	3.81
Maximum day	6.50	7.01	7.36	7.45	7.47	7.50
Maximum hour	13.9	15.0	15.8	16.0	16.0	16.1
Summer	1.40	1.51	1.59	1.60	1.61	1.61
Winter	2.10	2.26	2.38	2.41	2.41	2.42
BOD load, lb/d						
Minimum month	2,400	2,550	2,650	2,680	2,690	2,690
Average	3,200	3,410	3,560	3,600	3,610	3,620
Maximum month	4,250	4,550	4,750	4,800	4,820	4,830
Maximum 14-day	4,600	4,920	5,150	5,200	5,220	5,230
Maximum day	6,500	7,010	7,360	7,450	7,470	7,500
TSS load, lb/d						
Minimum month	1,900	2,050	2,150	2,180	2,180	2,190
Average	2,780	2,990	3,140	3,180	3,190	3,200
Maximum month	4,000	4,310	4,520	4,580	4,590	4,610
Maximum 14-day	4,600	4,970	5,220	5,280	5,300	5,310
Maximum day	6,800	7,330	7,700	7,790	7,820	7,840

a. Includes contributions from Rogue.

In summary, the flow and load projections are expected to mirror the population projection, with only a small increase (13 to 15 percent) over the next 50 years.

2.6 Permit Requirements

The WWTP is permitted to discharge under National Pollutant Discharge Elimination System (NPDES) Permit 102497, issued on May 3, 2002. The permitted discharge limits are summarized in Table 2-5. The current permit, which expired on April 30, 2007, remains in effect until a new permit is formalized.

Table 2-5. NPDES Permit Regulations

BOD and TSS Limits						
	Concentration-based Limits (mg/L)		Mass-based Limits (lb/d)			Removal Efficiency
	Monthly	Weekly	Monthly	Weekly	Daily Maximum[a]	
Summer (May 1–Oct 31)						
BOD	30	45	770	1,100	1,500	85%
TSS	30	45	770	1,100	1,500	85%
Winter (Nov 1–Apr 30)						
BOD	30	45	960	1,700	2,300	85%
TSS	30	45	960	1,700	2,300	85%
Other Limits						
Fecal coliform bacteria	126 per 100 mL (monthly geometric mean) with no sample exceeding 406 per 100 mL					
pH	6–9					
Total residual chlorine	0.47 mg/L					

Abbreviations: lb/d = pound(s) per day, mg/L = milligram(s) per liter, mL = milliliter(s)

a. Daily maximum limits suspended when flow exceeds 6.4 mgd.

2.7 Effluent Performance

Effluent concentrations for BOD and TSS have generally remained well below permit limits. Figures 2-7 and 2-8 present monthly average effluent concentrations and loadings, respectively, compared to permit limits.

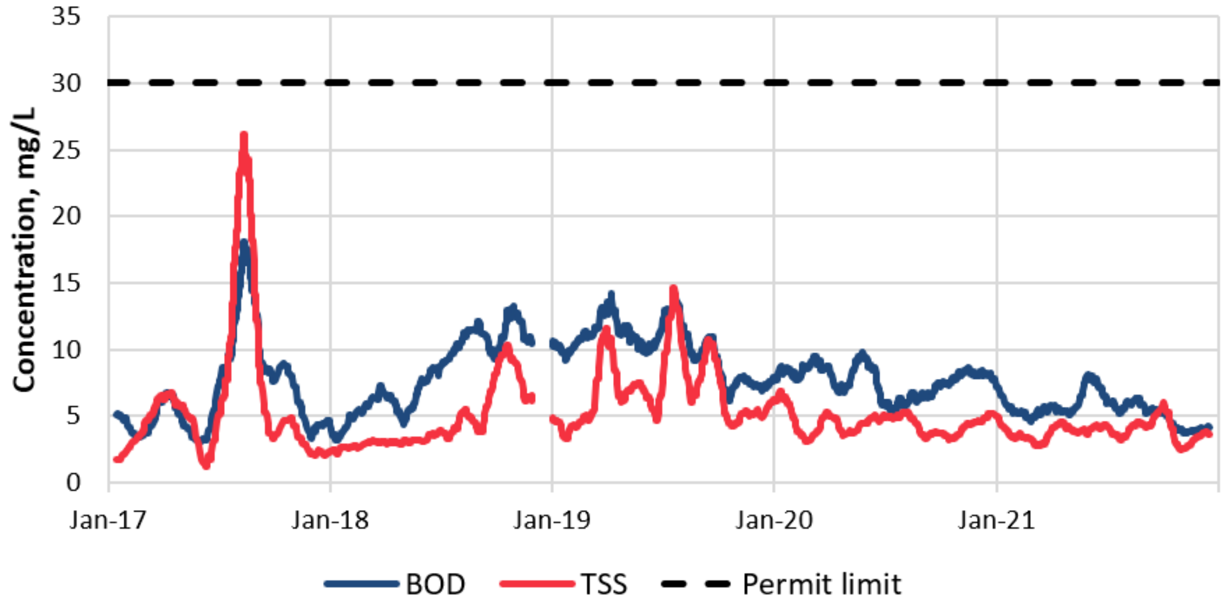

Figure 2-7. Effluent BOD and TSS concentration, 30-day average

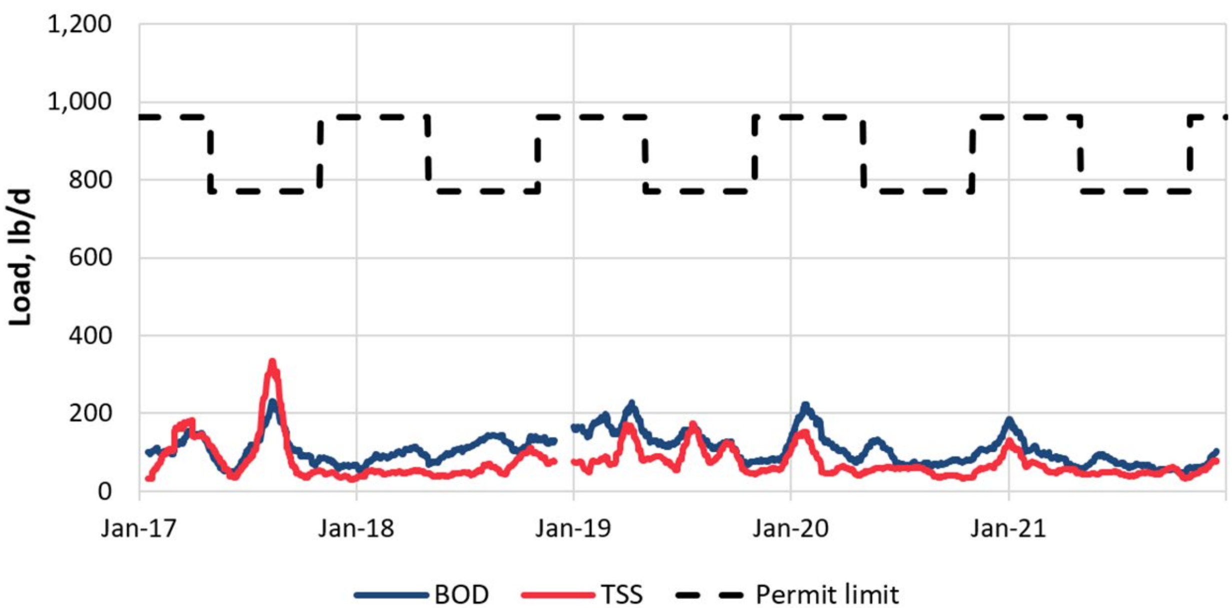

Figure 2-8. Effluent BOD and TSS loading, 30-day average

Section 3

Updated Condition and Criticality Evaluation

This section describes the processes, key updates from the 2021 condition assessment, and recommendations for near-term improvements for the Vance Avery Wastewater Treatment Plant (WWTP). A 2019 Existing Conditions Technical Memorandum (TM) (BC, 2019) summarized a previous condition assessment performed in 2018 (Waterdude, 2018); similarly, this TM captures key findings from an updated condition assessment performed in 2021 (Waterdude, 2021). The 2021 assessment is included in Appendix A. Unless otherwise noted, condition statuses are per Waterdude and have been paraphrased for brevity.

3.1 Condition Summary

The locations of major facilities are shown on Figure 3-1.

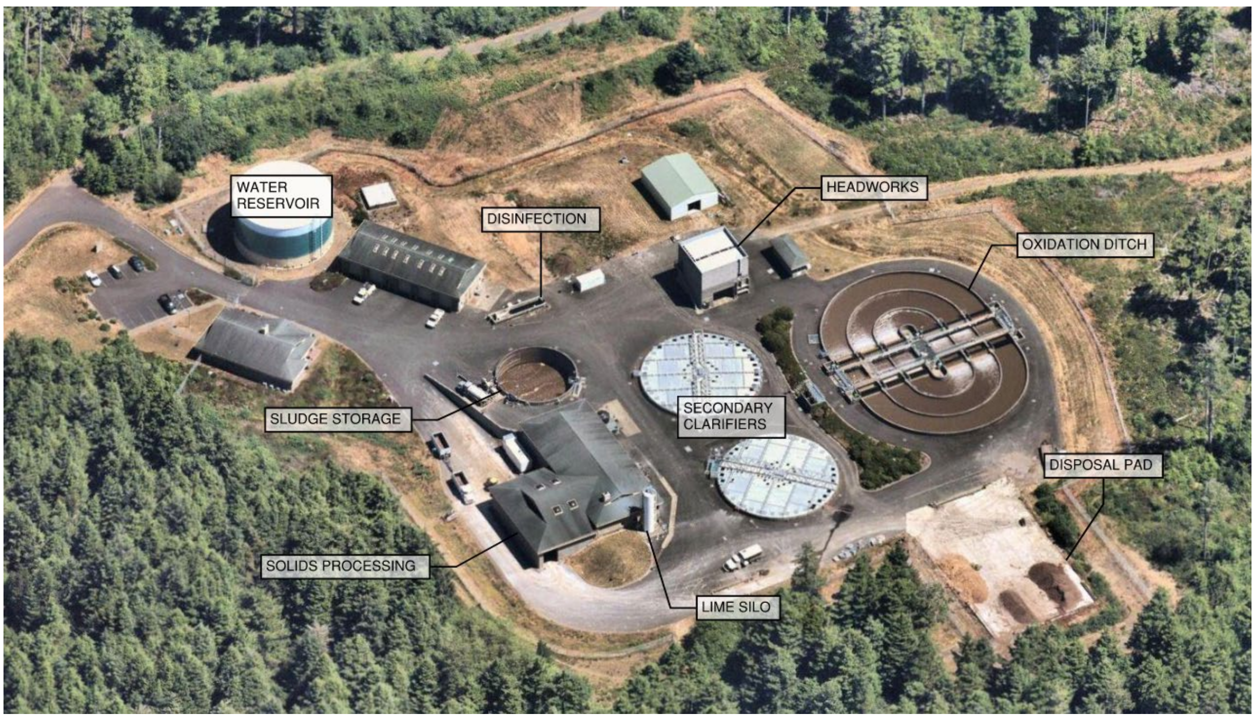

Figure 3-1. WWTP aerial layout

Table 3-1 summarizes applicable 2018 and 2021 criticality ratings. Ancillary processes that have been identified as critical are NSPS (discussed in Appendix H) and septage screening (discussed in Section 7). The status of each major unit process is summarized next.

Table 3-1. Major Unit Process Condition Rating Changes			
Description	2018 Rating	2021 Rating	Rating Change
Headworks Screenings	3.0	3.7	-0.7
Oxidation Ditch	2.9	2.7	+0.2
Secondary Clarification	2.0	2.3	-0.3
Disinfection System	2.5	3.3	-0.8
Lime Storage and Feed	2.8	3.4	-0.6
Biosolids System	2.6	3.4	-0.8

a. A rating of 1 reflects "very good" condition and 5 reflects "very poor" condition.

3.2 Headworks

The headworks contains the influent screening process, which removes rags, plastics, and medium to large debris from the influent flow stream, preventing their passage to downstream processes. Removing this debris protects downstream pumps and equipment and reduces maintenance requirements for downstream facilities.

Cylindrical screens and shaftless cleaning and conveying screws are housed in two of the four existing screening channels. The remaining two channels were constructed to facilitate future expansion and are currently blocked and unused. Screenings material is washed and compacted during its transport to a dumpster for offsite disposal. The City has noted "ragging" of the existing rotary screens results in buildup that impact screen performance and require regular clearing. Note that while grit removal was initially planned to be incorporated into the process, the City has indicated there are no current concerns with excess grit.

Corrosion is prevalent throughout the headworks building, and the odor control system is currently out of service. Corrosion could be a result of the proximity of the plant to the ocean and the fact that the upper level of the building is open to marine air. However, hydrogen sulfide (H_2S) concentrations are also very high and pose a safety risk to personnel working in this facility. H_2S also contributes to concrete erosion throughout the building in areas of high moisture. Corroding facilities such as the roof access ladder and stair gratings are safety concerns.

From 2018 to 2021, the condition of the existing screening system has worsened, partially due to increased corrosion over time. The screens have experienced further degradation since 2021 and are due for replacement. As discussed in the 2018 capacity assessment, there is insufficient screening redundancy or passive bypass; bypassing the screening process would only be possible by removing a screen entirely, for a certain period.

3.3 Oxidation Ditch

An Orbal oxidation ditch manufactured by Evoqua Water Technologies uses surface aerators to mix and aerate the wastewater. The basin is fitted with adjustable effluent gates that allow the water surface to be controlled to provide optimal mixing and aeration. The aeration process promotes growth of naturally occurring bacteria that consume biochemical waste material in the wastewater. This process removes 5-day biochemical oxygen demand (BOD_5), solids, and nutrients from the wastewater.

The aeration basin consists of three concentric, oval-shaped channels with four banks of surface aerators. Screened raw sewage and return activated sludge (RAS) typically enter the outer channel but can also be fed directly to the middle channel or both channels. The outer channel is operated at a near zero dissolved oxygen (DO) condition while the middle channel is operated at a DO of approximately 2 milligrams per liter (mg/L), and the inner channel is operated at a DO around 5 mg/L. Mixed liquor from the aeration basin is conveyed to the two secondary clarifiers via the mixed liquor splitter box.

The WWTP has experienced increased TSS in the effluent in the past and contracted with an operations specialist to evaluate and make operational recommendations to improve performance and optimize treatment processes. While the evaluation considered the whole WWTP, emphasis was placed on operational improvements to the aeration basins. The improvements aim to maintain set DO levels within each channel and set operational protocols for both the aeration basin and secondary clarifiers. Solids retention time (SRT) was recently reduced from 10 to 15 days, down to 9 days. Mixed liquor suspended solids (MLSS) has also been reduced recently from 3,200 mg/L to 2,400 mg/L, and process adjustments continue.

Due to capacity limitations, the ditch is typically operated at maximum overflow level. This is not ideal as it places the aerator shafts and bearings in contact with the activated sludge, leading to accelerated corrosion of these components. Furthermore, Phase I capacity analyses indicated the aeration system was not able to provide the target transfer efficiency to support the process.

Since 2018, the aerators underwent refurbishment and repairs, including new drives, bearings, and lubrication. In addition, the rotating speed was increased to provide more oxygen overall. These improvements are reflected in the 2021 criticality rating for the oxidation ditch. However, the capacity challenges will limit the timeframe between subsequent repairs moving forward if additional capacity is not incorporated to support the process.

3.4 Secondary Clarifiers

The secondary clarifiers take mixed liquor from the oxidation ditch and allow particles to settle out of the mixture forming sludge on the bottom of the clarifier. This sludge is drawn off the bottom of the clarifier and pumped to the aeration basin as RAS to improve process efficiency, or it is pumped as waste activated sludge (WAS) to the sludge storage tank. Pumps for the RAS and WAS processes are in the solids building. Scum floating on the clarifier surface is collected by skimmers, directed to the scum box, and pumped to the sludge storage tank.

Physically, the clarifiers are in decent condition with a few notable issues, as summarized below:

- The original scum removal sprayers have been removed due to plugging, and the current spray system is ineffective.
- In 2021, the drives and submerged portions of the blade-type mechanisms showed signs of corrosion. Deterioration of these components are reflected in the downgraded criticality rating between 2018 and 2021. However, the drive for Clarifier No. 2 was recently replaced, and the mechanism was recently recoated to mitigate corrosion. Similar work is planned for Clarifier No. 1 in 2023.
- According to the City, the clarifier covers require regular cleaning and present an operational challenge due to the obstruction of the equipment below. The City has noted a preference to have the covers removed, if possible, but they were included in the original design due to proximity to the regional airport and a stated criterion of minimizing attractions for birds. Reconsideration of this requirement may be warranted, including coordination with the Federal Aviation Administration to confirm that covers are required by law.

3.5 Disinfection

The disinfection system inactivates pathogens and other microorganisms before the effluent is discharged to the Pacific Ocean. Sodium hypochlorite solution (12.5 percent) is stored in a 3,650-gallon storage tank and pumped to the chlorine contact basin, where it is mixed with secondary effluent. The sodium hypochlorite solution can also be used at various other locations on the site. Disinfected effluent from the contact basins is measured with a Parshall flume before flowing by gravity through a 30-inch-diameter gravity effluent line under Yaquina Bay to the effluent booster pump station, where it is pumped to the ocean outfall near Nye Beach.

No capacity limitations were noted with the existing sodium hypochlorite disinfection system. However, the eyewash station present at the chlorine injection point is reaching the end of its useful life. In the past, eyewash stations have not received the required monthly inspections to ensure safety systems are fully operational. Furthermore, in 2023, a failure involving the existing diaphragm pumps resulted in an unplanned discharge of unchlorinated effluent. Pump replacement strategy and costs are presented later in this report.

In 2019, the chlorine delivery system was upgraded from manual control to automatic delivery. The chlorine set point is currently based on a control loop, which continuously analyzes effluent conditions and adjusts the dosage accordingly. This system has been reported to be effective.

3.6 Solids Treatment

The solids stream receives WAS and septage via the Hauled Waste Receiving Station. The WAS is conveyed from the RAS piping to the aerated WAS Storage Tank by WAS pumps located in the Solids Handling Building gallery. Septage from the Hauled Waste Receiving Station is also conveyed to the WAS Storage Tank.

Centrifuge Feed Pumps located in the Solids Handling Building gallery pump stored WAS and septage at a concentration of approximately 0.55 percent to centrifuges located on the ground level in the Solids Handling Building. Centrifuges and a liquid emulsion polymer system dewater WAS to approximately 20-percent solids concentration. Centrate decanted from the centrifuge is then returned to the plant headworks.

Conveyors transport dewatered cake to the Lime Stabilization equipment, located in the lime processing room adjacent to the centrifuges on the ground level of the Solids Handling Building. Cake is conveyed to a thermoblender where it is mixed with quicklime and heated. From the thermoblender, the heated sludge/lime mixture drops into a pasteurization vessel where it is held and heated for 30 minutes to produce Class A biosolids. The lime-stabilized, Class A biosolids finished product is conveyed to the solids storage bay on the west side of the Solids Handling Building where it is truck loaded and hauled to a biosolids end user or stored at Crestmont Farms, near Wren, Oregon. The plant currently has approximately three weeks of biosolids storage available onsite. A schematic of the existing solids stream is shown on Figure 3-2. Photos of the existing WAS Storage Tank, Centrifuge Feed Pumps, Centrifuges and RDP system are shown on Figures 3-3 to 3-6.

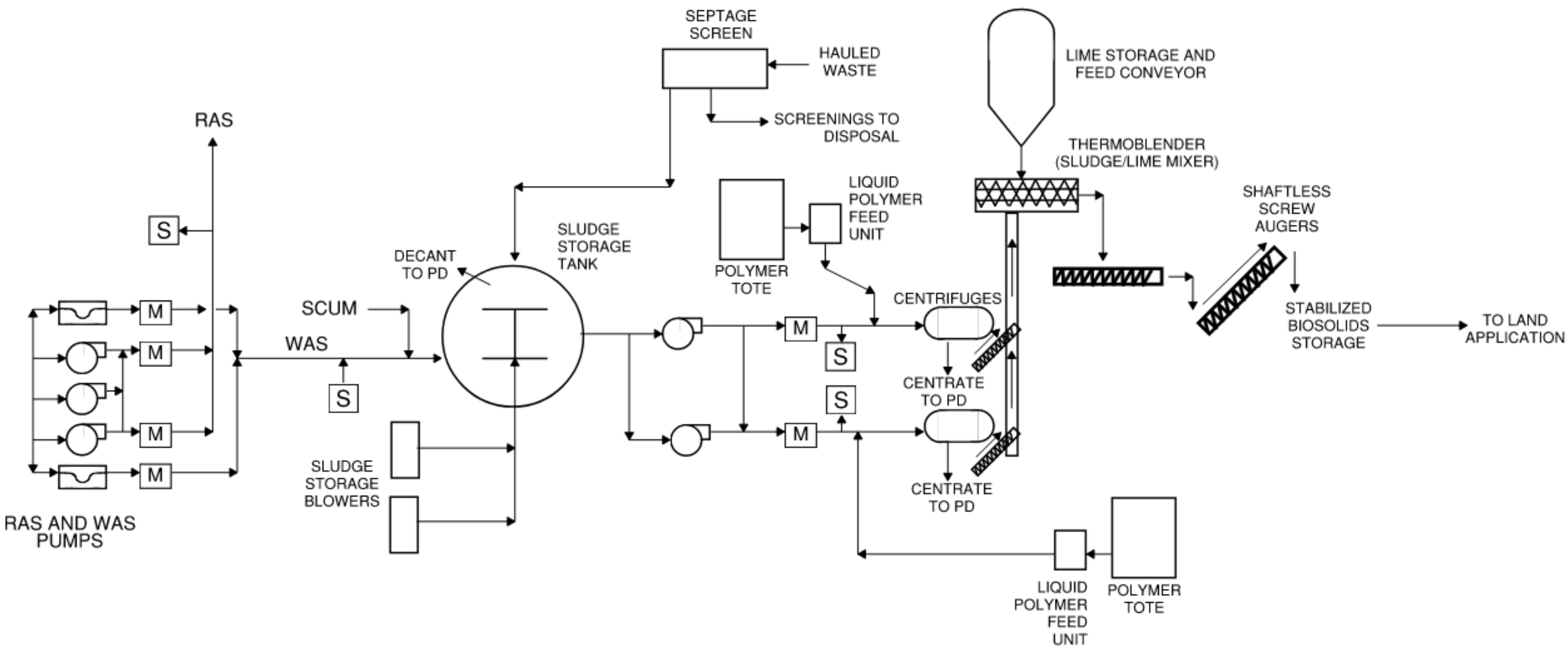

Figure 3-2. Solids stream schematic

Figure 3-3. WAS storage tank

Figure 3-4. Centrifuge feed pumps

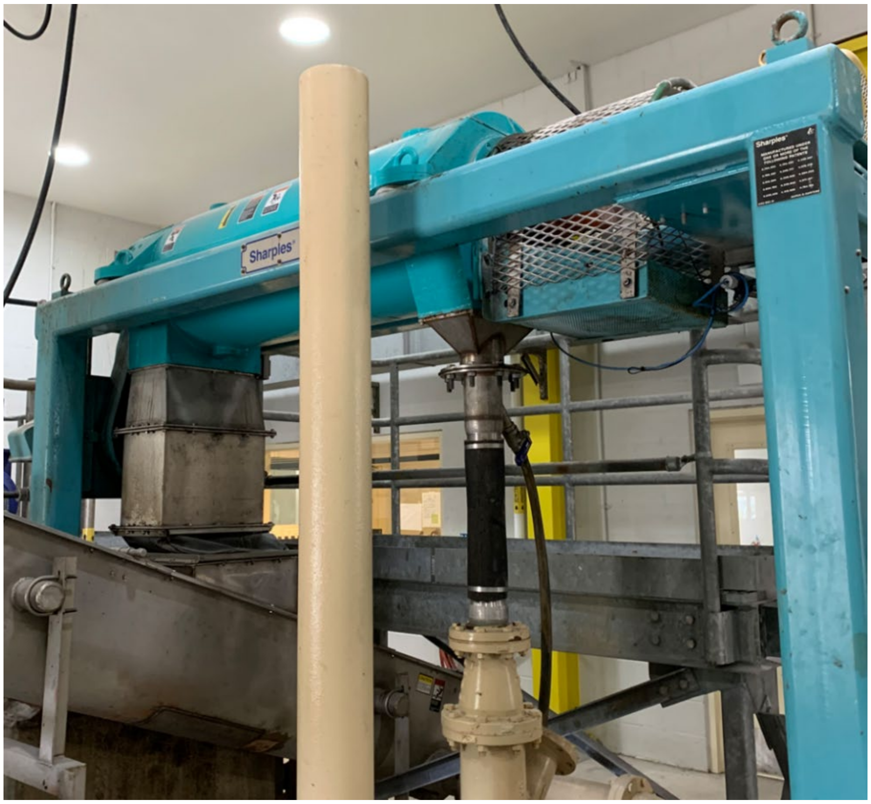

Figure 3-5. Centrifuges

Figure 3-6. RDP lime stabilization equipment

The solids process has experienced capacity issues for several years and a Biosolids Capacity Evaluation in 2012 made several recommendations to further evaluate and resolve the issues (BC, 2012). A rebuild of the centrifuges was completed in 2018 along with the installation of new control panels and a new polymer delivery system. The dewatering centrifuge capacity issues are also documented by BC in a 2018 capacity assessment, and by Kennedy Jenks in a Centrifuge Replacement TM (Appendix E).

The plant is currently looking to implement an emergency centrifuge replacement project, as the existing centrifuges are undersized and have reached the end of their useful life. Additional existing conditions information relating to dewatering is provided in the Centrifuge Replacement TM. Existing conditions of solids processes are also described in the Solids Basis of Design TM, included as Appendix J.

The existing RDP Lime Stabilization process is also reaching the end of its useful life, and product support and parts are becoming increasingly difficult to obtain for the existing system. The finished biosolids product is poor quality (e.g., consistency) and odiferous, making it more difficult to partner with agricultural land application sites and other end users.

Labor challenges with respect to biosolids hauling has resulted in backups at the plant. The plant pays to store biosolids at Crestmont Farms from November through April, as it is difficult to access the Class A Biosolids site during these months due to wet weather. DEQ has also notified the City that land application of biosolids is no longer permitted during the wet season (October through February), due to low nutrient update during winter months and difficulty with applying biosolids at the land application site. Large quantities of rainfall in the area do not allow the plants to absorb the nutrients in biosolids. The City has contracted storage of Class A biosolids with Crestmont Farms over the next 5 years. The farm will allow the City to haul and store a maximum of 4,500 wet tons of Class A biosolids annually, until they can be land-applied during the dry season. There are several sites available to the City for land application of Class A biosolids in the Siletz valley, mostly pasture lands; however, odors can be an issue on smaller sites. The DEQ is allowing the City to blend RDP Class A biosolids product with wood chips to improve quality and odor issues at certain sites. This is considered a “blended” product and allowed by the City’s existing Biosolids Management Plan. Wood chips are provided by Central Lincoln P.U.D. and are free to the City.

3.7 Near-Term Improvements

The following near-term upgrades are planned for key facilities:

1. NSPS Interim Improvements
2. NSPS Dechlorination Project
3. WWTP Centrifuge Replacements
4. WWTP Headworks Upgrades
5. WWTP Disinfection Improvements
6. Influent Pump Station Pipe Replacement

The NSPS interim improvements are summarized in Appendix H. Estimated design costs to incorporate dechlorination at this site have been developed separately and are driven by regulatory needs rather than condition or capacity reasons. Preliminary costs are included in Appendix I.

Imminent WWTP upgrades include headworks improvements, replacement of aging centrifuges, and disinfection pump replacements. Headworks upgrades are discussed in Section 3.2 and disinfection improvements are discussed in Section 6.4. Kennedy Jenks prepared a standalone TM presenting centrifuge alternatives and estimated costs, which is included as Appendix E

We understand the City is currently experiencing failure of pump suction and discharge piping at the influent pump station. While specific recommendations have not been developed as part of this WWTMP, replacement and rehabilitation is recommended as soon as funding can be secured. Complete pipe failures could cause flooding of raw sewage and unplanned pump shutdowns.

The NSPS dechlorination upgrades and WWTP centrifuge replacement projects are planned to start design in 2023, pending funding availability. Estimated yearly costs for all projects can be found in Section 9.2.2.

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Section 4

Capacity Assessment Update

A capacity assessment was developed as part of the 2018 Facilities Planning work. The capacity assessment was based on a combination of equipment data, historical operation and observations, and biological process modeling. That assessment has been updated as part of this plan.

4.1 Plant Operation

Figure 4-1 presents a process flow schematic representation of the plant.

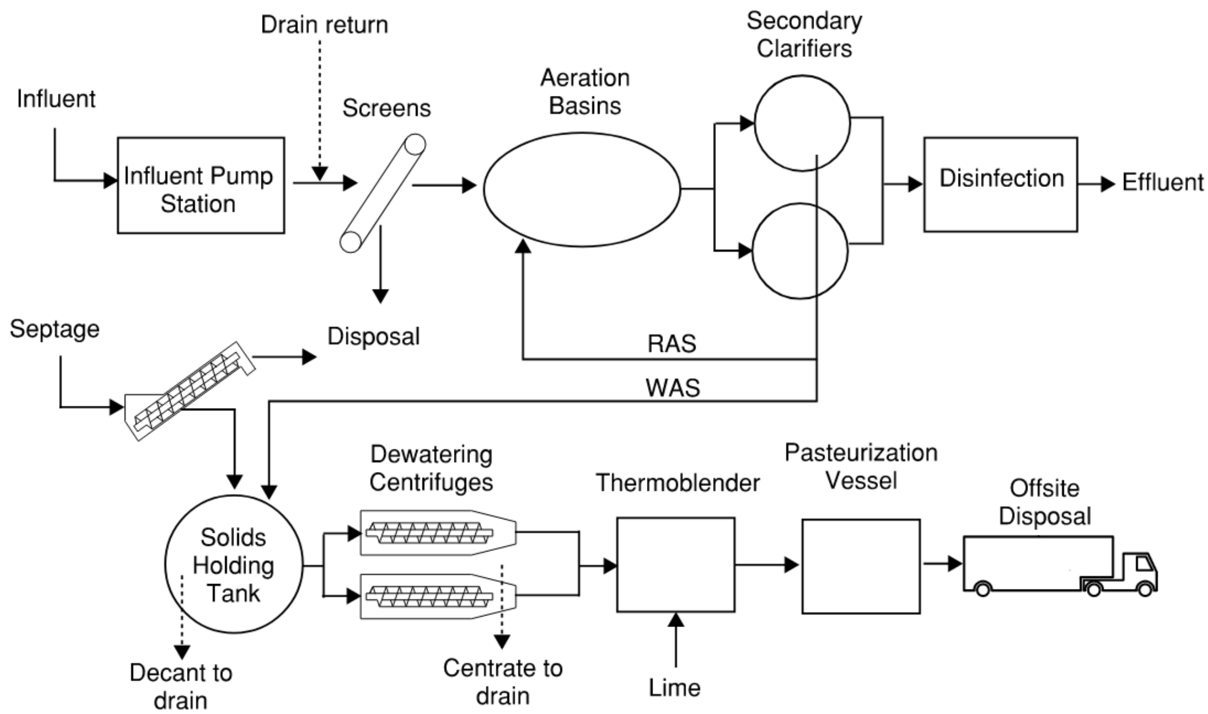

Figure 4-1. Plant process flow schematic

Influent is pumped up to the headworks, which houses a pair of in-channel rotary screens. Each screen has 0.25-inch openings and is rated for a capacity of 8 million gallons per day (mgd). Screened influent is conveyed to a 1.5-million-gallon Orbal oxidation ditch, which operates at a liquid depth of 11.5 feet. The Orbal system consists of three loops, each of which operates at a different DO concentration (Figure 4-2).

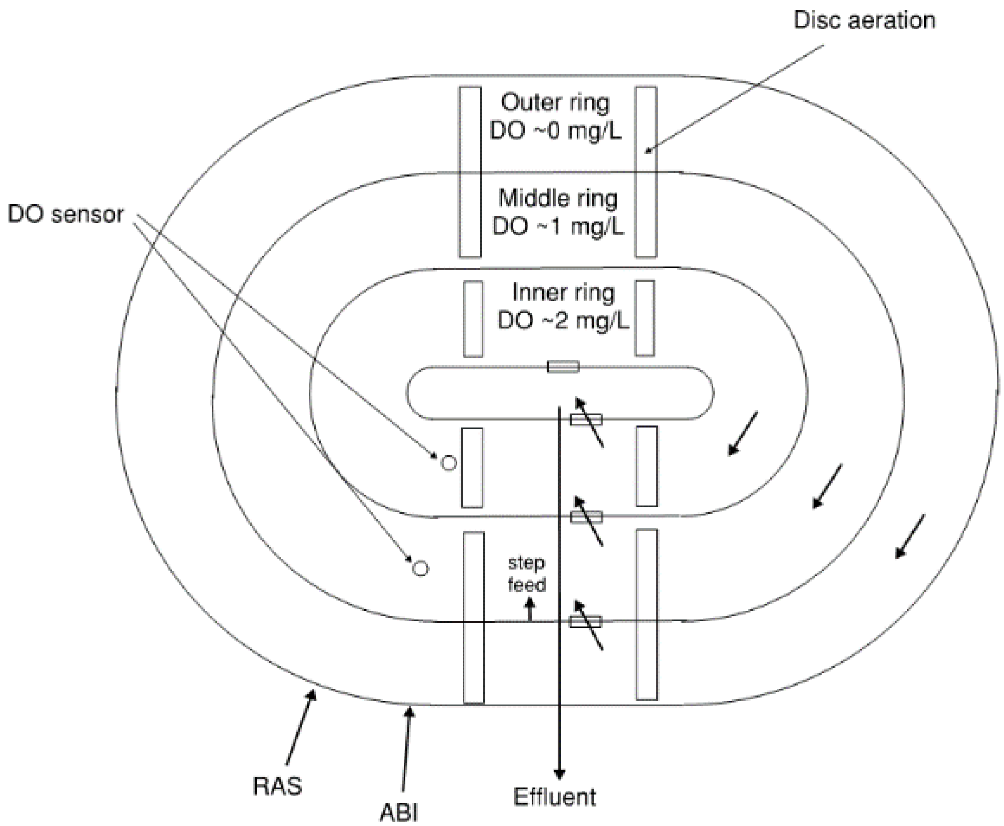

Figure 4-2. Schematic of Orbal oxidation ditch

The oxidation ditch is currently operated at an solids retention time (SRT) of 8 to 10 days. The mixed liquor suspended solids (MLSS) concentration is maintained at an average of 2,560 mg/L, with a typical monthly average range from 2,250 to 2,980 mg/L.

Mixed liquor from the ditch is sent to a pair of 90-foot-diameter secondary clarifiers for solids separation. Activated sludge bacteria are sent back to the ditch as RAS, and effluent is sent to a 13,600-gallon disinfection channel. The disinfection channel is primary used for mixing, with contact time achieved in the outfall pipeline, which has an estimated volume of 580,000 gallons.

WAS from the secondary clarifiers is sent to a holding tank where it is mixed with septage. The combined sludge is dewatered with a pair of centrifuges and stabilized via a lime pasteurization process.

4.2 2018 Capacity Assessment

The 2018 capacity assessment identified several capacity limitations:

1. The influent screens were operating with no redundancy, and firm capacity of the system was exceeded at peak flows.
2. The dewatering centrifuges were operating with no redundancy, and firm capacity of the system was exceeded at average load conditions.
3. The lime pasteurization system was operating above its design throughput of 24 hours/week.

4. The secondary process appeared to be operating near its capacity. The rated capacity, based on the ditch's design SRT of 5.5 days, was estimated to be 4.1 mgd (maximum month flow basis). However, it was recommended, due to a nutrient imbalance, to keep the SRT at a minimum of 8 days to improve mixed liquor settleability. Operation at the recommended minimum SRT of 8 to 10 days would reduce the rated capacity to 3.7 mgd, which was projected to be observed shortly after 2030.
5. Oxidation ditch aeration capacity appeared to be limited, based on operator observation of DO depression during peak loadings. This was assumed to be caused by a combination of the oxidation ditch disc aerators performing below specification with respect to oxygen transfer, and to a transfer efficiency depression which may have been related to peak loadings from Rogue.
6. The influent pumps and plant design hydraulics, both rated to 15 mgd (maximum hour), were projected to become capacity-limited in the early 2040s.

4.3 Capacity Assessment Update

The 2017 capacity assessment has been updated as part of this planning effort. Updates include:

1. Incorporating the new flow and load projections.
2. Reducing the Rogue BOD loadings from approximately 1,100 pounds per day (lb/d) to the current average of 475 lb/d. Since the 2017 assessment, pretreatment regulations have reduced Rogue loadings by more than 50 percent. This, combined with mechanical improvements to increase the motor power delivered by the oxidation ditch disc aerators, has eliminated the aeration limitations observed in the 2017 assessment.
3. Updating the secondary process capacity assessment based on the past 5 years of data. The main adjustment is to reduce the rated sludge volume index (SVI) from 361 milliliters per gram (mL/g) to 325 mL/g, meaning mixed liquor settleability has improved slightly.

Major findings from the capacity update include:

1. The influent screens continue to be a capacity limitation, with firm capacity already exceeded.
2. The dewatering centrifuges continue to be a capacity limitation.
3. The lime pasteurization system continues to exceed its design throughput. While this does not affect the plant's capacity to process solids, it impairs reliability and increases risk, as the system has less down-time for maintenance and repairs.
4. The influent pumps and plant design hydraulic limitations are expected to be exceeded a few years earlier (the late 2030s instead of the early 2040s), based on the updated flow projections.
5. Secondary process remains near capacity. The secondary process evaluation considered two factors:
   - **MLSS concentration in the oxidation ditch**: A common operating MLSS for oxidation ditches is 3,000 mg/L, and that is the maximum concentration currently being observed. With current flows and loads and an SRT of eight to ten days, the WWTP cannot operate at an MLSS concentration below 3,000 milligram per Liter (mg/L). Operating at a longer SRT, as is common practice with this type of ditch, would drive the MLSS concentration well above 3,000 mg/L and overload the secondary clarifiers.
   - **Secondary clarifier capacity**: At a 10-day SRT and the current SVI of 325 mL/g, which would be a recommended operating condition in the winter, capacity of the system is approximately 3.2 mgd. The current maximum month flow is 3.3 mgd. By this measure, the plant is at capacity.

– The secondary process is also limited with respect to redundancy. The above analysis assumes both secondary clarifiers are in service. With one clarifier out of service, which could happen at any time for required repairs or maintenance, capacity would be cut in half, and the plant would be severely restricted. Based on Oregon State guidelines, the clarifiers should have capacity to treat the maximum day with flow both units in service, and the maximum month dry weather flow with one unit out of service. The winter maximum day requirement is typically more limiting.

Figure 4-3 compares the capacity findings to current flows in terms of equivalent residential units (ERUs), including the NSPS. The secondary clarifier total capacity, for example, is listed as approximately 5,000 ERUs. As the system currently has 5,189 ERUs, the clarifiers are interpreted to be capacity limited.

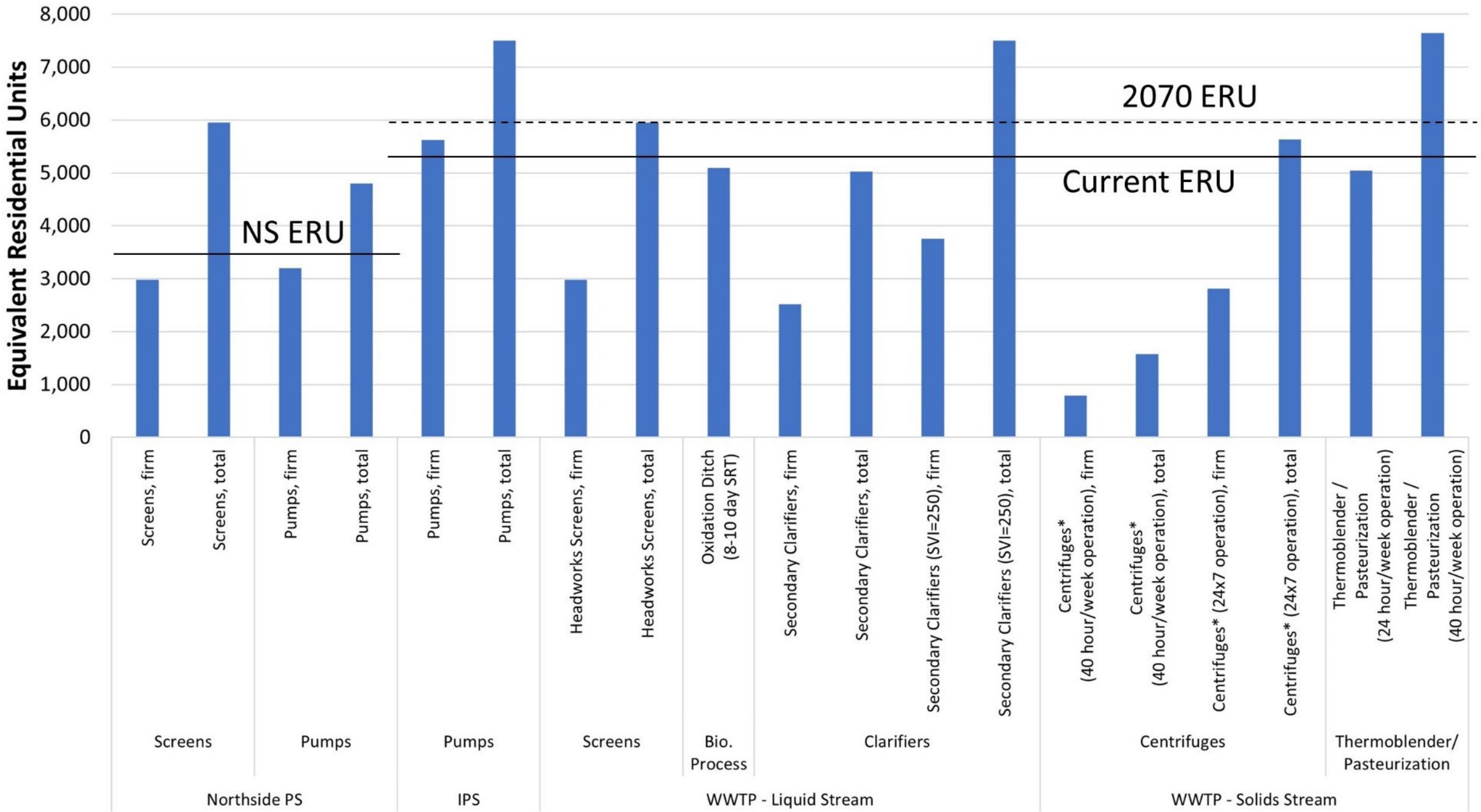

Figure 4-3. Capacity summary

4.4 Capacity Implications

Most of the capacity limitations are straightforward in terms of replacing equipment with larger units or adding units, and alternatives assessments for screens, dewatering, and biosolids are presented later in this report. Secondary process limitations are somewhat more complicated. The plant was designed with a single Orbal ditch and two secondary clarifiers. Design criteria reflected an extremely aggressive approach to operation, with a 5.5-day SRT in the ditch, and no redundancy in either the ditch or the clarifiers. Site layouts included plans for a second oxidation ditch and two more secondary clarifiers. Options for expanding capacity of the secondary process include the following:

1. **Reduce loadings from the Rogue Brewery.** This option has already been implemented, by imposing pretreatment regulations on the brewery. This has resulted in greater than 50 percent reduction in brewery loadings. While this has certainly reduced capacity risk, it has not eliminated the capacity limitation.
2. **Reduce loadings by applying pretreatment at the plant.** The most common form of pretreatment is primary clarifiers, which could reduce solids loading by 60 to 70 percent and reduce BOD loadings by 25 to 40 percent. Primary clarifiers would extend capacity of the secondary process for all projected flows and loads. However, primary sludge would impact biosolids decisions. The best way to stabilize a combined sludge from primary and secondary treatment (i.e., WAS) would be to implement some form of solids digestion at the plant.
3. **Expand capacity by building a second oxidation ditch and more secondary clarifiers.** The recommendation would be to build the second ditch plus one additional clarifier, which would resolve both capacity and redundancy limitations. A second ditch would provide capacity not only for projected loadings, but could also accommodate brewery or other industrial expansion, if desired.

Option 3 will be discussed in more detail in Section 6 of this plan.

Section 5

Headworks Alternatives Development

The status of the existing headworks building and associated equipment was discussed in Section 3.2 and 4.3. This section presents improvement alternatives and recommends path forward.

5.1 Alternative Descriptions and Evaluation

Two alternatives were developed for the existing headworks building as follows.

- **Alternative 1: Bare Minimum Investment**–Replace equipment and proceed with improvements that have been identified as critical.
- **Alternative 2: Minimum Investments + Upgraded Functionality**–Proceed with critical improvements and improvements to decrease labor requirements and add operational flexibility.

5.1.1 Minimum Investments

Bare minimum improvements were developed based on needs identified in the capacity and critical assessments discussed above. Most notably, the existing rotary screens are due for replacement. Recommended screen replacements are discussed in Section 5.1.3. Additional improvements are recommended to combat odor issues, mitigate the impacts of corrosion, and improve personnel safety:

- The existing screening channels should be enclosed and connected to an odor control unit to treat odorous air within the channels.
- The upper level should be enclosed to provide separation from the outside marine air, which in the past has contributed to corrosion issues throughout building.
- Access equipment that is currently corroded should be replaced, such as the roof access ladder and discharge channel maintenance hole covers.
- Fall protection measures are needed at the existing screening chute.
- Electrical work is required to repair inoperable lighting and switches.
- Roof replacement or rehabilitation is recommended due to significant rust on the interior face.

5.1.2 Non-Critical Upgrades

If funding allows, additional improvements could be incorporated to increase the functionality of existing headworks operations. Mainly, screening capacity and flexibility can be significantly increased with the addition of a third screen in one of the two available screening channels north and south of the channels that are currently occupied. The south channel is highly preferred due to the proximity of the north channel to the building wall and associated space restrictions. The additional redundancy would be helpful in facilitating screen maintenance and repairs, when required. To facilitate third screen operation, slide gates would be required upstream and downstream of the screen location, similar to the existing screen channels.

The City has also noted a preference to minimize labor requirements and add automation to the existing process. Electric actuators could be added to the existing gates and new gates to increase the ease with which flows are directed between the three channels. The actuator controls could be connected to the existing supervisory control and data acquisition (SCADA) system to streamline operations with the rest of the plant.

5.1.3 Screen Replacement Options

The existing rotary screens are recommended to be replaced with multi-rake bar screens or flexible multi-rake bar screens. These two screen types were recommended for several reasons:

1. No flushing water is required for cleaning
2. Use of multiple rakes allows for higher loading rates
3. Relatively low headloss
4. Simple design requires relatively little maintenance
5. Reasonable cost
6. Steep installation angle reduces lay length within existing screening channels
7. City preference against screens with rotating augers due to consistent ragging issues

The recommended screen types are commonly used in the industry and BC has specified them in the past. Note that for the basis of this evaluation, the Huber RakeMax and Duperon FlexRake were considered, but other alternatives are available from competing manufacturers. The two screens are similar, but have a few notable differences:

- The flexible multi-rake bar screen is designed to stay in operation when larger debris causes an obstruction of the cleaning rakes. The lack of a bottom chain connection allows the rakes to move freely away from the screen when debris are obstructing the screen's face at the bottom of the channel. This arrangement is possible due to the chain used in the screen's design and eliminates the need to enter the channel to maintain connection points (although that is uncommon for screens with sprockets).
- The lack of a bottom connection point can also allow large debris to remain in the channel and obstruct the flow pathway without detection from operations personnel. There have also been reports of the rakes getting misaligned on flexible multi-rake screens, causing the rake teeth to not engage between the screen bars and properly clean the screen.
- Large debris are not commonly observed at the WWTP Headworks due to pre-screening at the upstream NSPS. However, having the ability to handle unscreened waste at the WWTP could add process flexibility if upstream screening is unavailable. Additionally, a smaller drive motor is included with flexible multi-rake screens, which is possible because the rakes are spaced closer together with more overall rakes.
- Key benefits of a conventional bar screen include technology maturity, simplicity, size, and cost. The Huber RakeMax, specifically, has been installed at several WWTPs in Oregon and is a much more proven technology when compared to flexible multi-rake screens, of which there are fewer installations in the immediate area. The relatively fewer rakes on the conventional bar screens mean that periodic maintenance is simpler. Also, the drive chains can be re-tensioned in place and remain in alignment due to the bottom connection point in the channel. Finally, conventional screens are slightly shorter and less expensive than the catenary type-screens, though the existing hatch opening and bridge crane in the headworks building can facilitate the installation of either screen.

5.2 Recommended Layout

If Alternative 2 is selected, the third screen would be placed in one of the two existing channels that are currently unused. The south channel is recommended to facilitate access around the screen; access around a screen at the north channel would be impeded by the building wall on the north side. The proposed arrangement is shown in Figure 5-1. Note the additional screen is recommended to be staggered upstream of the two replaced screens in the center channels to create space for discharge piping to a new discharge chute. If preferred, the arrangement could be flipped so that the screens in the center channels are installed upstream of the screen in the outside channel.

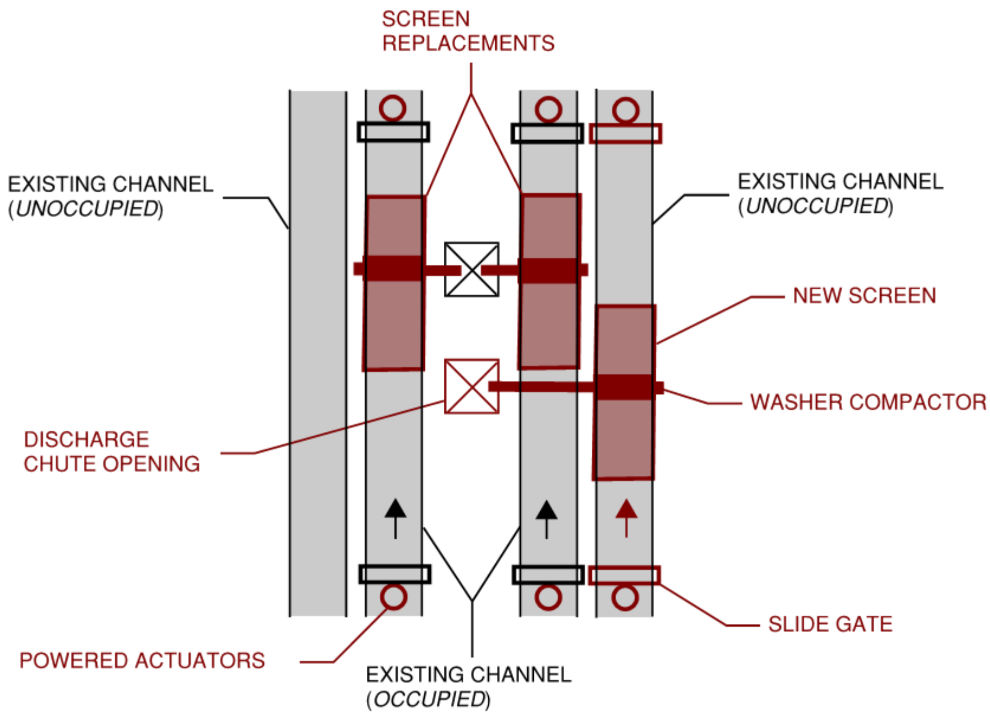

Figure 5-1. Headworks screening proposed plan

This staggered arrangement is possible because the proposed screens will be installed at a steeper installation angle than the existing rotary screens. The steeper angle decreases the lay length in the existing screening channels; however, note additional length upstream and downstream of the screens should be provided per manufacturer recommendations.

As shown in Figure 5-2, screened solids will be deposited into associated washer compactors and directed to the screening discharge chutes. To accommodate dual chute openings, a modification of the existing chute will be required, with one potential option shown in the figure. Separated discharge chutes may be desired to accommodate the additional screenings and facilitate distribution to the dumpster on the lower level.

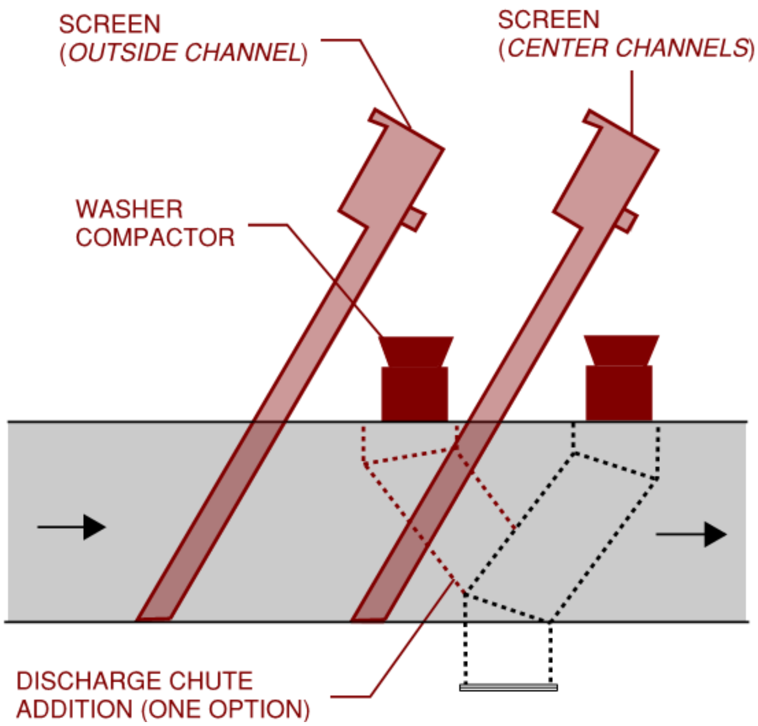

Figure 5-2. Headworks screening proposed profile

5.3 Costs

A construction cost summary for each alternative is shown in Table 5-1. Note that these costs are "construction only" and do not include additional fees necessary for engineering and administration. More detailed cost estimates are included in Appendix B.

As shown, the expected cost increase to incorporate the non-critical upgrades is approximately $800K. If desired, these upgrades could be postponed to a time when additional funding is available; however, activities such as re-mobilization and additional planning would likely increase the total cost of the improvements listed for Alternative 2.

Table 5-1. Headworks Construction Costs

Project Element	Alternative 1	Alternative 2
Replace Screens	$1,300,000	$1,300,000
Add Odor Control	$630,000	$630,000
Enclose Upper Level	$40,000	$40,000
Replace Corroded Elements	$50,000	$50,000
Electrical Allowance	$330,000	$500,000
Add New Screen	-	$640,000
Add Gates and Automation	-	$50,000
Total	**$2,400,000**	**$3,200,000**

Summarized life-cycle costs are presented in Table 5-2. Note that while an additional screen is proposed for Alternative 2, yearly labor costs will be similar to Alternative 1 since flows through each screen will be lower.

Table 5-2. Headworks Life Cycle Costs

Life Cycle Cost	Alternative 1	Alternative 2
Labor	$45,000	$45,000
Electricity	$3,439	$4,203
Yearly Totals:	**$48,439**	**$49,203**

a. Conventional multi-rake bar screens were assumed for life cycle analysis. Flexible multi-rake bar screens are expected to reduce yearly electrical costs by approximately $200 per year per screen.

5.4 Recommendations

Alternative 2 is recommended. The addition of a third screen increases process flexibility, redundancy, and capacity. Automated channel gates are recommended to decrease labor requirements and streamline operations moving forward. Combining these non-critical upgrades with the critical upgrades in Alternative 1 during construction is also recommended to reduce total project costs compared to implementing separately.

Further analysis is required to determine the ideal screen replacement type. A hydraulic evaluation is recommended to determine the anticipated water levels upstream and downstream of the proposed screens and rule out the need for any channel modifications. Comparative visits to nearby installations and discussions with manufacturers would also help inform key benefits and drawbacks of each type. As an additional option and if no strong preference is developed during design, these two screens have historically been bid head-to-head, with contract documents allowing both options for the contractor's consideration.

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Section 6

Liquids Stream Alternatives Evaluation

Guided by findings from capacity and condition assessments as well as discussions with plant staff, recommended improvements to the existing liquid stream processes are described and evaluated in this section.

6.1 Alternative Descriptions and Evaluation

While the existing secondary treatment process was not deemed to be in critical condition, limitations to capacity and redundancy are anticipated to compound with population growth, as described above. Two expansion options are presented in this section for consideration.

6.1.1 Primary Clarification

One alternative to reduce the biological oxygen demand (BOD) load to secondary treatment would be to add primary clarifiers upstream of the existing oxidation ditch. While clarifiers implement a different treatment mechanism than activated sludge treatment, they are sometimes capable of removing a similar percentage of BOD from the waste stream as biological treatment–reducing the capacity requirements for the downstream process. When compared to biological treatment, additional benefits include increased solids removal, lower energy costs, and smaller footprint within the site. The City of Newport (City) also suggested primary clarifiers could act as a stabilization tank upstream of the existing oxidation ditch, helping to resolve issues with variable BOD loading described in Section 2.3.

6.1.2 Expanded Oxidation

The main drawback with incorporating primary clarifiers is that they limit the space on site for a future biological process expansion for secondary treatment redundancy. The existing ditch is currently limited in terms of capacity and has been in service for over 20 years. As the equipment ages, increasing amounts of maintenance will be required. System redundancy provided by a second oxidation ditch will become more valuable. Also, to mitigate issues associated with variable loading, the City could consider incorporating other equalization measures, such as operating with a contact stabilization operating strategy, or selector zones upstream. Expanded oxidation is also the favorable option in terms of odor production; tank covers and a dedicated odor control system would be recommended for primary clarifiers.

6.1.3 Downstream Impacts

Digestion will be incorporated downstream of the secondary process and is discussed in Section 7. While this process is distinctly separate from primary and secondary treatment, it is impacted by the type of technology incorporated upstream. Primary clarification would produce primary sludge, which is beneficial for anaerobic digestion and production of biogas. Conversely, waste activated sludge from secondary treatment has minimal biogas production potential in anaerobic digestion. Accordingly, if there are no primary clarifiers, anaerobic digestion is typically nonviable.

6.2 Site Planning

Preliminary locations for equipment and associated piping are shown in Appendix F for consideration. Locations for solids processing equipment are also shown and described in Section 7. For background, the future locations for a second oxidation ditch and two additional secondary clarifiers are shown in the 2000 Record Drawings, an excerpt is included as Figure 6-1.

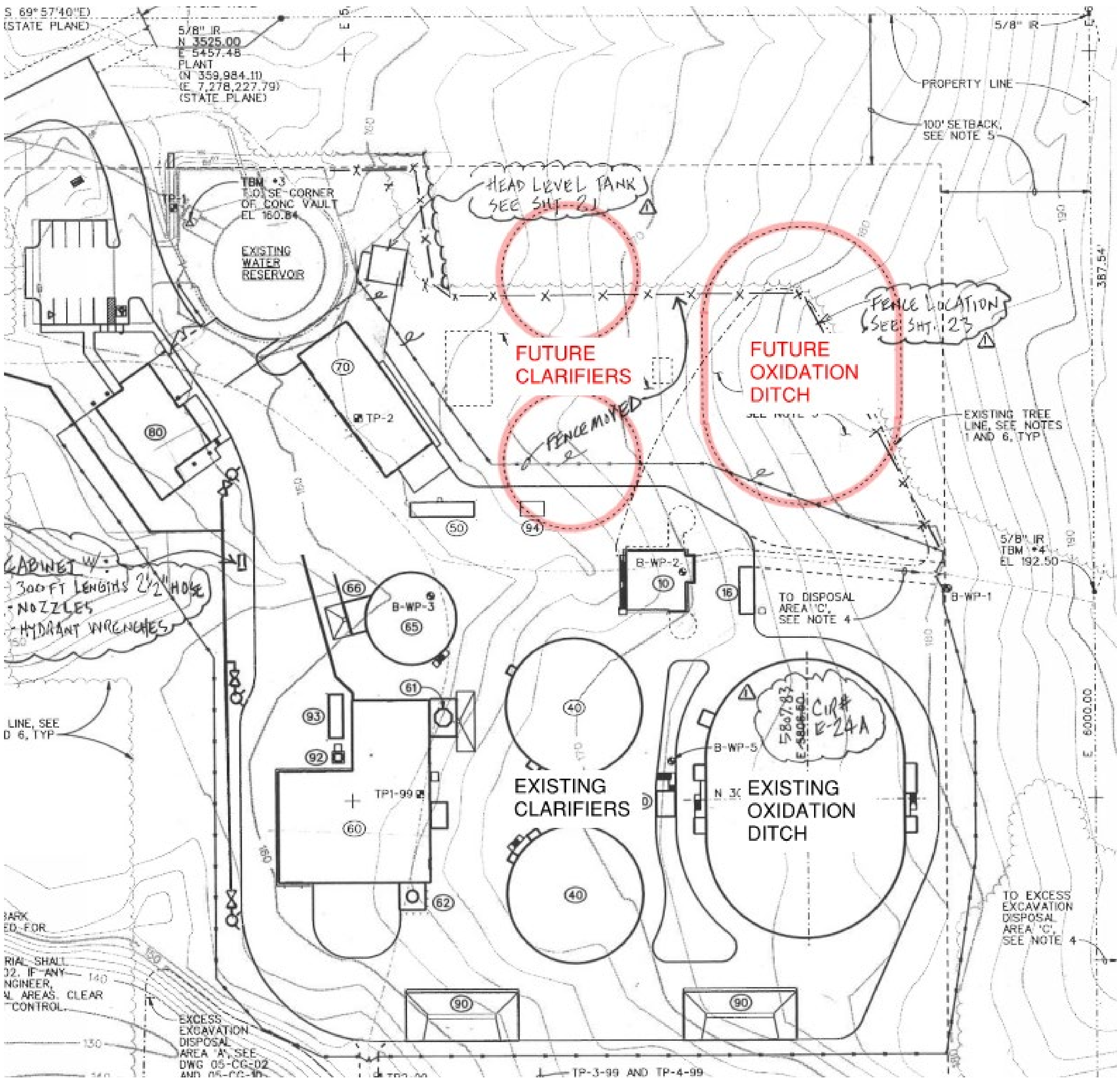

Figure 6-1. Future clarifier and oxidation ditch locations recommended per 2000 Record Drawings

The additional facilities were planned to be installed north of the existing facilities within a defined setback area from the property line (shown as a dashed line in the figure). Figure 6-2 shows the revised recommendations and will be discussed in the following sections.

Figure 6-2. Proposed oxidation ditch and clarifier locations

6.2.1 Second Oxidation Ditch

The area to the east of the existing ditch was also explored for expansion potential, however the steep slopes present in this direction would require significant earthwork to accommodate the required elevations for the proposed equipment. The proposed location for the second oxidation ditch is therefore unchanged from the 2000 record drawings, as shown on Figure 6-2.

6.2.2 Third Secondary Clarifier

The secondary clarifier expansion is proposed to change location from the 2000 record drawing layout. Flow projections and capacity analysis suggested a fourth secondary clarifier is not required at this time. Furthermore, there is space available to the south of the existing fence line that can house additional process equipment. The third clarifier can be located directly south of the two existing clarifiers–south of the fence line–to minimize lengths of site piping and streamline pumping between the existing and future clarifiers, as shown on Figure 6-2.

6.2.3 Primary Clarifiers

As part of alternatives evaluations, a site plan showing primary clarifiers was developed for consideration and cost estimating purposes. Two rectangular clarifiers would be recommended east of the headworks building and north of the existing oxidation ditch–each tank 16 feet wide by 80 feet long. As mentioned previously, the primary clarifier footprint would be significantly reduced when compared to a second oxidation ditch; an existing pull building could remain in this area that would require demolition for the second ditch.

6.3 Costs

The anticipated costs for liquid stream alternatives are included in Appendix C and summarized in Table 6-1.

Table 6-1. Liquids Alternatives Capital and 20-Year Cost Estimation

Description	Capital	Labor + Electricity	NPV
Second Oxidation Ditch + Third Secondary Clarifier	$27,197,000	$3,486,000	($31,978,000)
Primary Clarifiers + Third Secondary Clarifier	$25,574,000	$1,935,000	($28,543,000)

Costs for each alternative included a third secondary clarifier, additional RAS/WAS pumping, flow distribution equipment and piping, earthwork, demolition, paving, and electrical work. Running costs also considered were labor and electrical, for each alternative.

6.4 Recommended Improvements

Key recommended improvements are listed below:

1. Expand biological treatment by incorporating a second oxidation ditch.
2. Add a third secondary clarifier.

Capacity analyses suggest one additional oxidation ditch and one additional secondary clarifier will be sufficient to serve projected increased flows. These expansions will require additional RAS/WAS pumping and site piping to facilitate process flows between the additional equipment. An expanded process flow diagram is shown in Figure 6-3; red linework shows proposed additions to the existing network shown in black.

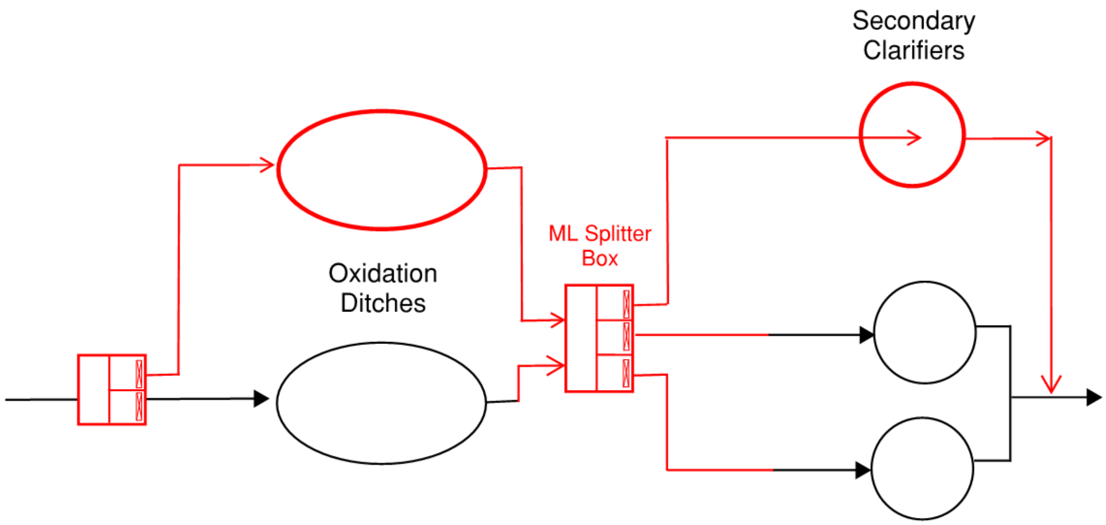

Figure 6-3. Proposed secondary treatment process flow diagram

As shown, flows can be distributed between the two oxidation ditches and three clarifiers using a mixed liquor splitter box. For the purposes of this analysis, the existing mixed liquor splitter box was assumed to be abandoned or demolished during construction of an entirely new splitter box. While process capacity is expanded overall, the ability to distribute flows also provides additional redundancy in case process equipment is taken out of service for maintenance or other unexpected shutdowns. Downstream of the clarifiers, a RAS flow mixing box (not shown) is also recommended to distribute RAS back to the oxidation ditches and WAS to the downstream solids process.

Detailed improvements to the disinfection system have been developed and are currently being incorporated into the existing system as time and funding allows. Key improvements are listed below. Preliminary costs are included as Appendix L.

1. Two new peristaltic chemical delivery pumps to replace the existing diaphragm pumps.
2. Associated pump skids to replace the existing chemical delivery system.
3. Addition of a chorine analyzer assembly to ensure accurate chemical dosing.
4. Submersible sewage pump to replace existing pump within the chlorine contact chamber.
5. Addition of a submersible mixer within the chlorine contact chamber.

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Section 7

Solids Stream Alternatives Evaluation

This section presents key alternatives for solids facility improvements and recommends additional processes to be incorporated into the wastewater treatment plant (WWTP).

7.1 Biosolids Regulations

Biosolids are the nutrient-rich organic material resulting from the treatment of sewage at domestic WWTPs. Through biosolids management, solid residue from the wastewater treatment process is treated to reduce or eliminate pathogens and minimize odors, forming a safe, beneficial product for land application or disposal.

Biosolids are regulated by both the U.S. Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (DEQ) to ensure quality standards are met. EPA's regulations can be found in 40 Code of Federal Regulations (CFR) Part 503 (Part 503) and DEQ's Chapter 340 Division 50 of the Oregon Administrative Rules (OARs) (Division 50). Regulations address pollutant concentrations, pathogen content, odor potential, and basic operational practices. Beneficial reuse of biosolids has long been preferred over historical disposal practices such as incineration or landfilling.

Land application practices and marketable biosolids products are encouraged, as an alternative to disposal, by state and federal regulatory authorities. Numerous publications from EPA and regional academic institutions such as Oregon State University, Washington State University, and University of Washington provide valuable information regarding biosolids management practices. DEQ's December 2005 biosolids guidance titled, "Implementing Oregon's Biosolids Program Internal Management Directive" (Biosolids IMD) provides very useful information for permit writers and the public regarding how Oregon administers state and federal biosolids regulations.

Currently, approximately 95 percent of biosolids in Oregon are beneficially used as Class B biosolids via agricultural land application or as Class A Exceptional Quality (EQ) biosolids as a marketable product (e.g., compost). Overall, there tends to be a slight reduction in biosolids beneficial use primarily because of the loss of farmland to development and decrease in public acceptance of Class B biosolids land application. There is an increasing trend, however, in the implementation of Class A EQ biosolids programs due to the decrease in available Class B biosolids land application sites. Overall, the regulatory outlook for biosolids management in Oregon remains supportive but there is a trend toward use of Class A EQ biosolids, and the additional flexibility presented to municipalities in markets for the end product.

7.1.1 Federal Regulations

Biosolids treatment for disposal and beneficial use is regulated at the federal level by the EPA to ensure quality standards are met. Promulgated in 1993, the Part 503 regulations set forth quality standards so that biosolids are protective of human health and the environment. Under these regulations, biosolids must meet risk-based pollutant limits and controls for pathogen reduction and vector attraction reduction (VAR). The rules also describe the requirements for land application, monitoring, testing, and reporting.

The federal regulations define two classes of biosolids based on pathogen reduction (i.e., Class B and Class A). Class B biosolids are treated but still contain detectable levels of pathogens. When utilizing Class B biosolids for land application, the site must be permitted. Agronomic application rates are specified and buffer requirements, public access restrictions, and crop harvesting restrictions must be met. This allows time for any pathogens that are present to be destroyed by environmental exposures to temperature changes, sunlight, drying, and competing soil microorganisms. Class A biosolids receive additional treatment and contain insignificant levels of pathogens. Class A biosolids that meet EQ standards have fewer restrictions on their use or sale to the public. Class A EQ biosolids meet the most stringent requirement for pathogens (Class A), vector control, pollutant concentrations, and are safe for unregulated use. In most cases, when a facility refers to producing a "Class A biosolids product" they meet the EQ designation as well. A review of Newport's biosolids quality testing data indicates the plant will likely meet the EQ standards in the future.

The following sections describe requirements for treating biosolids to reduce pathogens, VAR, pollutant concentrations (e.g., metals) as well as requirements for sampling and monitoring.

7.1.2 Class A Pathogen Reduction Requirements

Pathogen reduction can be achieved by treating solids prior to beneficial use or disposal and through environmental attenuation. Treatment processes are available that use a variety of approaches to reduce pathogens in solids making it a less effective medium for microbial growth (EPA, 2003). The 40 CFR Part 503 lists treatment technologies that are judged to produce biosolids with pathogens sufficiently reduced to protect public health and the environment. The regulation also allows the use of any other technologies that produce biosolids with adequately reduced pathogens as demonstrated through microbiological monitoring.

There are six alternative methods for demonstrating Class A pathogen reduction. The objective of these requirements is to reduce pathogen densities to below detectable limits. In addition to undergoing a treatment process, Class A biosolids must also be tested for bacteria. Class A biosolids must meet one of the following bacteria limits and one of the process treatment alternatives:

Biosolids must comply with one of the following bacteria limits:

- Fecal coliform is less than 1,000 Most Probable Number (MPN) per gram of total solids (dry weight).
- *Salmonella sp*. Bacteria density is less than 3 MPN per 4 grams total solids (dry weight).

Biosolids must meet one of the following treatment alternatives:

- Maintain the sludge at the time, temperature, and percent solids determined by using the formula in EPA Class A Alternative 1, per 503.32(a)(3).
- Maintain the temperature of the sludge above 52 degrees Celsius (ºC) (126 degrees Fahrenheit [ºF]) for 72 hours. The sludge must be above pH 12. Air dry the sludge to 50 percent solids or higher, EPA Class A Alternative 2, per 503.32(a)(4).
- Use a Process to Further Reduce Pathogens (PFRP) or equivalent treatment process approved by the permitting authority, EPA Class A Alternative 5 or 6, per 503.32(a)(7) and (8), and as listed in Table 7-1.

Table 7-1. Process to Further Reduce Pathogens	
Process	**Requirements**
Composting	Using either the within-vessel composting method or the static aerated pile composting method, the temperature of sewage sludge is maintained at 55 °C (131 °F) or higher for three consecutive days. Using the windrow composting method, the temperature of the sewage sludge is maintained at 55 °C (131 °F) or higher for 15 consecutive days or longer. During the period when the compost is maintained at 55 °C (131 °F) or higher, there shall be a minimum of five turnings of the windrow.
Heat Drying	Sewage sludge is dried by direct or indirect contact with hot gases to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the temperature of the sewage sludge particles exceeds 80 °C (176 °F) or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 °C (176 °F).
Heat Treatment	Liquid sewage sludge is heated to a temperature of 180 °C (356 °F) or higher for 30 minutes.
Thermophilic Aerobic Digestion	Liquid sewage sludge is agitated with air or oxygen to maintain aerobic conditions and the mean cell residence time (MCRT) (i.e., the solids retention time) of the sewage sludge is ten days at 55 °C (131 °F) to 60 °C (140 °F).
Beta Ray Irradiation	Sewage sludge is irradiated with beta rays from an electron accelerator at dosages of at least 1.0 megarad at room temperature (ca. 20 °C [68 °F]).
Gamma Ray Irradiation	Sewage sludge is irradiated with gamma rays from certain isotopes, such as Cobalt 60 and Cesium 137, at dosages of at least 1.0 megarad at room temperature (ca. 20 °C [68 °F]).
Pasteurization	The temperature of the sewage sludge is maintained at 70 °C (158 °F) or higher for 30 minutes or longer.

7.1.3 Class B Pathogen Reduction Requirements

The alternatives for Class B biosolids consist of either a treatment process, such as a Process to Significantly Reduce Pathogens (PSRP) or a fecal coliform bacteria limit. Biosolids must comply with the following bacteria limit:

- The geometric mean of the density of fecal coliform must be less than 2,000,000 MPN, per gram of total solids (dry weight).

Solids must undergo one of the PSRPs listed in Appendix B of 40 CFR Part 503 or an equivalent treatment method approved by the permitting authority (Table 7-2).

Table 7-2. Process to Significantly Reduce Pathogens	
Process	**Requirements**
Aerobic Digestion[a]	Sewage sludge is agitated with air or oxygen to maintain aerobic conditions for a specific MCRT (i.e., solids retention time) at a specific temperature. Values for the MCRT and temperature shall be between 40 days at 20 °C (68 °F) and 60 days at 15 °C (59 °F).
Air Drying	Sewage sludge is dried on sand beds or on paved or unpaved basins. The sewage sludge dries for a minimum of three months. During two of the three months, the ambient average daily temperature is above 0 °C (23 °F).
Anaerobic Digestion	Sewage sludge is treated in the absence of air for a specific MCRT (i.e., solids retention time) at a specific temperature. Values for the MCRT and temperature shall be between 15 days at 35 °C to 55 °C (131 °F) and 60 days at 20 °C (68 °F).
Composting	Using either the within-vessel, static aerated pile, or windrow composting methods, the temperature of the sewage sludge is raised to 40 °C (104 °F) or higher and remains at 40 °C (104 °F) or higher for five days. For four hours during the 5-day period, the temperature in the compost pile exceeds 55 °C (131 °F).
Lime Stabilization	Sufficient lime is added to the sewage sludge to raise the pH of the sewage sludge to 12 for ≥2 hours of contact.

a. The recommended aerobic digester will be sized for a MCRT of 25 days at a minimum operating temperature of 20 °C at design year conditions. This does not meet the requirements for a PSRP to achieve Class B biosolids but does provide some stabilization ahead of the Class A systems discussed in this section while maintaining good dewatering characteristics.

7.1.4 Vector Attraction Reduction Requirements

The pathogens in biosolids may pose a disease risk only if there are routes by which the pathogens are brought into contact with humans or animals (EPA, 2003). A primary route for transport of pathogens is vector transmission. Vectors are any living organism capable of transmitting a pathogen from one organism to another either mechanically or biologically by playing a specific role in the life cycle of the pathogen. Vectors for pathogens would most likely include insects, rodents, and birds. The VAR is accomplished by implementing one of the following:

- Biological processes which breakdown volatile solids, reducing the available nutrients for microbial activities and odor producing potential.
- Chemical or physical conditions which stop microbial activity.
- Physical barriers between vectors and volatile solids in the solids.

The term “stability” is often used to describe sewage sludge or biosolids. Although it is associated with VAR, stability is not regulated by 40 CFR Part 503. Stability is generally defined as the point at which food for microbial activity is no longer available (EPA, 2003). Solids which are stable will generally meet VAR but there are exceptions. Because stability is also related to odor generation and the continued degradation of solids, it is often considered an important parameter when producing Class A EQ biosolids for sale or distribution. Solids must undergo one of the VAR options set forth in 40 CFR Part 503, listed in Table 7.3.

Table 7-3. Vector Attraction Reduction Options

VAR Option	Requirements	Most Appropriate for the Following
#1-503.33(b)(1)	At least 38% reduction in volatile solids during sewage sludge treatment.	Sewage sludge processed by anaerobic or aerobic biological treatment.
#2-503.33(b)(2)	Less than 17% additional volatile solids loss during bench-scale anaerobic batch digestion of the sewage sludge for 40 additional days at 30 °C to 37 °C (86 °F to 99 °F).	Only for anaerobically digested sewage sludge that cannot meet the requirements of Option 1.
#3-503.33(b)(3)	Less than 15% additional volatile solids reduction during bench-scale aerobic batch digestion for 30 additional days at 20 °C (68 °F).	Only for aerobically digested liquid sewage sludge with 2% or less solids that cannot meet the requirements of Option 1 (e.g., sewage sludges treated in extended aeration plants). Sludges with 2% or greater solids must be diluted.
#4-503.33(b)(4)	Specific oxygen uptake rate (SOUR) at 20 °C (68 °F) is ≤ 1.5 mg oxygen/hr/g total sewage sludge solids.	Liquid sewage sludges (2% or less solids) from aerobic processes run at temperatures between 10 to 30 °C (50 to 86 °F) (should not be used for composted sewage sludges).
#5-503.33(b)(5)	Aerobic treatment of the sewage sludge for at least 14 days at over 40 °C (104 °F) with an average temperature of over 45 °C (113 °F).	Composted sewage sludge (For sewage sludges from other aerobic processes, it will likely be easier to meet Option 3 or 4.)
#6-503.33(b)(6)	Addition of sufficient alkali to raise the pH to at least 12 at 25 °C (77 °F) and maintain a pH ≥ 12 for 2 hours and a pH ≥ 11.5 for 22 more hours.	Alkali-treated sewage sludge (alkaline materials include lime, fly ash, kiln dust, and wood ash).
#7-503.33(b)(7)	% solids ≥ 75% prior to mixing with other materials.	Sewage sludges treated by an aerobic or anaerobic process (i.e., sewage sludges that do not contain unstabilized solids generated in primary wastewater treatment).
#8-503.33(b)(8)	% solids ≥ 90% prior to mixing with other materials.	Sewage sludges that contain unstabilized solids generated in primary wastewater treatment (e.g., heat-dried sewage sludges).

Table 7-3. Vector Attraction Reduction Options		
VAR Option	Requirements	Most Appropriate for the Following
#9-503.33(b)(9)	Sewage sludge is injected into soil so that no significant amount of sewage sludge is present on the land surface 1 hour after injection, except Class A biosolids which must be injected within 8 hours after the pathogen reduction process.	Sewage sludge applied to the land or placed on a surface disposal site. Domestic septage applied to agricultural land, a forest, or a reclamation site, or placed on a surface disposal site.
#10-503.33(b)(10)	Sewage sludge is incorporated into the soil within 6 hours after application to land or placement on a surface disposal site, except Class A biosolids which must be applied to or placed on the land surface within 8 hours after the pathogen reduction process.	Sewage sludge applied to the land or placed on a surface disposal site. Domestic septage applied to agricultural land, forest, or a reclamation site, or placed on a surface disposal site.

7.1.5 Pollutant Concentration Requirements

Biosolids for beneficial use must meet risk-based pollutant limits to protect public health and the environment. The 40 CFR Part 503 rules (Section 503.13) set regulatory limits for certain pollutants (metals) and requires biosolids be used in accordance with approved management practices including operational standards, monitoring, recordkeeping, and reporting.

The nine pollutants regulated are arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), and zinc (Zn). These limits determine how Oregon regulates land application under a permit. The regulatory limits are included in the sections to follow.

7.1.5.1 Ceiling Concentration Limits

This is the maximum concentration of each pollutant allowed in biosolids for beneficial use. According to 40 CFR Part 503, biosolids containing any pollutant that exceeds the Ceiling Concentration Limits (CCLs) cannot be beneficially used. This is also known as EPA Table 1, which is shown in the second column of Table 7-4 below.

7.1.5.2 Cumulative Pollutant Loading Rate

The Cumulative Pollutant Loading Rate (CPLR) is the maximum amount of a pollutant that can be applied to a site over its lifetime by all biosolids applications meeting ceiling concentration limits. Biosolids applications must be discontinued when any one of the pollutants reaches its maximum CPLR. This is also known as EPA Table 2, which is shown in the third column of Table 7-4 below.

7.1.5.3 Pollutant Concentration Limits

The Pollutant Concentration Limits (PCLs) are used along with the pathogen reduction and VAR requirements as quality standards for EQ biosolids. Biosolids with pollutant concentrations below the PCLs can be sold or given away without a permit from EPA or DEQ. However, these Class A EQ biosolids must still be land-applied at agronomic rates. Biosolids with pollutant concentrations above the PCL require a permit, applied at an agronomic rate, and the cumulative amounts of pollutants must be tracked. This is also known as EPA Table 3, which is shown in the fourth column of Table 7-4 below.

7.1.5.4 Annual Pollutant Loading Rate

The Annual Pollutant Loading Rate (APLR) sets the maximum amount of a pollutant that can be applied during a 365-day period. These rates apply to non-EQ biosolids. This is also known as EPA Table 4, which is shown in column 5 of Table 7-4 below.

Table 7-4. Pollutant Limits and Loading rates for Biosolids

Pollutant[a]	Ceiling Concentration Limits, EPA Table 1 (mg/kg)[b]	Cumulative Pollutant Loading Rate Limits, EPA Table 2 (mg/kg)[b]	Pollutant Concentration Limits, EPA Table 3 (mg/kg)[b]	Annual Pollutant Loading Rate Limits, EPA Table 4 (mg/kg/365-d-period)[b]
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum	75	-[c]	-[c]	-[c]
Nickel	420	420	420	21
Selenium	100	100	100	5.0
Zinc	7,500	2,800	2,800	140

a. Source: EPA 40 CFR Part 503; University of Georgia Extension (March 2017).

b. Dry-weight basis: mg/kg (milligrams per kilogram); kg/ha (kilograms per hectare).

c. February 25, 1994, 40 CFR Part 503 Rule Amendment deleted the molybdenum limits but retained the molybdenum CCL.

7.1.6 Oregon State Regulations

In addition to federal requirements, DEQ also implements regulations overseeing biosolids management in Oregon. OAR 340-050 incorporates all the legal requirements in 40 CFR Part 503 but goes further to require specific plans for land application, best management practices (e.g., setbacks), and additional public notice requirements.

In Oregon, biosolids are regulated under DEQ's water quality program through a water quality permit (NPDES or Water Pollution Control Facility permit), a biosolids management plan, and land application site authorization letters. The permit, management plan, and site authorization letters are specific to a facility and include conditions relevant to both state and federal regulations. The conditions in the management plan and site authorization letters are considered an integral part of the permit and thus are enforceable. Oregon's biosolids regulations are more restrictive than federal regulations.

Each permit is open for public comment when the facility's permit is renewed. The facility's biosolids management plan is also open for public comment when the facility's permit is renewed and anytime there are significant changes to the management plan. The public comment period is at least 30 or 35 days depending on the type of permit.

7.1.7 Future Biosolids Regulations

As part of this project, Kennedy Jenks (KJ) contacted DEQ's biosolids program staff to discuss their opinion regarding current and future trends in biosolids management. The staff at DEQ mentioned there is a general trend of moving from Class B to Class A EQ programs in Oregon. The trend allows more flexibility in biosolids product use, protects against any unforeseen regulatory changes, and addresses common public perception issues encountered with Class B land application. Also, there is continued public perception challenges on the Oregon Coast. Concerns are focused on odor, emerging contaminants, and lack of regulatory oversight.

When discussing potential future regulatory requirements, DEQ staff stated they did not foresee any immediate changes to OAR 340-050. However, they are intending on issuing a general permit for biosolids land application to allow facilities an additional option for permitting beneficial use.

The DEQ believes that much of the challenge associated with managing biosolids is the result of increased growth in rural areas. The urbanization of the Willamette Valley will continue to result in less local Class B land application sites and thus, more reliance on distant land application or Class A options for municipalities. On a federal level, new requirements will be implemented requiring utilities to test for per- and polyfluoroalkyl substances (PFAS).

The DEQ has designated PFAS as one of 60 priority chemicals or chemical classes for its Toxics Reduction Strategy. In addition, DEQ is working with the Oregon Health Authority (OHA) and other federal, state, and local agencies to address growing public health and environmental concerns. DEQ and OHA are evaluating appropriate policy responses to protect public health and the environment from PFAS contamination.

DEQ air, land, and water programs are taking the following steps to address PFAS:

- Identifying sites that may use PFAS in their operations.
- Overseeing site testing and assessment of impacts. This may include biosolids land application sites.
- Using newly developed analytical methods for testing for PFAS in water and working with the EPA and other agencies to develop testing methods for soil and biosolids.
- Using Cleaner Air Oregon's data on requested toxic pollutant emissions reports from industries that included PFAS.

7.2 Solids Alternative Descriptions

This Section presents process descriptions for Hauled Waste Receiving, Thickening, Stabilization, Dewatering, and Class A Biosolids Treatment. Sizing and design criteria for the solids processes described this this Section are included in the August 2022 Solids Stream Basis of Design and September 2022 Centrifuge Replacement Evaluation TMs prepared by KJ, included as Appendix J and Appendix E, respectively.

7.2.1 Hauled Waste

A new, packaged hauled waste system to receive septage trucked to the WWTP is included with each solids stream alternative evaluated in this report. The packaged system includes a truck unloading station, with an optional ticketing system for tracking loads. The proposed system is based on a Huber RoFas packaged receiving system which includes a 10-millimeter (mm) rotary drum screen, washer compactor, and grit and grease removal equipment. An optional rock trap can also be provided. An example installation of the Huber RoFas system is shown on Figure 7-1.

Figure 7-1. Huber RoFas packaged hauled waste system

(Source: Huber)

7.2.2 Stabilization

As discussed in Section 3.6, the current RDP Lime Stabilization system is reaching the end of its useful life, parts and support are increasingly difficult to obtain, and the system is not adequately sized for future biosolids production rates. The solids master planning effort has evaluated the following alternatives regarding stabilization:

1. **Lime Stabilization (base case scenario)**–Dewatered WAS would continue to be lime stabilized.
2. **No Stabilization**–Dewatered WAS would be discharged to an alternate Class A biosolids process, such as composting or indirect, belt dryer.
3. **Aerobic Digestion**–Thickened WAS would be discharged to an aerobic digester, capable of producing either Class A or B biosolids. The evaluation is based on conventional aerobic digestion. Alternatives such as Autothermal Thermophilic Aerobic Digestion are not evaluated due to high energy demands and odor potential associated with these processes.
4. **Anaerobic Digestion**–Thickened WAS would be discharged to an anerobic, mesophilic digester capable of producing Class A or B biosolids. Alternatives such as Thermophilic digestion and Thermal Hydrolysis pre-treatment were not evaluated.

Due to the issues with the existing RDP system discussed in Section 3.6, continued lime stabilization was eliminated from further consideration as its continued use is not feasible in the long term due to poor biosolids quality and difficulty obtaining support to maintain the equipment.

The production of Class A biosolids can be achieved without stabilization by either sufficiently drying the dewatered WAS or achieving volatile solids reduction through amending with a substrate and aerating. Belt dryers that heat solids indirectly and composting are evaluated in this report as Class A treatment alternatives. The lack of a stabilization step does not negatively impact the quality of the finished compost product; however, dried solids that have not been stabilized can be odiferous when re-wetted. The lack of a stabilization step also results in more solids that needs to be handled. For these reasons, solids alternatives that do not include stabilization were eliminated from further consideration.

7.2.2.1 Aerobic Digestion

In addition to improving odor characteristics and reducing the volume of handled materials, digestion provides additional treatment which improves the consistency of the finished product as well as the performance of downstream processes, such as dewatering and Class A drying.

Aerobic digestion is defined as the biological conversion of organic matter in the presence of air or oxygen. During aerobic digestion, bacteria convert organic matter to carbon dioxide, water, ammonia, new cellular biomass, and energy through oxidation. In the presence of adequate oxygen and declining food supply, the microorganisms convert their own protoplasm to energy that is used for cell maintenance purposes also known as endogenous metabolism. It is typically used at plants that have flow rates less than 5 mgd, but it has been installed at larger plants. The process requires higher energy to operate aeration equipment compared with anaerobic digestion. The space requirement is also slightly higher than anaerobic digestion, but the process is considered more stable under variable feed conditions and less labor intensive to operate.

Figure 7-2 shows an example of a rectangular aerobic digester.

Figure 7-2. Aerobic Digester

(Source: Ovivo)

Aerobic digestion can be used as a part of biosolids processing system to produce Class A and Class B biosolids, and is specifically discussed in EPA's biosolids regulations:

- **40 CFR 503.32(b)(3)**–Aerobic digestion is allowed as a PSRP to satisfy the pathogen reduction requirements for Class B biosolids. MCRT and temperature must be between 40 days at 20 °C (68 °F) and 60 days at 15 °C (59 °F).
- **40 CFR 503.33(b)(1)**–When aerobic digestion achieves a minimum volatile solids destruction of 38%, it may be used to satisfy the VAR requirements of this regulation.
- **40 CFR 503.33(b)(3)**–When aerobic digestion does not achieve a minimum volatile solids destruction of 38%, additional bench testing may be used to satisfy VAR requirements of this regulation.

Aerobic Digestion Process Considerations. Conventional aerobic digestion uses air to transfer oxygen to the sludge to facilitate the cell reproductive process. Oxygen requirements are typically based on volatile solids destruction requirements. Oxygen transfer is typically achieved through diffused air but can also be supplied by submersible jet aeration. Target (DO concentrations are between 0.4 and 1.0 parts per million (ppm) and 1.4 pounds of oxygen per pound of volatile suspended solids (VSS) destroyed. Ammonia is oxidized to nitrate in the aerobic process, causing reduced alkalinity and pH. Typically, the air is cycled off to promote denitrification and lower the nitrate concentrations in the return stream, which also stabilizes the alkalinity and raises the pH by producing carbon dioxide.

Mixing of the aerobic digester can lead to higher levels of air diffusion depending on the configuration of the digester and is typically required to keep solids from settling out of suspension. Mixing of the digester can be achieved by mechanical devices such as surface mounted or submersible mixers, jet (pump) mixing, or draft tubes. Jet mixing can be accomplished with submersible pumps or using pumps external to the tank and connected to an eductor mixing system.

Odors from new aerobic digesters will be less than the existing reactor because the digester will be designed to handle the plant's solids quantities and typically would remain uncovered. However, covering the aerobic digesters can provide benefits:

- Temperatures can be maintained slightly higher in winter to achieve the desired volatile solids destruction in less time.
- Improved operations and maintenance (O&M) access to any location at the tank top over a standard open top tank configuration with perimeter walkways.

Biological activity in the digester leads to the breakdown of cellular material and soluble BOD remaining in the WAS and hauled waste. Byproducts of the reaction are nitrate (conversion from ammonia by nitrification), water and hydrogen ions. The reaction kinetics follow a first order decay rate, which varies based on temperature. The optimal temperature for aerobic digestion ranges between 20 °C (68 °F) and 35 °C (95 °F). At temperatures below 10 °C (50 °F) biological activity is severely reduced, and nitrification is inhibited.

Class B biosolids requirements to provide a 40-day MCRT during the maximum loading condition projected for year 2040 indicate a tank volume of 0.28 million gallons (MG) would be required based on the projected solids and hauled waste loads. A covered digester is assumed to better maintain a temperature of at least 20 °C (68 °F). The tank may also be partitioned and run with a 25-day MCRT ahead of a Class A process to maintain optimum dewaterability. By constructing sufficient volume to provide a 40-day MCRT, the plant would be able to produce Class B biosolids if the Class A treatment system was offline for an extended period.

Often municipalities may operate at shorter residence times of 20 to 30 days and still meet Class B based on SOUR or bench testing. The SOUR test is based on the biosolids consuming very little oxygen, which indicates their value as a food source to microorganisms is very low and therefore active microbes are unlikely to be attracted to them. This test is only applicable to liquid aerobic biosolids sampled from an aerobic process.

Research conducted on similar plants running aerobic digesters in Washington State with conventional secondary treatment found an average SRT of 30 days or less is required to achieve Class B VAR requirements based on SOUR testing results. The cities of Shelton (28-29 days SRT), and Gig Harbor, Washington (20-25 days SRT), operate aerobic digesters at an average SRT of less than 30 days. Given the City intends to meet Class A requirements, the need to make Class B biosolids will only be for times when the Class A treatment system is down for extended maintenance.

Extended residence time in the digester to achieve Class B can also create issues with dispersed floc, due in part to the release of soluble proteins and polysaccharides from the breakdown of cellular material, making subsequent dewatering of the biosolids more difficult. Studies have shown that addition of positively charged ions such as calcium or magnesium can improve floc formation and dewaterability in aerobic digesters (Murthy and Novak, 1999) and (Novak, et al, 1998). The addition of calcium or magnesium is not likely to be required given the ability to control cell residence time in the digester and operate on a shorter MCRT of 25 days. If calcium or magnesium were required to improve dewaterability, these chemicals would be added periodically using bulk bags and are not assumed to be liquid metering systems.

Advantages and Disadvantages of Aerobic Digestion. The advantages and disadvantages of aerobic digestion are summarized in Table 7-5.

Table 7-5. Aerobic Digestion–Advantages and Disadvantages

Advantages	Disadvantages
• Ability to meet Class B biosolids at ambient temperatures, likely without chemical addition • Relatively simple operational control, amenable to variations in sewage sludge feed composition • It is a common treatment technology for small to medium sized wastewater treatment facilities, and thus excellent operational knowledge exists in the industry • Volatile solids destruction exceeding 38% or demonstrating required stabilization by alternative testing methods • Relatively low strength recycle stream as compared with anaerobic digestion • Improved safety without the generation of methane (as compared with anaerobic digestion) • Limited equipment to maintain	• High energy and capital cost requirements for aeration • Extended retention times to meet PSRP requirements • Dispersed floc can sometimes be difficult to dewater at higher SRT • Stabilization is reduced at colder water temperatures (i.e., winters in the Pacific Northwest) resulting in the need for longer detention times or addition of covers to help maintain temperature • Larger volume required compared to anaerobic digestion • No ability to harvest or reuse biogas

7.2.2.2 Anaerobic Digestion

Anaerobic digestion is a biological process in which anaerobic bacteria convert organic matter into methane and carbon dioxide (sometimes called biogas) in the absence of air. The process stabilizes the organic matter in wastewater solids, reduces pathogens and odors, and reduces the total solids quantity. Solids are reduced by converting the volatile solids fraction of the wastewater into biogas. Digesters run at mesophilic temperature ranging between 30 to 38 °C (85 to 100 °F) or thermophilic temperature ranging between 49 to 60 °C (120 to 140 ºF) which result in solids destruction. Thermophilic digestion can produce Class A biosolids and has higher biogas outputs than conventional mesophilic digestion. Figure 7-3 shows an example of an anerobic digester.

Figure 7-3. Anaerobic digester

Anaerobic digestion generally requires less tank volume than aerobic digestion and produces biogas as a byproduct of the anaerobic decomposition process. However, the mesophilic anaerobic process evaluated requires a biogas or natural gas-fired sludge heating system to maintain sludge temperatures at 30 to 38 °C (86 to 100 °F) increasing the rate of digestion. When biogas is used to offset natural gas or electricity needs, the benefit can be significant and may offset some or all treatment facility energy costs.

Anaerobic digestion can be used as part of a biosolids processing system to produce Class A and Class B biosolids, and is specifically discussed in EPA's biosolids regulations:

- **40 CFR 503.32(b)(3)**–Anaerobic digestion is allowed as a PSRP to satisfy the pathogen reduction requirements for Class B biosolids. MCRT and temperature must be between 15 days at 35 to 55 °C (95 to 131 °F) and 60 days at 20 °C (68 °F).
- **40 CFR 503.33(b)(1)**–When anaerobic digestion achieves a minimum volatile solids destruction of 38 percent, it may be used to satisfy the VAR requirements of this regulation.
- **40 CFR 503.33(b)(2)**–When anaerobic digestion does not achieve a minimum volatile solids destruction of 38 percent, additional bench testing may be used to satisfy VAR requirements of this regulation.

Anaerobic Digestion Process Considerations. As stated, anaerobic digestion reduces the total solids quantity by converting part of the volatile solids fraction to biogas. Biogas, which is about 60-percent methane and 40-percent carbon dioxide, has historically been either used to power boilers, to heat digesters, used to run reciprocating engines to generate power, or flared. This process operates best under a constant homogeneous feed.

Advantages and Disadvantages of Anaerobic Digestion. The advantages and disadvantages of anaerobic digestion are summarized in Table 7-6.

Table 7-6. Anaerobic Digestion–Advantages and Disadvantages	
Advantages	**Disadvantages**
• Ability to meet Class B biosolids requirements at lower electrical cost and residence time. • Generates biogas, which can be used for heating or renewable energy. • Lower capital cost due to smaller tank volume required. • Suitable for cold environments. • Potential volatile solids destruction exceeding 55 percent. • Could potentially allow acceptance of outside feedstocks for co-digestion (e.g., FOG and Food Waste) that would provide additional tipping fees and increase gas production.	• High operation and maintenance costs for sewage sludge heating and mixing equipment. • Proper operation requires primary wasting, which is not currently available at the WWTP. • Greater operational complexity; potential for upset and slow startup/recovery period following upsets. • Safety risk due to handling of potentially explosive digester gas. • Typically, most cost effective with primary or raw sewage sludge, where more "food" is available as opposed to more stabilized septage and hauled sewage sludge. • Requires consistent and continuous solids feed for stability (not amenable to wide variability associated with hauled waste receiving). • Greater potential for odor generation.

7.2.3 Class A Treatment

Two key options are available for treatment of solids to a Class A product.

7.2.3.1 Compost

Composting is a treatment process that uses time and temperature to produce a final product that meets Class A pathogen reduction criteria and is highly marketable.

There are four general methods of composting including aerated static pile, covered aerated static pile (CASP), windrow, and in-vessel systems. Each method involves mixing dewatered biosolids with a "bulking material" to provide carbon and increase porosity. The resulting mixture is placed in a vessel or pile where microbial activity causes the temperature of the mixture to rise during the "active composting" period. The specific temperatures that must be achieved and maintained for successful composting vary based on the method and use of the biosolids end-product. After active composting, the material is screened, cured, and distributed for public use.

7.2.3.1.1 Compost Bulking Materials and Ratios

A carbon source is a necessary component of a composting system because it provides the energy and predominant cellular mass for compost, along with the "nitrogen" derived from the biosolids that is consumed during the active composting process. In addition to the carbon and nitrogen materials, a "bulking agent" is added which allows air to flow through the compost mixture. Typically, the carbon source and bulking agent together are referred to as the "bulking material."

Ground wood waste, hog fuel, green waste, or yard debris are regularly used as carbon sources in composting operations. Primary compost feed stocks typically consist of an easily degradable carbon source. As a carbon source, the primary purpose of the wood waste material is to break down during the composting process and, thus, a finer grade of material is desirable. The use of yard debris as a primary carbon source is desirable when material is relatively free of grass clippings, plastics, metals, and other contaminants. Yard debris is typically ground to a finer degree prior to being added to a composting process.

The use of wood chips for a bulking agent requires a coarser grade of material that will be screened-out after composting and reused. In this case, the size and other characteristics of the wood chips must be tailored to the aeration system and other operational parameters.

Covered Aerated Static Pile Technology Summary. For the purposes of this report, the CASP composting technology was considered. This technology was considered because it is a commonly used composting system proven to meet Class A regulatory requirements, and the final biosolids end-product is marketable for distribution to the public.

The CASP composting is a forced aeration composting system for treating blended piles of organic residuals. The CASP process utilizes the process of aerobic biological degradation to reduce pathogens and organic solids. Process airflow pushed through the piles provides adequate oxygen to support the microbial community while controlling the pile temperature. The CASP composting utilizes a cover (e.g., porous membrane or finished compost product) over the pile to control moisture levels, odor emissions, and reduce temperature variability. In addition, the capital costs for CASP are lower than aerated static piles (without covers) with fewer permanent structures required. The covered piles are aerated under positive and negative pressure using blowers with low energy requirements.

The CASP composting process takes place by means of controlled pressurized aeration in encapsulated windrow covers. A resultant insulating layer of air guarantees an even distribution of temperature in the body of the heap. The cover also works as a physical barrier against odors and other gaseous substances escaping from the composting material.

The aeration piping and leachate collection system are combined in an "in-floor" system with permanent aeration trenches. The aeration trenches have perforated metal lids and also serve as a leachate collection system. The biosolids composting process can take six to eight weeks and occurs in three phases. The City of Albany's CASP composting facility is shown in Figure 7-4.

Figure 7-4. Compost facility

Advantages and Disadvantages of Composting. The advantages and disadvantages of composting are summarized in Table 7.7.

Table 7-7. Composting–Advantages and Disadvantages	
Advantages	**Disadvantages**
• Composting is a relatively simple, reliable technology. • Composting is the most used technology for achieving Class A biosolids standards according to the EPA. • Composting produces a highly marketable biosolids end-product that is typically well accepted by the public. • Composting can be gradually phased in with additional compost piles added over time. • There is sufficient space at the WWTP for a composting facility. • The City may be able to secure the bulking agent at little to no cost.	• Total volume of Class A biosolids will be greater than other alternatives because of the addition of bulking material (e.g., wood chips and yard debris) needed for the composting process. • The time required for the process to achieve Class A is the highest of the alternatives considered.

7.2.3.2 Dryer

Thermal drying technology removes water via evaporation from dewatered biosolids, reducing the volume and weight. The high temperatures utilized by a dryer ensure that the EPA time and temperature requirements for Class A biosolids are met. Thermal drying typically results in a material with a solids content greater than 90% dry weight.

A thermally dried Class A EQ biosolids product has universal applications. The dried biosolids can supplement fuel in the drying process, can be land-applied for reclamation and other soil improvement projects, or blended with other materials to create fertilizer.

Thermal drying can be accomplished by one of two main drying technologies: indirect convection or indirect conduction dryers. Direct dryers expose the biosolids to open flame and are not considered further in this evaluation. Figure 7-5 shows an image of an indirect belt dryer.

Figure 7-5. Indirect belt dryer

(Source: Centrisys)

Advantages and Disadvantages of Drying. The advantages and disadvantages of drying are summarized in Table 7-8.

Table 7-8. Drying–Advantages and Disadvantages	
Advantages	Disadvantages
• Thermal drying generates the least volume of biosolids because of the high solids concentration (>90 percent) and the absence of bulking agents such as lime or yard debris. This greatly reduces the amount of storage needed. • The cost of transport is reduced due to the volume reduction of the product compared to other treatment methods. To haul the same quantity of biosolids, three to four times as many truckloads are required to transport dewatered biosolids compared to a dried product. • Dryer facilities would be located at the WWTP site and do not require offsite land acquisition or lease agreements as is the case with composting. • Biosolids end-product is highly stable and less voluminous when compared to lime pasteurized products. • Biosolids end-product can be easily blended with landscape products (e.g., soil and compost mixes) to generate further markets of beneficial use. • Dryers are a popular technology for achieving Class A biosolids throughout the globe. • Several vendors that offer this technology.	• Adequate digestion is required to mitigate or eliminate the odor that can occur when a dried biosolids product is wetted in the environment. • Drying is an energy intensive process and is thus very sensitive to changes in fuel costs and increased moisture due to poor dewatering. Drying will require a new natural gas service be constructed into the WWTP site. The high end of the range of gas consumption was used in the alternatives analysis presented in Section 7.4. • The dryer can be operated intermittently, 16 hours per day, 4 days per week, which is preferred by the City based on current WWTP staffing. However, the dryer will operate with decreased energy efficiency due to daily heat up and cool down cycles, during which time the dryer will not be treating solids. • Due to their high organic content, both the heat-drying end-product and the dust generated during production of the end-product are flammable, and precautions must be taken to design the heat-drying process, equipment, and storage to minimize the potential for explosion or fire. The dryer will be outfitted with classified electrical equipment that meets the hazard classification based on the National Fire Protection Association (NFPA) Publication 820, latest edition.

7.2.4 Ancillary Processes

Sludge thickening and biosolids dewatering are recommended to be incorporated into the solids stream process.

7.2.4.1 Thickening

Sludge thickening is a physical process and is normally the first unit process in a plant's solids stream. The purpose of this unit process is to reduce the water content (increase solids concentration) of the WAS captured during the secondary clarification process. Thickening before sludge stabilization processes can aid in reducing the volume of tankage needed for downstream activities. For this report, thickening is included in the treatment alternatives with solids stabilization processes.

Solids thickening is achieved through physical separation of solid particles from liquid. The mechanism used for separation is often one of the following: centrifugal force, filtration, screening, sedimentation, or flotation. The effectiveness of the separation mechanism can depend upon hydraulic flow rate, solids loading rate, and the quantity of chemicals used for increasing particle size (e.g., polymer flocculation).

Rotary Drum Thickener. The use of rotary drum thickeners (RDTs) was assumed for this analysis. While there are other thickening technologies available, RDTs are more commonly used for new installations and are representative of the costs associated with thickening, as a whole. In addition, the relative cost difference in thickening operations between treatment train alternatives was expected to be the same regardless of thickening technology assumed. If thickening is needed for the selected treatment train alternative, other thickening processes will be considered during preliminary design and the advantages and disadvantages of each will be considered in more detail for the best fit for the WWTP.

RDTs are often used due to their mechanical simplicity, small footprint, low power requirements, and moderate capital cost. Sludge is conditioned with polymer before being introduced into a rotating drum screen. Free water drains through the screen openings and collects in a trough underdrain. Thickened sludge is conveyed through the rotating drum and out the discharge end via a continuous internal screw or angled flights. The drum is sometimes inclined to aid in dewatering.

A thickened solids content of three to five percent is typically obtained with RDTs, depending upon the solids concentration in the feed sludge. Polymer addition in the range of 8 to 12 lbs per dry ton is required for optimum thickening and represents most of the operational costs. Between 93 to 99 percent of solids are retained with this process. The unit is typically monitored whenever it operates to ensure proper function and accommodate fluctuating sludge characteristics by adjusting polymer dosage, feed rate, and drum speed. A typical RDT is shown on Figure 7-6.

Figure 7-6. Rotary drum thickener

(Source: FKC)

Thickener Considerations. Thickening facilities were assumed to include the following:

- Installation in the existing lime processing room
- Two equal capacity rotary drum thickeners sized for continuous, parallel operation.
- Odor control
- Polymer feed system
- New Thickening Feed Pumps installed in the Solids Handling Building gallery.
- Controls and electrical equipment
- Continued use of the existing WAS Storage Tank
- RDT operation allows for continuous, unattended operation, providing 24/7 wasting and Thickened WAS feed to the stabilization process.

7.2.4.2 Dewatering

Dewatering is the removal of water from biosolids to reduce the weight and volume of solids that require hauling and application. There are several dewatering technologies available such as a belt filter press, fan press, or screw press; however, as the City is soon moving forward with an emergency centrifuge replacement project, this evaluation will be based on centrifuge dewatering.

Centrifuge Dewatering. In a centrifuge, the applied centrifugal force causes suspended solids to migrate through the liquid away from the axis of rotation due to the difference in densities between the solids and liquids. The solids are then conveyed via auger, also called a scroll, to one end of the machine for discharge. The liquid filtrate overflows a weir and is discharged from the opposite end of the machine. The bowl and the scroll are controlled by separate drives, rotate at different speeds, and have relatively high electrical energy demands. High speed centrifuges can produce cake with solids concentrations higher than those produced using lower energy technologies. When using polymer, centrifuges can typically produce dewatered cake with 20 to 25 percent solids content and usually capture more than 95 percent of the solids. Conditioning with polymers is required to prevent floc shear and to improve centrate quality and solids capture.

Centrifuge dewatering is a closed process, which makes for easy containment of odors. The liquids and solids discharge from the bottom of the machine by gravity. The controlled discharge and containment of the dewatering mechanism allow for localized odor control at the liquids and solids discharge ports. Dewatered cake from a centrifuge is generally more odorous and odor control is required on the cake and centrate outlets. Because odor control is at point sources, smaller foul air volumes must be treated.

Centrifuges require operator attention, and therefore cannot be operated unattended. For this reason, the dewatering process as well as downstream processes are recommended to run 16 hours per day, 4 days per week to align with the WWTP's staffing availability.

As discussed in Section 3.6, and referenced in Appendix E, the existing centrifuges are undersized and have reached the end of their useful life and will be replaced. A photo of the existing centrifuges is shown on Figure 7-7. The existing odor control equipment serving the existing centrifuges will need to be evaluated in terms of size and condition for continued service following centrifuge replacement.

Figure 7-7. Existing dewatering centrifuges

7.3 Solids Alternative Site Plans

A preliminary overall site plan depicting proposed solids improvements is shown on Figure 7-8.

7.3.1 Hauled Waste Receiving

The proposed packaged Hauled Waste facility would be installed adjacent to the existing station to allow for the continued receipt of septage during construction. Consideration was made to relocate hauled waste receiving to the NSPS; however, that concept was abandoned early in the master planning process. Septage receiving and construction traffic/access would be coordinated during design. As there are no other nearby septage disposal locations, and waste from facilities at nearby tourist areas are hauled to the plant, continuation of septage receiving is desired. Septage receiving also brings in approximately $80,000 to $100,000 annually in revenues to the City.

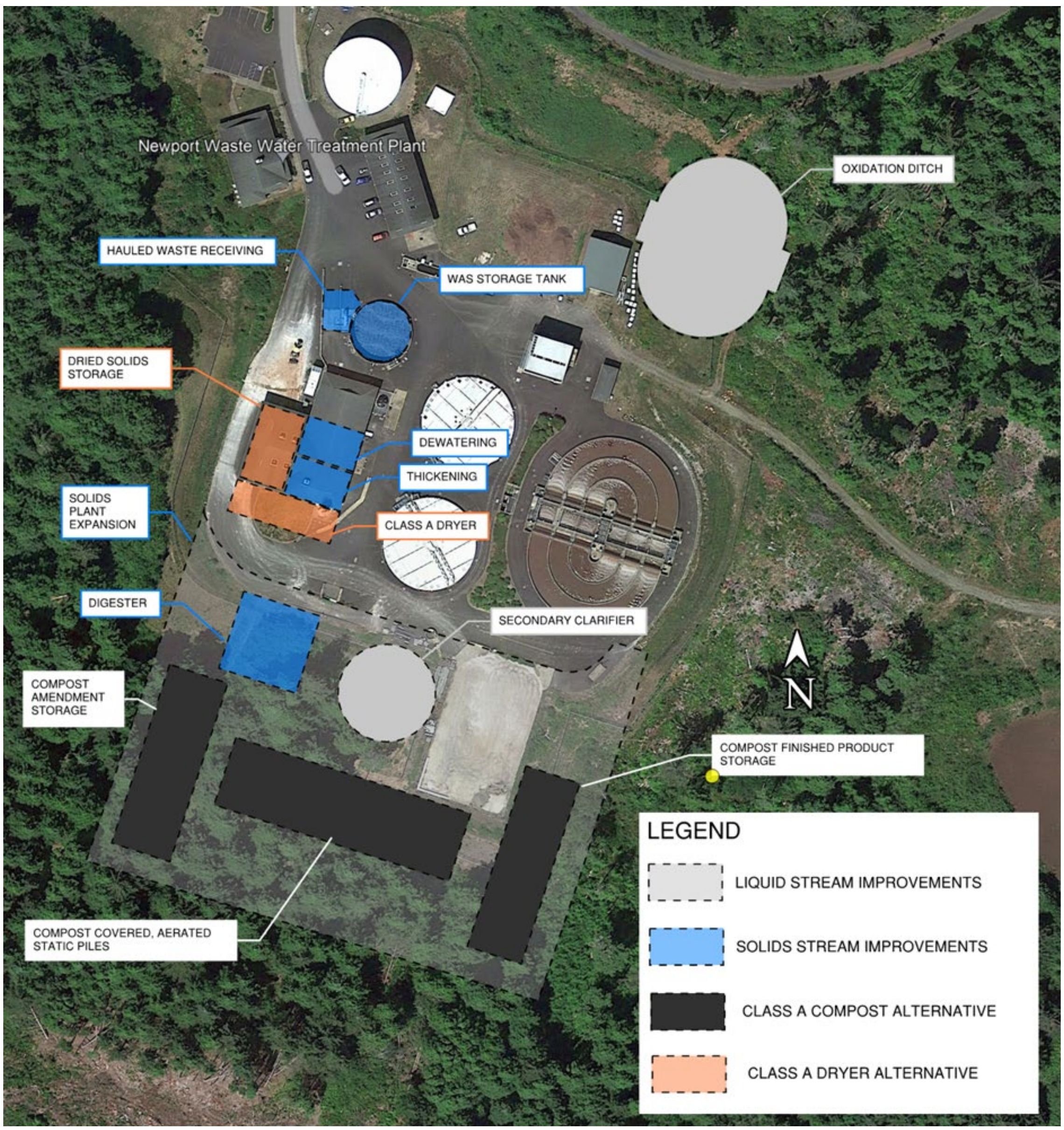

Figure 7-8. Solids stream site plan

7.3.2 Thickening

Mechanical thickening with RDTs is proposed to be installed in the existing lime processing room. The WAS would be wasted continuously, and the WAS Storage Tank would continue to be used to provide process flexibility. With the removal of the Lime Stabilization equipment, RDTs would be installed at ground level, with open-throat thickened WAS pumps installed on the intermediate level below and positioned beneath RDT discharges, as shown on Figure 7-9 and Figure 7-10.

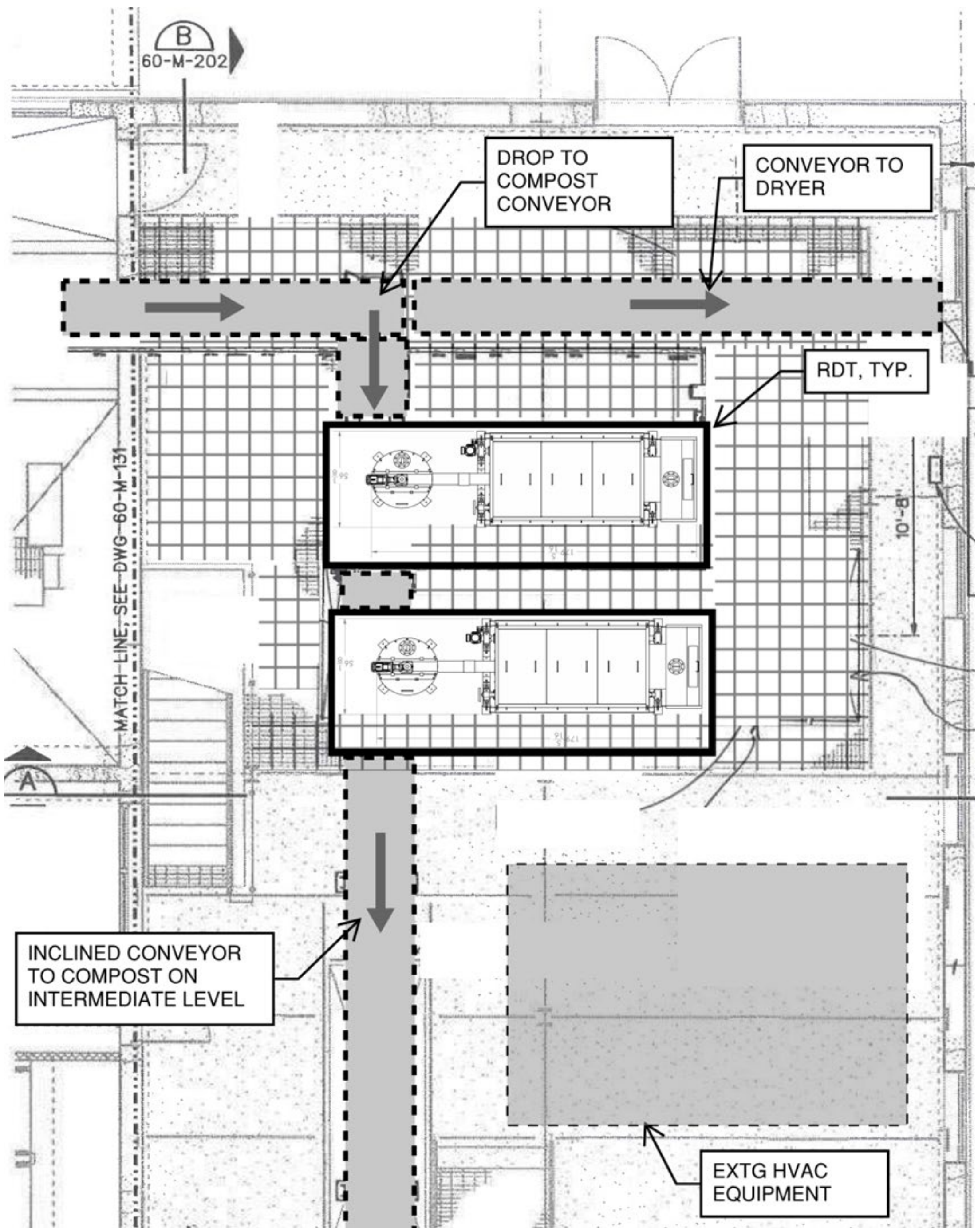

Figure 7-9. Thickening plan

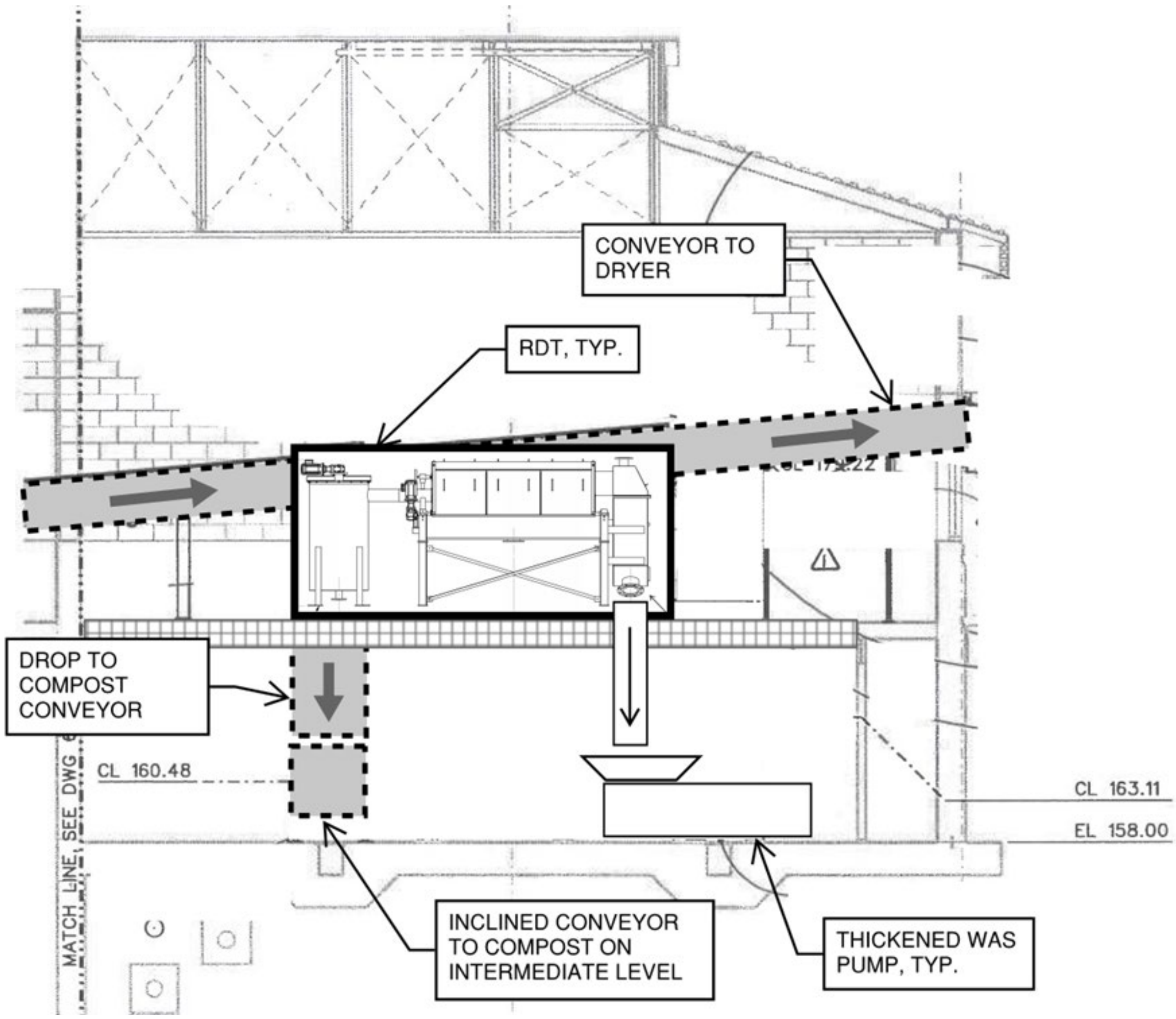

Figure 7-10. Thickening section

Alternatively, thickened WAS pumps may be installed on the same level as the RDTs. Concrete work to support equipment, along with grating and access platforms would be provided to facilitate access to RDTs while maintaining the existing stairway access to the intermediate level below. New thickening feed pumps would be installed in the Solids Handling Building gallery, replacing the existing centrifuge feed pumps.

7.3.3 Stabilization

The existing plant fence line is proposed to be extended south to accommodate the solids stabilization and composting facilities. Within the expanded area, the proposed stabilization process shown on Figure 7-8 is located across an existing roadway to minimize thickened WAS pumping distance. The stabilization area is roughly 75 feet by 75 feet and includes an adjoining support building.

Table 7-9 summarizes the sizing and facility descriptions for Aerobic and Anaerobic Digesters.

Table 7-9. Stabilization Sizing and Facilities		
Parameter	**Aerobic Digester**	**Anaerobic Digester**
Footprint, feet	50 x 50[a]	40[b]
Volume, gal	280,000[c]	216,000[d]
Design Loading		
Average, ppd	3,380	3,380
Maximum Month, ppd	4,226	4,226
Sidewater Depth, feet	15[e]	23[f]
Support Building and Facilities	• Blowers • Electrical Room • Digested Sludge Pumps	• Boilers • Heat Exchangers • Digested Sludge Pumps • Electrical Room • Waste Gas Burner

a. *Covered, rectangular footprint is divided into four equally-sized cells equipped with mixers and diffusers.*

b. *Diameter of circular tank equipped with mixing system.*

c. *Design Condition–2040 Max Month: (1) Redundancy: None, (2) Thickened WAS solids concentration: 4%, (3) Digester content solids concentration: 2.67%, (4) Volatile Fraction: 0.83, (5) Solids Retention Time: 40 days.*

d. *Design Condition–2040 Max Month: (1) Redundancy: None, (2) Thickened WAS solids concentration: 4%. (3) Volatile Fraction: 0.83, (4) Volatile Solids (VS) Loading: 0.15 lbs VS/CF/day, (5) Solids Retention Time: 15 days minimum.*

e. *Minimum tank depth for efficient oxygen transfer.*

f. *Assumes 3 feet of freeboard and 6-feet dome height for a total height of 32 feet.*

7.3.4 Dewatering

Dewatering improvements described in the Centrifuge Replacement TM (as Appendix E) include the removal and replacement of existing centrifuges with larger centrifuges and conveyors sized to accommodate the 2040 max month loading condition. The sizing criteria in the Centrifuge Replacement TM indicates a WAS feed solids concentration to centrifuges of 0.55 percent, as no other solids improvements were considered as part of the centrifuge evaluation. The recommended replacement project includes a fully redundant centrifuge. For the master planning project, thickening and stabilization will precede dewatering. With this reduced loading, centrifuge operation will require fewer operating hours and offer increased redundancy. The proposed dewatering improvements are shown on Figure 7-11.

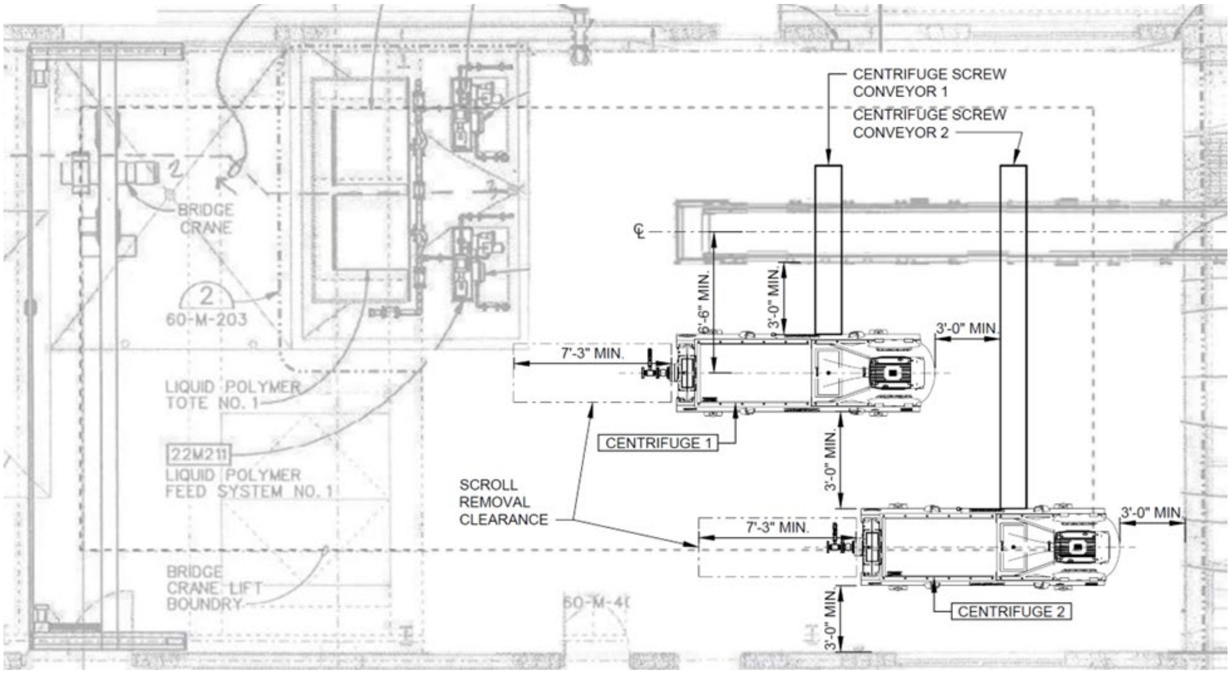

Figure 7-11. Dewatering plan

7.3.5 Class A Treatment

The proposed Class A Treatment alternatives would require expansion of the plant site and/or the existing Solids Handling Building. Design criteria relating to Class A treatment are discussed in the Solids Basis of Design TM, included as Appendix J.

7.3.5.1 Compost

The proposed Class A compost facility is located south of the existing plant fence line. This wooded area rises gradually in grade to the south and east. An extensive area would need to be cleared, grubbed, and graded to accommodate the large footprint of the compost area. A significant amount of earthwork, grading, and the installation of retaining walls would be needed to construct 20- to 30-feet wide paved roadways to facilitate the handling and transport of compost materials. Site footprint is also needed to locate amendment mixing and screening equipment for final processing of finished product.

A finished product storage area is included, which will negate the need to store solids at a third-party location (November through April) as the plant currently does. Compost facilities may be phased in over time, as the storage and processing bays are modular and can be readily expanded. Improvements would include a new system of conveyors to transport dewatered cake to the existing solids bay, as shown on Figure 7-9. A site plan of the proposed Class A compost facility is shown on Figure 7-12.

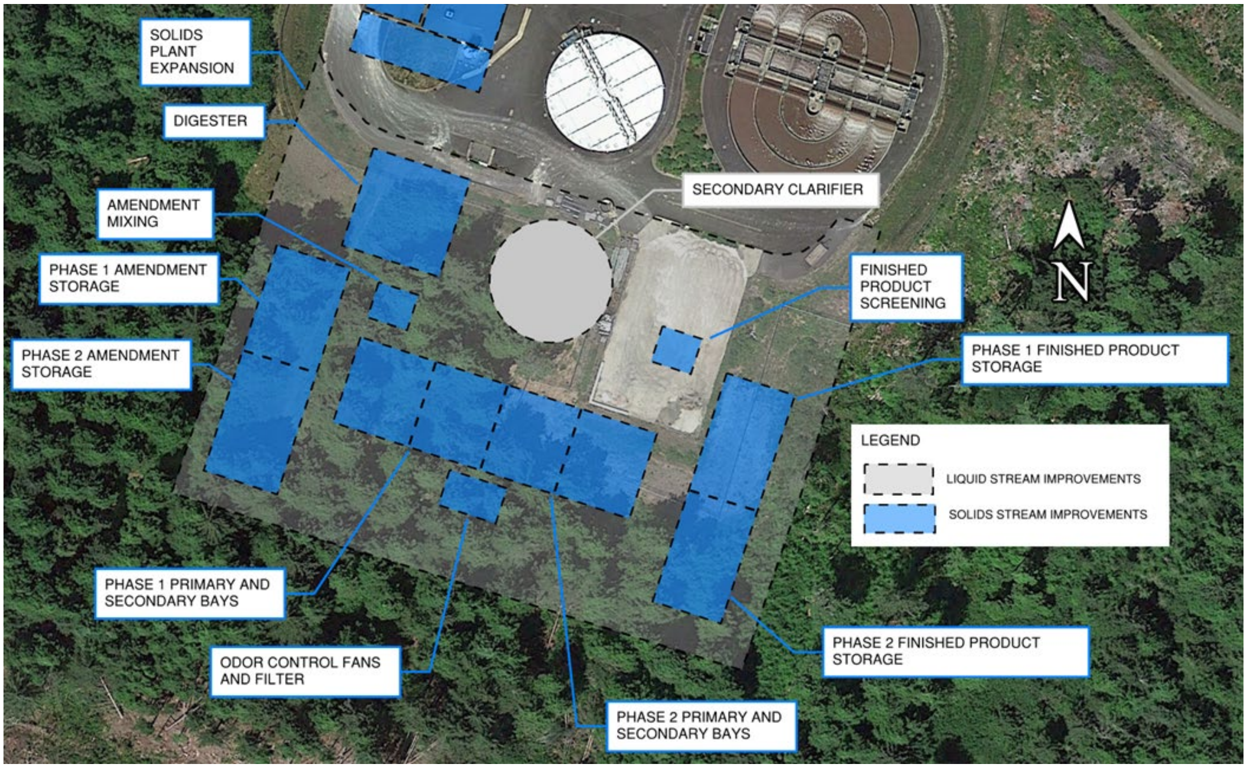

Figure 7-12. Class A compost facility plan

7.3.5.2 Dryer

The proposed Class A dryer is a large piece of equipment and may include numerous ancillary equipment depending on the manufacturer selected. The dryer itself may be 44 to 70 feet in length, 12 to 40 feet in width, and up to 26 feet in height, depending on the manufacturer.

The existing Solids Handling Building would be expanded to provide a dedicated room housing the Class A dryer, cake bin, and associated electrical and controls room. The existing Lime Silo and outdoor equipment would be demolished. Conveyors, shown on Figure 7-9, would transport dewatered cake from the dewatering area to the Dryer Room. Alternatively, a dedicated building may be constructed adjacent to the Solids Handling Building on its own foundation with minimal separation between the outside walls of new and existing structures. Dried solids would be bagged into supersacks and stored in the existing solids storage bay.

The new Dryer Room would be installed at an elevation that matches the existing intermediate level elevation in the Solids Handling Building. This would facilitate truck access to the supersack bagging system via a new roll-door on the south side of the room, transport of supersacks to the existing solids bay for storage and allow for a maximum building height close to the existing Solids Handling Building. The proposed dryer improvements are shown on Figures 7-13 and 7-14.

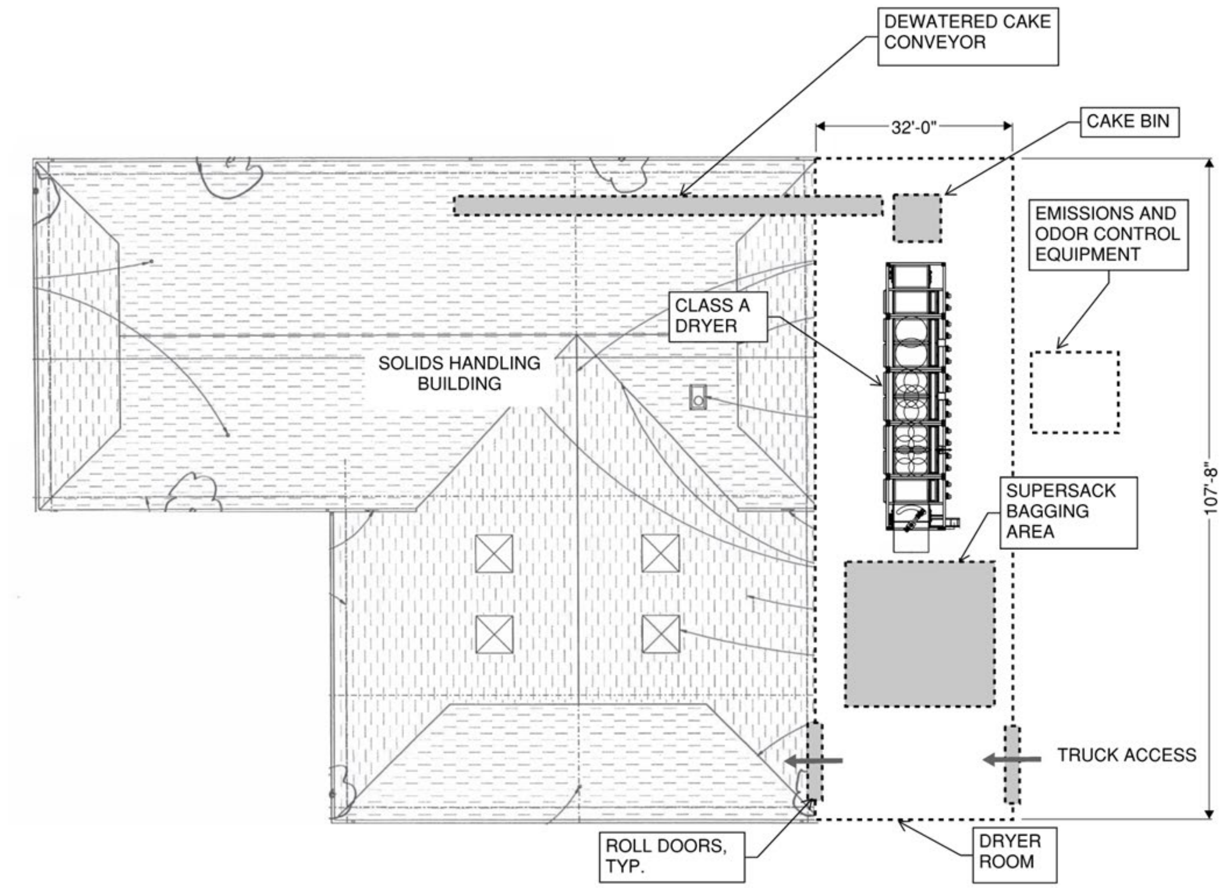

Figure 7-13. Class A dryer plan

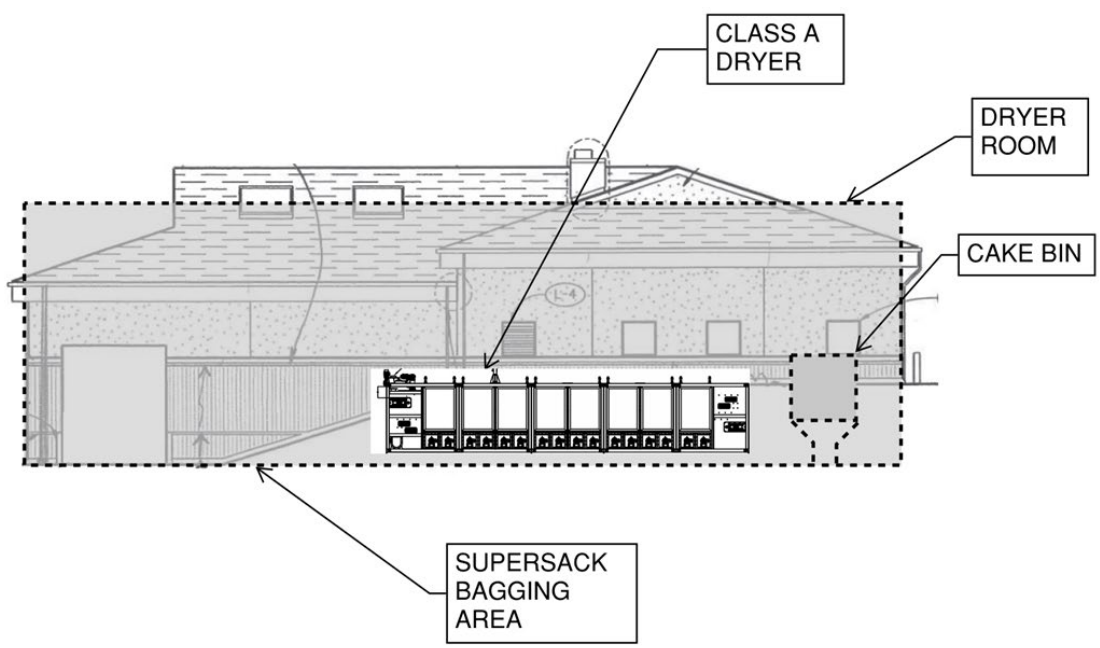

Figure 7-14. Class A dryer section

7.4 Solids Alternatives Evaluation

Solids processes such as Hauled Waste Receiving, Thickening, and Dewatering are common to each of the solids alternatives considered and are presented in Section 7.1, with additional detail and design criteria included in Appendix J. The following sections focus on the stabilization and Class A treatment alternatives under consideration.

Stabilization is recommended to reduce solids quantities and improve the performance of downstream processes. The inclusion of aerobic or anaerobic digestion also allows the production of Class B Biosolids if Class A Treatment systems are offline for an extended period. There are several key differentiators and considerations to account for in the evaluation of aerobic versus anaerobic digestion, including but not limited to labor resources, energy use, construction costs, and site conditions. A list of key considerations is provided in Table 7-10.

Table 7-10. Aerobic versus Anaerobic Digestion

Parameter	Aerobic Digester	Anaerobic Digester
Footprint	Slightly Larger Footprint	Slightly Smaller Footprint
Process Flexibility	Capable of Producing Class B Biosolids without downstream treatment	Capable of Producing Class B biosolids without downstream treatment
Odor Potential	Increased Potential for Odors	Less Odor Potential
Labor Requirements	Lower Labor Effort	Additional O&M Required
Capital Costs	Lower Capital Costs	Higher Capital Costs
Energy Costs	Increased Energy Costs for Aeration	Lower Energy Costs
General Sizing Criteria	Typical for Facilities < 5 mgd	Typical for Facilities > 5 mgd

While the capital cost for the aerobic system is significantly less than the anaerobic system, ongoing energy costs are higher due to aeration demands, Ongoing labor is relatively minor for an aerobic digester. In addition, odors produced by an aerobic digester are like those produced from the activated sludge process and no additional odor control system would be required.

Anaerobic digestion requires more labor effort to maintain the heating and mixing systems, along with gas handling equipment such as waste gas burners. There is potential with anaerobic digestion to meet digester heat demands by firing boilers on digester gas. Given the relatively small size of the facility, reduced labor and generally lower capital costs, aerobic digestion was selected as the preferred stabilization process by the City, BC, and KJ in a workshop held on April 25, 2023.

Class A treatment is recommended to improve the quality of biosolids, reduce odors, and maintain flexibility with respect to disposal at various land application sites. Table 7-11 summarizes the pros and cons associated with composting versus drying in the production of Class A Biosolids.

Table 7-11. Composting versus Drying		
Parameter	**Compost**	**Dryer**
Footprint	Land Intensive	Relatively Small Footprint Compared to Compost
Odor Potential	Potential for Odors	Indoor, Ventilated Process, Low Odor Potential when paired with adequate Odor Control equipment.
Labor Requirements	Labor Intensive, Labor Required to Handle Compost	Labor Intensive, Labor Required to Maintain Numerous Equipment
Capital Costs	Lower Capital Costs	Higher Capital Costs
Energy Costs	Less Energy Intensive	High Electricity and Natural Gas Use

Although the Class A dryer has higher capital and operation and maintenance (O&M) costs than a compost facility, it results in a dried product that is greater than 90 percent solids which significantly reduces the quantity of biosolids that need to be stored, handled, and transported. Compost however requires a bulking agent or amendment such as wood chips that significantly increases the volume of the finished product. The City indicates that the nearby Georgia Pacific mill is a reliable and long-term source for amendment material. A life-cycle cost analysis of the compost and dryer Class A alternatives is therefore recommended to understand the cost differences between the two alternatives.

7.5 Class A Solids Life-cycle Cost Evaluation

The estimated capital costs, annual O&M costs, and total O&M present-worth costs for the Class A compost and dryer alternatives are summarized in Table 7-12. Costs for solids improvements common to each alternative are also included to indicate the overall total costs. Detailed cost estimates are included in Appendix D.

The following assumptions were made in the preparation of the capital costs:

- Capital costs include Opinion of Probable Construction Cost (OPCC) as well as an allowance of 38 percent for soft costs, such as engineering, administrative, permits, and legal costs.
- Estimates are Association for the Advancement of Cost Engineering (AACE) Class IV estimates with a stated range of accuracy of +40 percent to -20 percent.
- Estimates do not include hazardous materials removal or disposal. Costs assume that structural conditions are suitable and that special foundations are not required.

Table 7-12. Class A Lifecycle Cost Evaluation		
Cost Element	Compost	Dryer
Capital Cost[a,b,c]		
Hauled Waste	$2,400,000	
Thickening	$2,400,000	
Aerobic Digester	$7,100,000	
Dewatering	$6,400,000	
Class A Biosolids Process	$11,200,000	$17,300,000
Sitework	$3,000,000	$4,300,000
Capital Cost Subtotal	$32,500,000	$39,900,000
Annual O&M Costs[d,e,f,g,h,i]		
Hauled Waste	($80,000)	
Thickening	$70,000	
Aerobic Digester	$80,000	
Dewatering	$110,000	
Class A Biosolids Process	$180,000	$380,000
Annual O&M Subtotal	$360,000	$560,000
Total O&M Present Worth Cost[j]	$7,500,000	$11,700,000
Total Present Worth Cost	$40,000,000	$51,600,000

a. Capital costs are rounded to the nearest $100,000.

b. Construction costs include a 17% adder for Electrical, Instrumentation and Controls.

c. Construction costs include the following markups: Contractor Indirects (12%), Overhead and Profit (15%), Contingency (25%) and Escalation (4% per year) assuming 5 years to the mid-point of construction.

d. O&M costs are rounded to the nearest $10,000, and include labor, maintenance, equipment replacement, utilities, chemical use, and biosolids hauling.

e. Electricity costs are based on a rate of $0.08 per kilowatt hour (kW-hr).

f. Natural Gas costs are based on a rate of $1.25 per therm.

g. Labor costs assume a burdened labor rate of $50 per hour.

h. Chemical costs are for liquid emulsion polymer, $4,20 per active lb. Assumes eight to ten active lbs of polymer per dry ton for thickening and 20 active lbs per dry ton for dewatering.

i. Maintenance costs are annualized at 2% of equipment costs.

j. Present worth costs are based on 20-year life-cycle costs in 2023 dollars, assuming a 3% inflation rate and 2.5 discount rate per OMB Circular A-94, Appendix C.

The Class A compost facility is projected to have lower capital and annual O&M costs compared to the Class A dryer. The differences in capital costs are largely due to the dryer equipment costs, costs for constructing the new Dryer Building, and the need to install a new natural gas pipeline to the plant for firing the dryer furnace. The dryer also has higher annual O&M costs than composting, mainly due to the high energy use associated with drying biosolids. The dryer is anticipated to require up to 10,333 million British Thermal Unit (MMBTU) (103,330 therms) of natural gas per year, and up to 640,000 kilowatt per hour (kW-hr) per year of electricity. For this reason, and given the available land at the WWTP, the Class A compost facility is recommended.

7.6 Recommended Solids Improvements

The key recommended solids stream improvements include:

- Packaged Hauled Waste Receiving Station
- Continued use of WAS Storage Tank
- Mechanical Thickening
- Aerobic Digestion
- Centrifuge Dewatering
- Class A Compost Facility

Design data for the proposed solids improvements and projected solids loadings are summarized in Tables 7-13 and 7-14, respectively. Detailed design data for proposed equipment are also available in the vendor proposals included as Appendix K. Equipment and process sizing criteria are presented the Solids Basis of Design, included as Appendix J. A Site Plan and Process Flow Diagram for the recommended improvements are shown on Figures 7-15 and 7-16.

Solids improvements may be phased to prioritize critical areas and capacity bottlenecks. Dewatering improvements could be constructed in Phase 1. Phase 2 may include the Class A compost facility. Phase 3 may include Mechanical Thickening, Aerobic Digester, and Hauled Waste Receiving.

Table 7-13. Recommended Solids Improvements Design Data

Process Area/Parameter	Units	Value
Hauled Waste		
Type		Packaged, Rotary Drum Screen
No. of Systems		1
Operation		Intermittent
Days/Week		7
Hours / Day		2
Drum		
Perforation Size	mm	10
Motor	hp	3
Washer Compactor		
Motor	hp	7.5
Grit Screws		
No.		2
Screw Motors	hp, ea	0.75
Grease Pump		
Motor	hp	3

Table 7-13. Recommended Solids Improvements Design Data		
Process Area/Parameter	Units	Value
Thickening		
Thickening Feed Pumps		
No.		2
Type		Recessed Impeller
Motor	hp, ea	15
Thickeners		
No.		2
Type		Rotary Drum
Motor	hp, ea	1.5
Thickened WAS Pumps		
No.		2
Type		Progressing Cavity
Motor	hp, ea	2
Aerobic Digester		
No. of Cells		4
Cell Length	ft	25
Cell Width	ft	25
Sidewater Depth	ft	15
Volume	gal	280,000
Design SRT[a]	days	40
Blowers		
No.		4
Type		Hybrid Positive Displacement and Screw Compressor
Motor	hp, ea	150
Mixers		
No.		4
Type		Submersible
Motor	hp, ea	10
Digested Sludge Pumps		
No.		2
Type		Progressing Cavity
Motor	hp, ea	5
Dewatering		
Centrifuges		
No.		2
Motor	hp, ea	95 (75 hp Main Drive, 20 hp Back Drive)
Conveyors		

Process Area/Parameter	Units	Value
No.		3
Type		Shaftless Auger
Motor	hp, ea	(1) 3 hp and (2) 2 hp
Compost		
Type		CASP
No. of Stages		2, (1) Active, (1) Secondary
No. of Bays		4, (2) Active, (2) Secondary
Design Retention Time[b]		
Active Bays	days	20
Secondary Bays	days	20
Bay Length		
Active Bays	ft	40
Secondary Bays	ft	33
Bay Width		
Active Bays	ft	20
Secondary Bays	ft	20
Pile Height	ft	8
Aeration		
Capacity		
Active Bays	CFM/CY	6
Secondary Bays	CFM/CY	2.5
Fan Power		
Active Bays	hp	22.5
Secondary Bays	hp	5
Biofilter Area	ft^2	690

Table 7-13. Recommended Solids Improvements Design Data

a. Assumes covered digester with minimum operating temperature of 68 °F.

b. At 2040 max month condition.

Table 7-14. Projected Solids Loadings					
Parameter	Units	Design Condition			
		Current-2023	Design-2040		
		Average	Average	Max Month	Max Week
WAS[a]					
Solids Loading	lb/d	3,198	3,558	4,448	5,338
Solids Flow	gpd	69,717	77,575	96,969	116,363
Solids Concentration	%	0.55	0.55	0.55	0.55
Thickened Sludge[b]					
Solids Concentration	%	4.00			
Solids Production	lb/d	3,038	3,380	4,226	5,071
Solids Flow	gpd	9,107	10,133	12,667	15,200
VSS/TSS Ratio[c]	%	83			
VSS Loading	lb/d	2,522	2,806	3,507	4,209
Thickener Supernatant					
Total Supernatant (daily flow)	gpd	76,450	83,282	100,143	117,003
Solids Concentration	mg/L	250	256	266	273
Aerobic Digester Feed[d]					
Solids Loading	lb/d	3,038	3,380	4,226	5,071
Solids Flow	gpd	9,107	10,133	12,667	15,200
Solids Concentration	%	4.00	4.00	4.00	4.00
Volatile Solids by Source					
Thick Sludge VSS Loading	lb/d	2,522	2,806	3,507	4,209
Thick Sludge VSS Reduction	%	40			
Thick Sludge VSS Reduction	lb/d	1,009	1,122	1,403	1,683
Total VSS Reduced	lb/d	1,009	1,122	1,403	1,683
Total Solids Remaining	lb/d	2,029	2,258	2,823	3,387
Dewatering Feed[e]					
Solids Loading (intermittent)[(f)]	lb/hr	222	247	309	370
Solids Loading (intermittent)	lb/d	3,551	3,952	4,940	5,928
Solids Loading (intermittent)	dry tons/day	2	2	2	3
Solids Flow (intermittent)	gpm	17	18	23	28
TSS Concentration	%	2.67	2.67	2.67	2.67
Dewatering Performance					
Cake Concentration	%	20.0			
Cake Production (intermittent)	lb/d	3,374	3,754	4,693	5,631
Cake Production (intermittent)	tons/d	1.7	1.9	2.3	2.8

Table 7-14. Projected Solids Loadings					
Parameter	Units	Design Condition			
		Current-2023	Design-2040		
		Average	Average	Max Month	Max Week
Centrate		1156	1286	1608	1929
Total Centrate (intermittent)	gpd	19,549	21,607	26,687	31,768
Centrate Solids Load	lb/d	169	188	235	282
Compost Feed					
Solids Loading (intermittent)	lb/d	3,374	3,754	4,693	5,631
Solids Loading (intermittent)	dry tons/day	1.7	1.9	2.3	2.8
Solids Concentration	%	20.00	20.00	20.00	20.00
Amendment[g]	wet tons/day	10	11	14	17
Amendment	wet tons/year	3,694	4,111	5,139	6,166
Compost Production					
Compost Production	CY/d	32.0	35.0	44.0	53.0
Compost Production	CY/year	11,545	12,846	16,059	19,269
Compost Production[h]	tons/d	14.0	15.3	19.2	23.1
Compost Production	tons/d	5,039	5,607	7,010	8,411

a. Assumes continuous wasting.

b. Two units, each sized for 100 gpm, 1 duty unit runs continuously with 1 standby unit. Assumes 95% capture.

c. RAS sampling-based on 1 week of data from December 2021. VSS/TSS ratio is provided by BC.

d. Continuous Digester Feed.

e. One duty, 1 standby unit. Assumes 95% capture.

f. Sixteen hrs/day, 4 days/week.

g. Based on 1.2 to 1.0 ratio of amendment to biosolids wet tons.

h. Based on nominal mix density of 873 lb/CY.

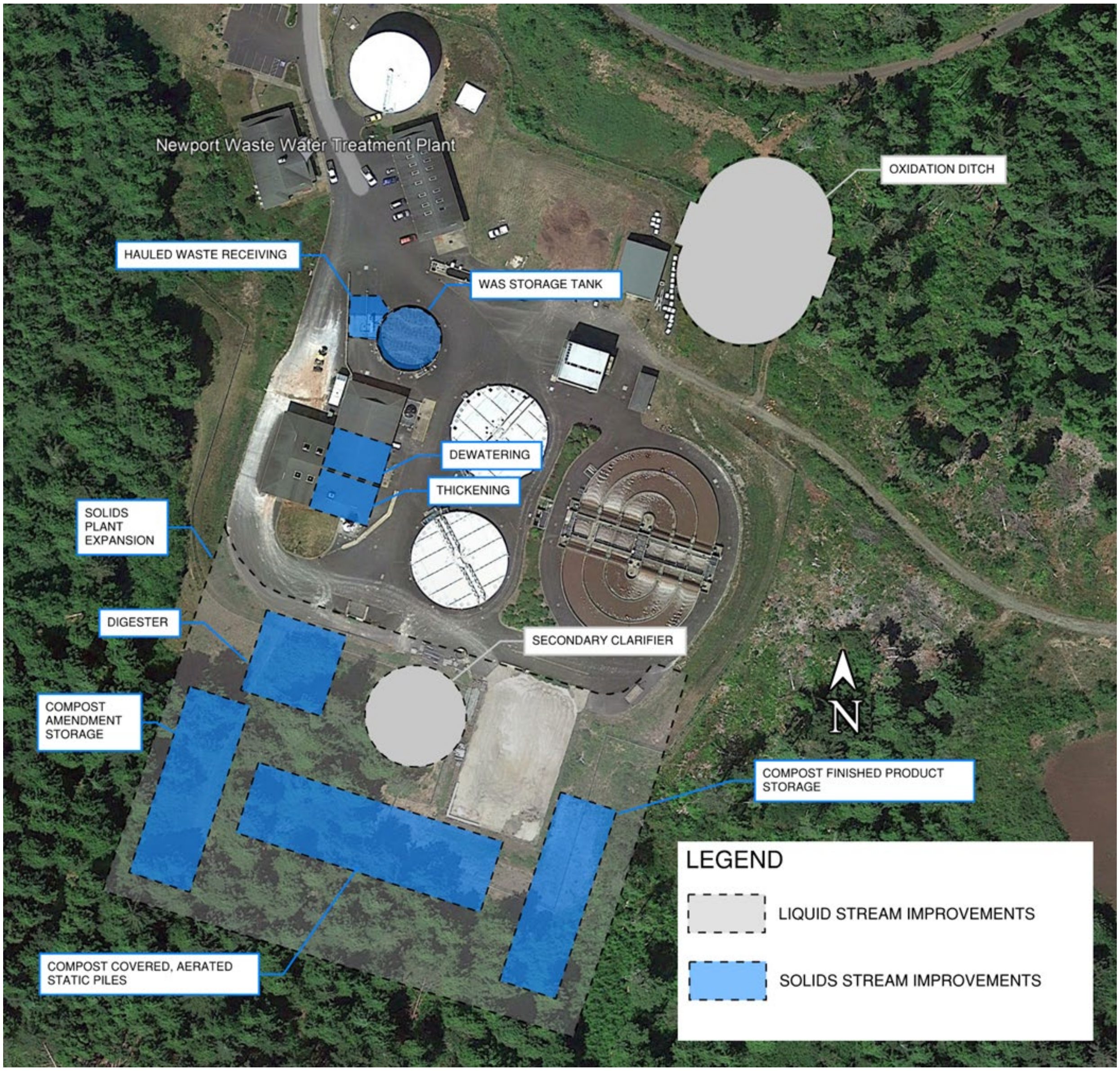

Figure 7-15. Recommended solids stream improvements site plan

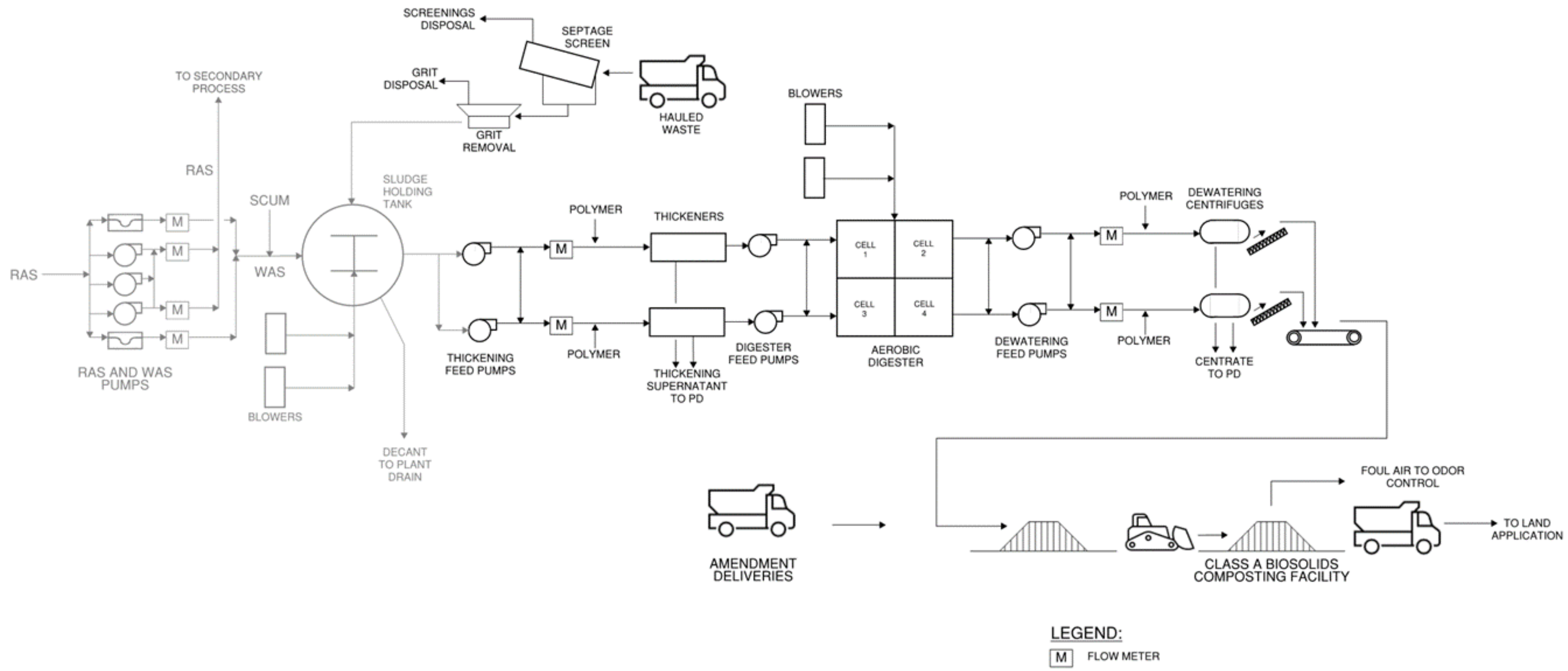

Figure 7-16. Recommended solids stream improvements process flow diagram

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Section 8

Northside Pump Station

Alternatives for Northside Pump Station are developed in a standalone TM under this project scope (see Appendix H). Imminent upgrades are required to replace failing equipment and address significant safety concerns. Ideally, a new facility would replace the existing facility entirely. Due to the limited funding available, the City has elected to proceed with interim improvements to address critical concerns while additional funding is secured to proceed with the incorporation of an entirely new buildout facility.

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Section 9

Recommendations and Conclusions

9.1 Alternative Criteria and Scoring

To facilitate selection of alternatives, the City of Newport (City) and Brown and Caldwell/Kennedy Jenks (BC/KJ) project team developed a method of scoring non-cost considerations alongside of life cycle costs. Non-cost considerations were grouped into two categories, with subcategories:

1. **Operational Benefits**: Processes that optimize flexibility and simplicity in operations without compromising compliance or health and safety.
    a. *Process and Regulatory Flexibility*–Higher scores for alternatives that mitigate future risk. For biosolids, this can mean the ability to easily switch between Class A or B to provide for more beneficial use/disposal options. For liquids, this can mean the ability to adapt to potential future regulations (e.g., nutrients, metals, etc.).
    b. *Labor Requirements*–Higher scores for reduced need for additional full-time employees (FTEs) and level of skill required to run the proposed processes. Finding/retaining O&M staff has been a challenge for the City.
    c. *Simplicity, Reliability, and Health and Safety*–Higher scores for reduced level of effort required to operate and maintain in normal and failure modes, and how consistently the process is expected to meet design criteria. Intrinsic health and safety is also considered.
2. **Community Benefits**: Processes that optimize local resources and have minimal negative impacts on the community such as odor generation.
    a. *Fenceline Odor Potential*–Higher scores for reduced risk of odor migration offsite.
    b. *Expandability and Site Efficiency*–Higher scores for increased ease with which the process could be expanded for additional future loading. Higher scores also for processes that require less space at the treatment plant site and thus would not impact the constructability of potential future expansions.
    c. *Public Outreach and Resource Recovery*–Higher scores for processes that create an opportunity for the WWTP to be a community center and resource recovery facility.

The alternatives scoring is summarized in Figure 9-1.

Based on the scoring results, the City and BC/KJ project team elected a second oxidation ditch with aerobic digestion as the liquids stream alternative and solids stabilization process, respectively. Subsequently, the cost analysis on the biosolids process confirmed selection of composting as the preferred alternative, and Alternative 4 as presented in Figure 9-1 was selected for capital improvement planning efforts.

	Alternative		1		2		3		4		5		6		7	
	Liquids Process		2nd Oxidation Ditch		2nd Oxidation Ditch		2nd Oxidation Ditch		2nd Oxidation Ditch		2nd Oxidation Ditch		Oxidation Ditch / Primary Clarifiers		Oxidation Ditch / Primary Clarifiers	
	Stabilization Process		No Stabilization		No Stabilization		No Stabilization		Aerobic Digester		Aerobic Digester		Anaerobic Digester		Anaerobic Digester	
	Solids Process		Existing RDP		Composting		Dryer		Composting		Dryer		Composting		Dryer	
	Criteria	Criteria Weight	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
1	**Operational Benefits**	**50%**		**0.5**		**0.8**		**1**		**1.1**		**1.3**		**0.7**		**0.95**
	Process and Regulatory Flexibility	20%	1	0.2	1	0.2	1	0.2	2.5	0.5	2	0.4	2	0.4	2.5	0.5
	Labor Requirements	10%	1	0.1	2	0.2	3	0.3	2	0.2	3	0.3	1	0.1	2.5	0.25
	Simplicity, Reliability, and Health and Safety	20%	1	0.2	2	0.4	2.5	0.5	2	0.4	3	0.6	1	0.2	1	0.2
2	**Community Benefits**	**30%**		**0.6**		**0.35**		**0.575**		**0.7**		**0.675**		**0.55**		**0.65**
	Fenceline Odor Potential	15%	3	0.45	1	0.15	2.5	0.375	2	0.3	2.5	0.375	1	0.15	2	0.3
	Expandability and Site Efficiency	5%	1	0.05	2	0.1	2	0.1	2	0.1	2	0.1	2	0.1	3	0.15
	Public Outreach and Resource Recovery	10%	1	0.1	1	0.1	1	0.1	3	0.3	2	0.2	3	0.3	2	0.2
3	**Relative Cost (Net Present Value)**	**20%**	**3**	**0.6**	**2**	**0.4**	**2**	**0.4**	**2**	**0.4**	**2**	**0.4**	**2**	**0.4**	**2**	**0.4**
	TOTAL	**100%**	2.3		1.9		**2.55**		**2.9**		**3.05**		2.2		**2.65**	

Each alternative assigned a score of 1 (negative / worse than average), 2 (average), or 3 (positive / better than average)

Figure 9-1. Alternatives evaluation criteria and scoring

9.2 Capital Improvement Plan (CIP)

The following sections describe the basis and assumptions used to develop cost estimates for recommended projects, and the criteria used to prioritize individual projects within the CIP.

9.2.1 Cost Estimating Basics and Assumptions

An engineering OPCC (estimate) has been developed for each of the improvement projects identified in previous sections. Project definitions and associated costs presented in this CIP are conceptual in nature due to the limited design information that is available at this stage of project planning. The scope of work for projects and studies were approximated based on equipment and/or facility size and comparison with similar replacement projects. As each project progresses into design and construction, the associated costs may vary as project-specific requirements are identified.

All estimates provided in this section were prepared in accordance with a Class 5 OPCC as defined by the AACE. A Class 5 estimate is appropriate for projects that have been developed to a conceptual level only. The purpose of a Class 5 estimate is to provide a cost that can be used in budgetary planning. The expected range in accuracy of a Class 5 estimate is from -20 percent to -50 percent low and +30 percent to +100 percent high and is typically developed through analogy to costs from similar construction, judgment, and parametric models. These cost estimates are based on unit costs developed using a combination of data from RS Means CostWorks® and recent bids, experience with similar projects, and foreseeable regulatory requirements.

The costs for each project in the CIP include an allowance for “soft costs” and for contingency. The “soft costs” are the portion a project’s total cost required to plan, design, and manage each project through construction and are estimated at the planning level using a percentage markup applied to the estimated construction cost. The contingency allowance accounts for aspects of the work that are currently unknown and that cannot be reasonably identified at the conceptual phase. The contingency allowance is also estimated at the planning level using a percentage markup, which can be reduced as the project is better understood through detailed design.

Adjustments to each project estimate were made using the following markups:

- 40 percent markup of the itemized construction sub-total was added to account for construction contingency and unforeseen work items.
- 38 percent markup of the total construction cost including contingency was added to account for project development services including project administration, planning, alternatives analysis, engineering design, surveying, permitting, construction administration, inspection, materials testing, etc.

Detailed cost estimates for each project are included in the appendices. See Table 9-1 for specific reference information.

9.2.2 Capital Improvement Plan

In addition to the wastewater treatment upgrades described in this report, key upgrades are required for aging collection system facilities, mainly NSPS and the IPS. Class 5 cost estimates are shown for upgrades along with recommended implementation timeframes in Table 9-1. As discussed, implementation timeframes are driven by the associated capacity and criticality assessments, with most at-risk facilities slated for upgrades in the near future.

Table 9-1. Capital Improvement Projects			
Project	Estimated Cost	Schedule	Reference
Northside PS Interim Improvements	$6,890,000	2023-2025	Appendix H
Northside PS Dechlorination	$3,740,000	2023-2025	Appendix I
WWTP Centrifuge Upgrades	$5,600,000	2023-2025	Appendix E
IPS Pipe Replacement	$350,000	2025	See Note a.
WWTP Headworks Upgrades	$4,450,000	2023-2025	Appendix B
WWTP 2nd Oxidation Ditch	$17,870,000	2025-2028	Appendix C
WWTP 3rd Secondary Clarifier	$20,600,000	2025-2028	Appendix C
WWTP Disinfection Upgrades	$190,000	2023-2025	Appendix L
WWTP Solids Upgrades	$32,500,000	2025-2028	Appendix D
IPS Upgrades	$1,000,000	2030	See Note a.
NSPS Buildout Facility	$46,830,000	2034-2037	Appendix H

a. *Detailed cost estimates for the Influent Pump Station (IPS) have not yet been developed. Costs shown are for reference only and based on improvements described by the City.*

b. *Additional engineering and administrative costs have been applied to projects for which this was not applied during capital cost development.*

Required funding for each project is expected to increase over the duration of the project. Projects expected to last 3 years will require 20 percent of the total funding for the first year, then 40 percent of total estimated cost during each of the next 2 years. Four-year projects will require approximately 10 percent of the total funding for the first year, then 20 percent, 35 percent, and 35 percent for the following years. This distribution was applied to each of the multi-year projects in Table 9-1 and used to develop Figure 9-2, which shows the estimated total yearly funding required for applicable projects occurring during each fiscal year. WWTP upgrades in FY 2027 and 2028 are anticipated to require approximately 25 million per year, representing the most expensive upgrade period.

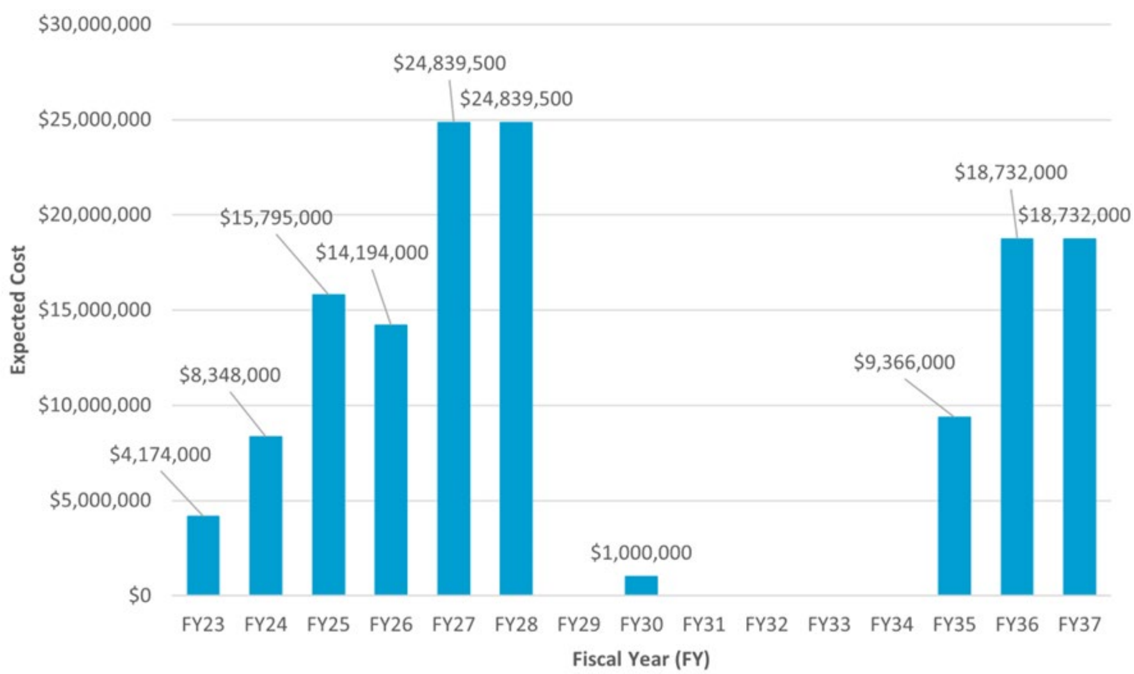

Figure 9-2. Capital cost distribution by year

Section 10

Limitations

This document was prepared solely for City of Newport in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Newport and Brown and Caldwell dated March 9, 2017. This document is governed by the specific scope of work authorized by City of Newport; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Newport and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Section 11

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Office

6500 S Macadam Avenue, Suite 200
Portland, OR 97239-3552

T 503.244.7005

Appendix A Updated Criticality Assessment

Waterdude

Technical Memorandum

Project: Wastewater Treatment Facilities Condition Assessment Update

Client: City of Newport

To: Andrew Grant, Wastewater Treatment Supervisor

From: Mark Walter, Waterdude Solutions

Date: October 11, 2021

1. Introduction and Scope of Technical Memorandum

This technical memorandum (TM) provides an update to the Wastewater Treatment Facilities Condition Assessment dated January 2017. The information in this TM includes the following:

- Description of the 2021 condition assessment update.
- A summary of wastewater treatment facilities systems current condition.
- Tabulated results from the condition assessment and criticality matrix update.
- Observations based on the results of the update.

2. 2021 Condition Assessment Update

Workshops were conducted September 27 and 28, 2021 to update system condition ratings and the criticality matrix. The systems rating spreadsheet used for the 2017 assessment was used as a condition baseline. The system ratings spreadsheet includes nineteen systems reflecting the entire WWTP facility. Key components of each system are rated and tabulated for a system score. The condition rating scale used for the assessment is shown as Table 1. This condition assessment update is intended to support facility planning and prioritization of improvements.

The criticality matrix developed in March 2018 was reviewed and updated. The criticality matrix measures impact including health and safety, compliance, reliability, disruption, ability to return to service and financial.

The likelihood and trigger matrix further defines system characteristics by placing values on:

- Condition assessment overall
- Effective operating protocols
- Reliability
- Planned redundancy
- Capacity and utilization
- Obsolescence
- Annual maintenance cost

The two matrices are combined and tabulated to provide an overall system risk score. These tables and the final criticality risk matrix are included as Appendix A.

Asset Condition Assessment Rating Scale

GRADE	CONDITION	DESCRIPTION
0	Abandoned	Asset Abandoned, not longer in use, or no longer exists
1	Very Good	Sound physical condition. Meets current needs. Operative and well maintained. Asset expected to perform adequately with routine maintenance for 10 yr. or more. No work required.
2	Good	Acceptable physical condition. Shows minor wear that has minimal impact on performance. Minimal short term failure risk. Potential for deterioration or impaired performance over next 5-10 years. Minor work (if any) required.
3	Fair	Functionally sound but showing wear and diminished performance. Moderate short term failure risk. Potential for further deterioration and diminished performance within next 5 years. Renewal or major component replacement expected within next 5 years. Minor work required but asset is serviceable.
4	Poor	Asset functions but required high level of maintenance to remain operable. High risk of short term failure. Likely to have significant deterioration in performance within next two years. Renewal or replacement expected within next 2 years. Substantial work required, asset barely serviceable.
5	Very Poor	Asset failed or failure is imminent. Excessive maintenance required. No further service life expectancy. Significant health and safety hazer. Major work or replacement is urgent.

Source: Association of Metropolitan Sewerage Authorities, "Managing Public Infrastructure Assets" 2002

Table 1

3. Systems Condition Summary

The overall average condition of all wastewater treatment systems has decreased from Good-Fair to Fair. This reduction in condition rating is primarily due to acquiring additional time in service creating component wear. As the facilities near 20 years in service, obsolescence is affecting the ability to acquire parts and service.

Numerous refurbishment and replacement projects have been completed since 2018. These projects focused on replacing failed system components and replacement of some previously abandoned systems including:

- Various pump refurbishment and replacements
- New chlorine residual analyzer at the chlorine contact basin
- Refurbishment and optimization of the aerators
- Centrifuge refurbishment
- Centrifuge controls replacement
- Repairs of the solids pasteurization system

Several projects are funded and scheduled for 2021 including:

- Replacement and optimization of the disinfection system
- Continued optimization of aerators
- Clarifier drive and mechanism refurbishment
- Solids conveyor belt replacement

While these projects help maintain the wastewater system's design level of service, obsolescence and age continue to challenge system performance and reliability.

Wastewater Treatment Facilities Condition Assessment Update

The criticality matrix was updated to aid with this effort. Table 2 incorporates the overall condition rating, risk score and critically rank to aid with evaluation and prioritization of improvements.

System Description	Risk Rank	Overall Condition Rating	Criticality Rank
Pasteurization System Biosolids	1	3.4	1
Septage	2	3.6	9
Centrifuge	3	3.2	5
Northside Pump Station	4	3.1	4
Headworks Screenings	5	3.7	10
Sodium Hypochlorite System	6	3.3	2
Pasteurization System Lime Storage and Feed	7	3.4	3
Aeration Basin	8	2.7	14
RAS/WAS Pumping	9	2.4	11
Influent Pump Station	10	3.0	7
Secondary Clarification	11	2.3	12
Electrical	12	2.3	8
Sludge Storage and Dewatering Feed Pumping	13	2.1	17
Generator Power	14	2.0	6
Instrumentation and Control	15	Not Rated	15
Plant Drain	16	2.0	19
Dewatering Polymer	17	2.2	18
Plant Effluent	18	1.8	16
Effluent Conveyance	19	2.2	13
W3 and Sump Pumping	20	3.0	19
Structures	21	1.9	21
W1	22	2.4	22

Table 2

The risk rank provides a means of identifying the systems that pose the highest risk to the facility. The corresponding overall condition rating provides a separate score to compare with the risk rank. The criticality rank provides an additional reference point. This information provides the city with different perspectives when developing plans for these facilities.

The systems most at risk include four main areas:

- Northside pump station
- Headworks
- Septage
- Solids handling

Key findings in each of these systems is summarized as follows.

Northside Pump Station

The northside pump station is a remote pump station located at the site of the original wastewater treatment facility. Failure of the station results in sewage overflow as well as potential overflow of the Nye Beach pump station. The station provides pretreatment including screening and grit removal. These systems and the structure that houses these systems are in Fair to Poor condition. During 2019 and 2020 staff engaged consultants to develop improvement options. Implementation of improvement options are pending.

The condition of the station continues to challenge ongoing operation and maintenance of the station. One example is the screening system. The system is quickly reaching the end of its service life and requires continuous maintenance to maintain operation. The package screening and conveyance unit has been repaired several times and continues to degrade. Figure 1 shows how the conveyor has begun to wear through the housing creating leakage from the unit.

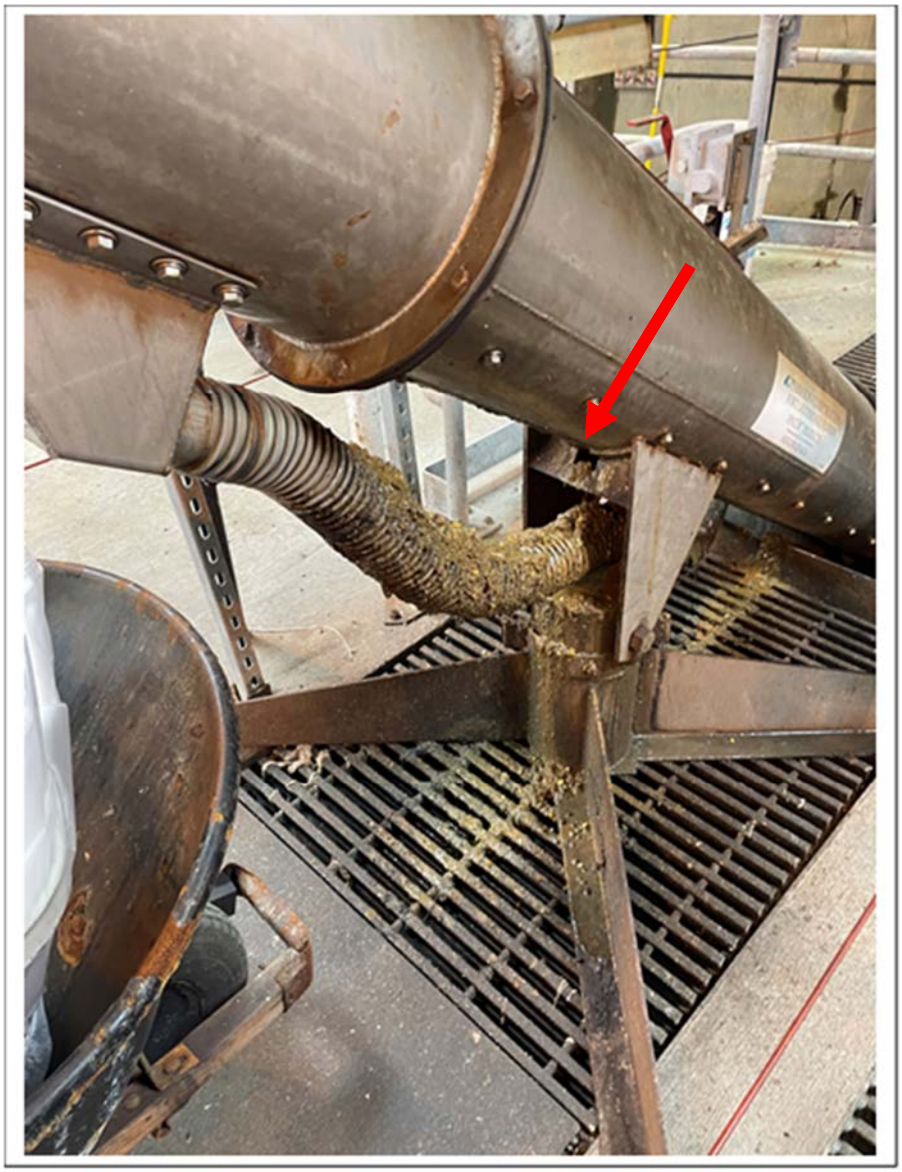


Figure 1

The equipment in the station is exposed to weather due to the failure of the geodesic dome that serves as the roof. Numerous leaks create operational challenges and requires staff to cover equipment with plastic for protection. Figure 2 shows the screening controls that must be covered to preserve electrical control.

Figure 2

Headworks

The headworks is located at the treatment plant site and includes screening and sampling. The screening system is the same as northside pump station. In addition to having the same maintenance challenges, the headworks is exposed to high levels of hydrogen sulfide. This exposure results in severe corrosion throughout the system. The sampling and air handing equipment requires replacement on a regular basis due to this corrosion. The sampling system is currently out of service due to this condition. Staff have implemented an interim sampling solution that requires addition of ice to maintain the required temperature to preserve sample integrity.

Corrosion is damaging infrastructure throughout the conveyance system, from the northside pump station to the influent pump station and into the headworks. The septic conditions that produce hydrogen sulfide also creates an oxygen demand on the secondary treatment system which strains the aeration system at times. High levels of hydrogen sulfide gas create hazardous atmospheres that are toxic. Figure 3 shows the effect of hydrogen sulfide on concrete. This photo was taken in front of the influent pump station where air is removed from the wet well for treatment. The concrete is eroding due to sulfuric acid created by hydrogen sulfide and moisture.

Figure 3

Septage Receiving

Septage receiving is an ongoing activity at the treatment plant as septage haulers from the region arrive on a regular basis to off load septage. The package receiving system includes automated control and screening. The screening system is like the northside and headworks systems. The seepage screen is no longer performing and requires manual removal of screening. This requires the haulers or staff to intervene between loads to remove debris from the screen.

Solids Handling

The overall condition of the solids handling system is Fair to Poor even after several component refurbishments over the past three years. Much of the condition deterioration is due to the fact the system must operate well over 40 hours a week to process the incoming solids. This leaves little time for maintenance and results in immediate impact when a component failure occurs. The system's automation incorporates multiple systems. While many controls have been refurbished, the incomplete integration caused by failures over the years has resulted in manual control and monitoring. Operation of the system requires in excess of one full time equivalent employee resource.

2018 to 2021 Condition Rating Comparison and Observations

This section concludes the condition assessment update TM. Table 3 provides a summary and comparison of 2018 and 2021 ratings. Rating changes that result in negative values indicate further deterioration in asset condition. An observations column has been added to provide context to the rating change.

Observations based on the comparison of the two condition assessments:

- The system condition ratings from 2018 to 2021 have degraded by about 6% even though several refurbishment projects have been completed in that time.
- Approximately half of the systems show declining condition.
- Refurbishments of the aeration and polymer systems have resulted in an improved condition score.
- Pump failures in IPS, RAS/WAS, NS pump station contribute to a decreased rating.
- Personnel safety in the areas of the NS pump station, headworks and septage systems contribute to reduced condition rating.
- The condition of the solids handling systems combined (pasteurization system, centrifuge, lime feed and septage receiving) pose a significant risk to the city.

System Description	2018 Condition Rating	2021 Condition Rating	Rating Change	Observation
Influent Pump Station	3.2	3.0	0.20	Pump improvements; Odor system in service; Wet well and equipment corrosion increasing.
Effluent Conveyance	2.2	2.2	0.00	Planned to install chlorine residual monitoring.
Headworks Screenings	3.0	3.7	-0.71	Pump out of service; Screening ineffective; Screening chute safety; Corrosion.
Aeration Basin	2.9	2.7	0.22	New aerator drives, bearings, lubrication; Increased RPM to provide additional aeration.
Secondary Clarification	2.0	2.3	-0.33	Drive and mechanism deterioration, refurbishment scheduled for 2022. New scum pump installed.
Sodium Hypochlorite System	2.5	3.3	-0.79	Chemical metering and control not reliable. New skid mounted system design is 80% complete.
W3 and Sump Pumping	2.6	3.0	-0.40	Sump pumps not accessible for maintenance, requires cutting pipe.
Septage	2.9	3.6	-0.67	New access deck installed; screening removal requires manual effort; Monitoring sensors not in operation.
Plant Drain	2.4	2.0	0.40	Replaced plant drain pump.
Plant Effluent	2.4	1.8	0.57	Replaced sample pump; New chlorine analyzer; Purchased new mixer and control panel.
W1	2.1	2.4	-0.28	Pump condition decreased to fair.
Generator Power	2.0	2.0	0.00	Serviced and load tested July 2021.
RAS/WAS Pumping	1.4	2.4	-1.04	One RAS pump out of service; WAS flow metering not accurate.
Sludge Storage and Dewatering Feed Pumping	1.9	2.1	-0.16	Blower not operating at design pressure.
Dewatering Polymer	3.4	2.2	1.20	Replaced one of two polymer make down systems.
Centrifuge	3.7	3.2	0.55	One centrifuge out of service due to feed port; New centrifuge motors, controls; New screw conveyor for No. 1 centrifuge. Both centrifuges on line do not meet throughput needs.
Pasteurization System Lime Storage and Feed	2.8	3.4	-0.64	Equipment on top of lime storage not accessible due to safety. Other equipment requires excessive maintenance.
Pasteurization System Biosolids	2.6	3.4	-0.80	Control requires manual operation; Heat system not reliable; conveyor replacement scheduled for December 2021.
Northside Pump Station	2.5	3.1	-0.64	One of three pumps out of service for repair; Screens are worn and not effective in removing screenings.
Structures	1.9	1.9	0.03	Perimeter fence project completed; Northside pump station cover has missing panel, broken skylights and corrosion.
Electrical	2.5	2.3	0.16	Harmonic filters not serviceable; Several adjustable frequency drives have been replaced.
Instrumentation and Control	Not Rated	n/a	n/a	n/a

Table 3

Criticality Matrix

Wastewater Treatment - criticality levels by possible impact						
Impact Category	**Weight**	**Negligible = 1**	**Low = 4**	**Moderate = 7**	**Critical = 10**
1 Health & Safety of employees and public	1.0	No injuries or adverse health effects	No lost-time injuries or medical attention necessary	Lost time injury or injury requires medical attention	Long term disability or death.
2 Compliance with permits and regulations	0.8	No violations of permits or regulations. No environmental or public health impact.	Warning Letter but no enforcement action taken, No environmental or public health impact	Violation of NPDES Permit. Possible short-term environmental impact. Possible public health impact.	Violation of NPDES Permit. Enforcement action likely. Long-term environmental impact likely; public health impact likely.
3 Service reliability	0.8	<20 services interrupted; No Process Impact	<500 services effected; Reduction in Process efficiency	500-1000 services effected; Long term Process impacts	Service interruption >1000 services; Process failure
4 Disruption to the community / Public Image	0.7	No social or economic impact on the businesses or the community. No disruption to the community. No media coverage.	No social or economic impact on the businesses or the community. Minor disruption to the community (e.g., traffic, dust, noise). No media coverage.	Short-term economic impact on residential customers and/or a few business. Minor disruption to the community (e.g., traffic, dust, noise). Local media coverage.	Long-term or area-wide economic impact on numerous businesses or any "high-priority" customer. Major disruption to the community (e.g., traffic, dust, noise). National media coverage.
5 Ability to return asset to service	0.7	Less than 4 hours	Service restored 4 to 12 hours	Service restored 12 to 24 hours	Not able to restore service for >24 hrs
6 Financial impact on utility	0.6	<$5,000	$5,000 to $25,000	$25,000 to $150,000	>$150,000

Likelihood-Trigger Matrix

Likelihood - Trigger Matrix							
	Objective	Weight	Negligible = 1	Minor = 2	Moderate = 4	Major = 7	Critical = 10
Likelihood	Condition Assessment Overall	0.75	Only planned maintenance required (Condition Grade 1)	5% needs corrective maintenance or renewal (Condition Grade 2)	10 to 20% needs corrective maintenance or renewal (Condition Grade 3)	20 to 40% needs corrective maintenance or renewal (Condition Grade 4)	>50% requires corrective maintenance or renewal (Condition Grade 5)
Likelihood	Effective Operating Protocols[1]	0.10	Optimal	Satisfactory	Known improvements needed	No protocols currently exist	
Likelihood	Reliability	0.10	No Corrective work order Events within 12 months	<2 corrective work order events within 12 months	2-5 corrective work order events within 12 months	>6-8 corrective work order events within 12 months	>8 corrective work order events within 12 months
Likelihood	Planned Redundancy[2]	0.05	200% - additional spare parts in stock - action plan in place and practiced	100% - spare parts in stock - action plan developed and implemented	Spare parts are available within 4 hours - action plan developed and implemented	Spare parts are available within 24 hours - action plan developed and implemented	0% - no parts - no plan
Trigger	Capacity and Utilization[3]	0.5	Sized correctly for meeting conditions	Under utilized (Time)	Over capacity (Volume)	Over utilized (Time)	Unable to meet capacity
Trigger	Obsolescence	0.2	New - optimal technology	Technology change	No manufactured parts available	Parts probably available from other sources	Parts are not available
Trigger	Annual Maintenance Cost[4]	0.3	<10% of replacement cost	10-20% of replacement cost	20-30% of replacement cost	30-50% of replacement cost	>50% of replacement cost

[1] Includes standard operating procedures, O&M manuals, maintenance checklists, etc.
[2] Includes availability of parts and written plan to find in-stock parts, and obtain parts from others.
[3] Capacity relates to volume, quantity or flow; utilization relates to the amount of time asset is in-use.
[4] Includes all maintenance costs, both planned and unplanned.

Appendix A

System Criticality and Risk Scoring

Wastewater Systems	Weight	Influent Pump Station	Effluent Conveyance	Headworks Screening	Aeration Basin	Secondary Clarification	Sodium Hypochlorite System	W3 and Sump Pumping	Septage	Plant Drain	Plant Effluent	W1	Generator Power	RAS/WAS Pumping	Sludge Storage and Dewatering Feed Pumping	Dewatering Polymer	Centrifuge	Pasteurization System Lime Storage and Feed	Pasteurization System Biosolids	Northside Pump Station	Structures	Electrical	Instrumentation and Control
Criticality	**Weight**																						
Health & Safety of employees and public	1.0	4	1	7	1	1	7	4	4	4	4	1	1	4	4	1	1	7	7	4	1	4	1
Compliance with permits and regulations	0.8	7	7	1	1	1	10	1	1	1	1	1	10	4	1	1	4	7	10	7	1	7	4
Service reliability	0.8	7	4	4	10	4	10	4	10	4	7	1	7	4	4	4	10	10	10	7	1	4	7
Disruption to the community / Public Image	0.7	7	7	4	4	4	10	1	7	1	4	1	7	4	4	4	7	10	10	10	1	4	4
Ability to return asset to service	0.7	4	4	7	4	10	7	4	4	4	1	1	10	10	4	4	10	10	10	10	4	10	4
Financial impact on utility	0.6	7	4	7	7	10	7	1	7	1	1	1	4	4	1	4	10	7	10	10	7	7	4
Criticality Score		**27.1**	**19.9**	**22.9**	**19.6**	**20.8**	**39.1**	**12.1**	**24.7**	**12.1**	**14.5**	**4.6**	**28.9**	**22.6**	**14.2**	**13.0**	**30.1**	**38.8**	**43.0**	**35.2**	**10.3**	**26.8**	**17.8**
Criticality Rank		**7**	**13**	**10**	**14**	**12**	**2**	**19**	**9**	**19**	**16**	**22**	**6**	**11**	**17**	**18**	**5**	**3**	**1**	**4**	**21**	**8**	**15**
Likelihood	**Weight**																						
Condition Assessment Overall	0.75	4	1	7	7	4	10	2	10	2	2	1	1	4	1	2	7	7	10	7	2	2	2
Effective Operating Protocols1	0.10	2	2	2	2	2	4	1	4	2	2	1	2	1	2	2	4	2	4	4	2	2	2
Reliability	0.10	10	2	2	10	4	10	1	10	4	1	1	4	7	2	2	10	7	10	10	2	2	4
Planned Redundancy2	0.05	4	2	2	7	4	7	2	7	4	2	2	4	4	4	2	10	7	7	7	2	4	2
Likelihood Score		**4.4**	**1.25**	**5.75**	**6.8**	**3.8**	**9.25**	**1.8**	**9.25**	**2.3**	**1.9**	**1.05**	**1.55**	**4**	**1.35**	**2**	**7.15**	**6.5**	**9.25**	**7**	**2**	**2.1**	**2.2**
Likelihood Rank		**9**	**21**	**8**	**6**	**11**	**1**	**18**	**1**	**12**	**17**	**22**	**19**	**10**	**20**	**15**	**4**	**7**	**1**	**5**	**15**	**14**	**13**
Trigger	**Weight**																						
Capacity and Utilization3	0.50	2	1	10	4	1	1	1	10	1	1	1	1	4	4	1	10	1	7	4	1	1	1
Obsolescence	0.20	2	1	2	1	1	2	1	2	1	1	1	1	2	2	2	2	7	7	2	1	1	1
Annual Maintenance Cost4	0.30	2	1	4	7	2	4	1	2	2	1	1	1	2	1	1	2	2	7	4	1	1	1
Trigger Score		**2**	**1**	**6.6**	**4.3**	**1.3**	**2.1**	**1**	**6**	**1.3**	**1**	**1**	**1**	**3**	**2.7**	**1.2**	**6**	**2.5**	**7**	**3.6**	**1**	**1**	**1**
Trigger Rank		**11**	**15**	**2**	**5**	**12**	**10**	**15**	**3**	**12**	**15**	**15**	**15**	**7**	**8**	**14**	**3**	**9**	**1**	**6**	**15**	**15**	**15**
Risk																							
Risk Score		**238**	**25**	**869**	**573**	**103**	**760**	**22**	**1371**	**36**	**28**	**5**	**45**	**271**	**52**	**31**	**1291**	**631**	**2784**	**887**	**21**	**56**	**39**
Risk Rank		**10**	**19**	**5**	**8**	**11**	**6**	**20**	**2**	**16**	**18**	**22**	**14**	**9**	**13**	**17**	**3**	**7**	**1**	**4**	**21**	**12**	**15**

Appendix B Headworks Alternatives Cost Estimate

Alternative:	Headworks Improvements					
Last Updated:	1/16/2023					
QC/QC Date:	1/11/2023					
Detail Capital Costs						
Component/Item		Quantity	Units	Unit Cost	Bare Cost	Capital Cost
Headworks						
	Demo existing screens	2	ea	10,000	$20,000	$44,296
	New screen, with washer/compactor	3	ea	250,000	$750,000	$1,661,101
	New screen installation	3	ea	37,500	$112,500	$249,165
	New gates, 36" x 60", motor operated	2	ea	7,500	$15,000	$33,222
	Operator for existing gates	4	ea	2,000	$8,000	$17,718
	Replace manhole covers, 24"	2	ea	250	$500	$1,107
	Replace grating, 4' x 8', aluminum	32	sqft	65	$2,080	$4,607
	Channel covers, aluminum	300	sqft	75	$22,500	$49,833
	Enclose exterior wall openings, CIP stem wall	175	sqft	45	$7,875	$17,442
	Enclose exterior wall openings, CMU	333	sqft	30	$9,990	$22,126
	Odor Control System	1	ls	140,000	$140,000	$310,072
	Odor Control System installation	1	ls	21,000	$21,000	$46,511
	Odorous air ductwork	1	ls	100,000	$100,000	$221,480
	Misc repairs	1	ls	20,000	$20,000	$44,296
	Electrical Allowance	1	ls	226,000	$226,000	$500,545
Assumes project will be D/B/B						
					$1,455,445	
Construction Markups						
	Contractor Overhead and Profit	15	%		$218,317	
	Subtotal				$1,673,762	
	Contractor General Conditions	12	%		$200,851	
	Subtotal				$1,874,613	
	Undesigned/Undeveloped Detail Contingency	40	%		$749,845	
	Subtotal				$2,624,458	
	Bonds and Insurance	3.5	%		$91,856	
	Subtotal				$2,716,314	
	Oregon Corporate Activity Tax	0.57	%		$15,483	
	Subtotal				$2,731,797	
	Escalation to Midpoint (March 2027)	18	%		$491,724	
	SUBTOTAL CONSTRUCTION COST				**$3,223,521**	
Other Markups						
	Risk Based Contingency	0	%		$0	
	Subtotal				$3,223,521	
	Soft Costs	0	%		$0	
TOTAL CAPITAL COST					**$3,223,521**	**$3,223,521**

Appendix C Liquids Stream Alternatives Cost Estimate

Alternative: 2nd Oxidation Ditch + 3rd Secondary Clarifier
Last Updated: 1/16/2023
QC/QC Date: 1/11/2023

Detail Capital Costs

Component/Item	Quantity	Units	Unit Cost	Bare Cost	Capital Cost
Oxidation Ditch, 1.44 MG, 180 ft long x 130 ft wide					
Ground Improvements Allowance	20000	sqft	20	$400,000	$885,920
Structural and Earthwork	1	ls	2,883,000	$2,883,000	$6,385,271
Equipment	1	ls	788,000	$788,000	$1,745,263
Process Piping	1	ls	47,000	$47,000	$104,096
Secondary Clarifier, 90 ft dia x 16 ft deep, fully buried					
Ground Improvements Allowance	7100	sqft	20	$142,000	$314,502
Structural and Earthwork	1	ls	1,922,000	$1,922,000	$4,256,847
Equipment	1	ls	686,000	$686,000	$1,519,353
Process Piping	1	ls	93,000	$93,000	$205,976
RAS/WAS Pumping Station					
Structural and Earthwork	1	ls	275,000	$275,000	$609,070
Equipment	1	ls	157,000	$157,000	$347,724
Process Piping	1	ls	116,000	$116,000	$256,917
RAS Mixing Box, 24 ft x 6 ft x 16 ft deep, with gates					
Structural and Earthwork	1	ls	52,000	$52,000	$115,170
Equipment	1	ls	42,000	$42,000	$93,022
ML Splitter Box, 18 ft x 19 ft x 15 ft deep, 3 channels with cutthroat flumes and gates					
Structural and Earthwork	1	ls	123,000	$123,000	$272,421
Equipment	1	ls	45,000	$45,000	$99,666
Site Work					
Site Grading	1	ls	200,000	$200,000	$442,960
Demo Pole Building, 50' x 40'	2000	sqft	12	$24,000	$53,155
Asphalt Roadway	24080	sqft	6	$144,480	$319,994
36" ML (DI) Piping, buried	600	lf	1,000	$600,000	$1,328,881
30" RS (DI) Piping, buried	165	lf	850	$140,250	$310,626
24" SE (DI) piping, buried	380	lf	780	$296,400	$656,467
16" RAS (DI) piping, buried	620	lf	450	$279,000	$617,929
6" WAS, TD, DS (DI) Piping, buried	1050	lf	255	$267,750	$593,013
6" Scum (DI glass lined) Piping, buried	325	lf	280	$91,000	$201,547
4" TWAS (DI) Piping, buried	0	ls	225	$0	$0
Site Utility Piping Allowance	1	ls	10,000	$10,000	$22,148
Electrical Allowance	1	ls	2,456,000	$2,456,000	$5,439,551
Assumes project will be D/B/B					
				$12,279,880	
Construction Markups					
Contractor Overhead and Profit	15	%		$1,841,982	
Subtotal				$14,121,862	
Contractor General Conditions	12	%		$1,694,623	
Subtotal				$15,816,485	
Undesigned/Undeveloped Detail Contingency	40	%		$6,326,594	
Subtotal				$22,143,080	
Bonds and Insurance	3.5	%		$775,008	
Subtotal				$22,918,087	
Oregon Corporate Activity Tax	0.57	%		$130,633	
Subtotal				$23,048,721	
Escalation to Midpoint (March 2027)	18	%		$4,148,770	
SUBTOTAL CONSTRUCTION COST				**$27,197,490**	
Other Markups					
Risk Based Contingency	0	%		$0	
Subtotal				$27,197,490	
Soft Costs	0	%		$0	
TOTAL CAPITAL COST				**$27,197,490**	**$27,197,490**

Alternative: Primary Clarifiers + 3rd Secondary Clarifier					
Last Updated: 1/16/2023					
QC/QC Date: 1/11/2023					
Detail Capital Costs					
Component/Item	Quantity	Units	Unit Cost	Bare Cost	Capital Cost
Primary Clarifiers, 80 ft long x 16 ft wide x 14' deep, typ of 2, buried half way					
Ground Improvements Allowance	2500	sqft	20	$50,000	$110,740
Structural and Earthwork	1	ls	1,244,000	$1,244,000	$2,755,212
Equipment	1	ls	1,047,000	$1,047,000	$2,318,897
Process Piping	1	ls	523,500	$523,500	$1,159,448
Secondary Clarifier, 90 ft dia x 16 ft deep, fully buried					
Ground Improvements Allowance	7100	sqft	20	$142,000	$314,502
Structural and Earthwork	1	ls	1,922,000	$1,922,000	$4,256,847
Equipment	1	ls	686,000	$686,000	$1,519,353
Process Piping	1	ls	93,000	$93,000	$205,976
RAS/WAS Pumping Station					
Structural and Earthwork	1	ls	275,000	$275,000	$609,070
Equipment	1	ls	157,000	$157,000	$347,724
Process Piping	1	ls	116,000	$116,000	$256,917
RAS Mixing Box, 24 ft x 6 ft x 16 ft deep, with gates					
Structural and Earthwork	1	ls	52,000	$52,000	$115,170
Equipment	1	ls	42,000	$42,000	$93,022
ML Splitter Box, 18 ft x 19 ft x 15 ft deep, 3 channels with cutthroat flumes and gates					
Structural and Earthwork	1	ls	123,000	$123,000	$272,421
Equipment	1	ls	45,000	$45,000	$99,666
Site Work					
Site Grading	1	ls	250,000	$250,000	$553,700
Asphalt Roadway	15080	sqft	6	$90,480	$200,395
36" ML (DI) Piping, buried	20	lf	1,000	$20,000	$44,296
30" RS, PE (DI) Piping, buried	260	lf	850	$221,000	$489,471
24" ML, SE (DI) piping, buried	615	lf	780	$479,700	$1,062,440
16" RAS (DI) piping, buried	240	lf	450	$108,000	$239,199
6" WAS, DS, Drain (DI) Piping, buried	1780	lf	255	$453,900	$1,005,298
6" Scum (DI glass lined) Piping, buried	600	lf	280	$168,000	$372,087
4" TWAS, DS (DI) Piping, buried	495	ls	225	$111,375	$246,673
Site Utility Piping Allowance	1	ls	10,000	$10,000	$22,148
Electrical Allowance	1	ls	2,107,000	$2,107,000	$4,666,586
Assumes project will be D/B/B					
				$10,536,955	
Construction Markups					
Contractor Overhead and Profit	15	%		$1,580,543	
Subtotal				$12,117,498	
Contractor General Conditions	12	%		$1,454,100	
Subtotal				$13,571,598	
Undesigned/Undeveloped Detail Contingency	40	%		$5,428,639	
Subtotal				$19,000,237	
Bonds and Insurance	3.5	%		$665,008	
Subtotal				$19,665,246	
Oregon Corporate Activity Tax	0.57	%		$112,092	
Subtotal				$19,777,337	
Escalation to Midpoint (March 2027)	18	%		$3,559,921	
SUBTOTAL CONSTRUCTION COST				**$23,337,258**	
Other Markups					
Risk Based Contingency	0	%		$0	
Subtotal				$23,337,258	
Soft Costs	0	%		$0	
TOTAL CAPITAL COST				**$23,337,258**	**$23,337,258**

Appendix D Solids Alternatives Cost Estimate

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project:	BC - Newport Solids Master Planning	**Prepared By:**	BIB
		Date Prepared:	05.23.2023
Building:	Class A Compost Alternative	**K/J Proj. No.:**	2276008*00

Estimate Type:

- ■ **Conceptual**
- ☐ **Preliminary (w/o plans)**
- ☐ **Design Development @**
- ☐ **Construction**
- ☐ **Change Order**

Current at ENR	13,288.00
Escalated to ENR	
Mos. to Midpoint	60

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
	Hauled Waste Receiving		$530,050	$165,398	$200,522	$895,970
	Thickening		$537,300	$185,690	$175,022	$898,012
	Aerobic Digester		$1,414,162	$533,442	$676,464	$2,624,068
	Dewatering Centrifuge		$1,481,153	$391,372	$501,868	$2,374,393
	Compost		$2,097,068	$1,103,161	$929,226	$4,129,456
	Sitework		$546,095	$546,095	$0	$1,092,190
	Subtotals		$6,605,828	$2,925,158	$2,483,103	$12,014,089
	Contractor Indirects	12%	$792,699	$351,019	$297,972	$1,441,691
	Subtotals		$7,398,528	$3,276,177	$2,781,075	$13,455,779
	Contractor OH&P @	15%	$1,109,779	$491,426	$417,161	$2,018,367
	Subtotals		$8,508,307	$3,767,603	$3,198,236	$15,474,146
	Estimate Contingency @	25%				$3,868,537
	Subtotal					$19,342,683
	Escalation to Mid-Pt of Construction	4%				$4,190,648
	Subtotal					$23,533,331
	Engineering, Administrative, Permits, Legal	38%				$8,942,666
	Total Estimate					$32,500,000

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$45,500,000	**$32,500,000**	**$26,000,000**

File: Compost Capital Costs.xlsm
Tab: SUMMARY

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project: **BC - Newport Solids Master Planning**

Building, Area: **Packaged Hauled Waste System - Huber RoFas**

Prepared By: BB
Date Prepared: 31-May-23
KJ Proj. No. 2276008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ **Conceptual**
- ☐ **Preliminary (w/o plans)**
- ☐ **Design Development @** _________ **% Complete**
- ☐ **Construction**
- ☐ **Change Order**

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
			Demo Existing Haul Station	1	LS	500.00	500	5,000.00	5,000			5,500
4			Excavation: Small structures	100	BCY			21.73	2,173			2,173
7			Import fill: crushed rock and fill	80	LCY	26.14	2,091	7.30	584			2,675
11			Compact: Small structures	240	ECY			1.74	418			418
12			Haul (offsite disposal of excess cut)	20	LCY			7.40	148			148
28			Base course	50	SY	5.02	251	1.10	55			306
29			6" stone base, 4" binder, 2" topper	50	SF	4.16	208	0.50	25			233
44			Demo bituminous pavement and curb	50	SY			4.90	245			245
	SUBTOTAL - DIVISION 02						2,550		3,648			6,198
	DIVISION 03 - CONCRETE											
			Misc concrete equip. slabs	1	LS	10,000.00	10,000	5,000.00	5,000			15,000
	SUBTOTAL - DIVISION 03						10,000		5,000			15,000
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
			Misc metals	1	LS	5,000.00	5,000	2,500.00	2,500			7,500
	SUBTOTAL - DIVISION 05						5,000		2,500			7,500
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
			Pipe coating	1	LS	2,500	2,500	1,250	1,250			3,750
	SUBTOTAL - DIVISION 09						2,500		1,250			3,750
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
			Huber RoFas	1	EA	495,000	495,000	148,500	148,500			643,500
	SUBTOTAL - DIVISION 11						495,000		148,500			643,500
	DIVISION 12 - FURNISHINGS											
	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
	SUBTOTAL - DIVISION 13											
	DIVISION 14 - CONVEYING SYSTEMS											
	SUBTOTAL - DIVISION 14											
	DIVISION 15 - MECHANICAL											
			Piping	1	LS	15,000.00	15,000	4,500.00	4,500			19,500
	SUBTOTAL - DIVISION 15						15,000		4,500			19,500
	DIVISION 16 - ELECTRICAL											
			25-Percent of Div 11, 14 and 15 costs	1	LS					165,750	165,750	83,454
	SUBTOTAL - DIVISION 16										165,750	83,454
	DIVISION 17 - INSTRUMENTATION											
			5-Percent of total cost	1	LS					34,772	34,772	34,772
	SUBTOTAL - DIVISION 17										34,772	34,772
	SUBTOTAL, ALL DIVISIONS						530,050		165,398		200,522	813,674

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS, INC.**

Project: BC - Newport Solids Master Planning

Building, Area: Mechanical Thickening - FKC RDT

Prepared By: BB
Date Prepared: 31-May-23
KJ Proj. No. 2276008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @ ______ % Complete
- ☐ Construction
- ☐ Change Order

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
			Demo Existing Lime Eqpt, Conc. and Grating	1	LS	5,000.00	5,000	25,000.00	25,000			30,000
	SUBTOTAL - DIVISION 02						5,000		25,000			30,000
	DIVISION 03 - CONCRETE											
			Misc concrete equip. slabs	1	LS	20,000.00	20,000	10,000.00	10,000			30,000
	SUBTOTAL - DIVISION 03						20,000		10,000			30,000
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
			Misc metals	1	LS	50,000.00	50,000	10,000.00	10,000			60,000
			Access Platform(s)	1	LS	25,000.00	25,000	7,500.00	7,500			32,500
	SUBTOTAL - DIVISION 05						75,000		17,500			92,500
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
			Pipe coating	1	LS	10,000	10,000	5,000	5,000			15,000
	SUBTOTAL - DIVISION 09						10,000		5,000			15,000
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
			Thickening Feed Pumps	2	EA	40,000	80,000	12,000	24,000			104,000
			Rotary Drum Thickeners	2	EA	121,150	242,300	36,345	72,690			314,990
			TWAS Feed Pumps	2	EA	20,000.00	40,000	6,000	12,000			52,000
	SUBTOTAL - DIVISION 11						362,300		108,690			470,990
	DIVISION 12 - FURNISHINGS											
	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
85												
	SUBTOTAL - DIVISION 13											
	DIVISION 14 - CONVEYING SYSTEMS											
	SUBTOTAL - DIVISION 14											
	DIVISION 15 - MECHANICAL											
			Pipe and Fittings	1	LS	35,000.00	35,000	10,500.00	10,500			45,500
			Yard Piping	1	LS	30,000.00	30,000	9,000.00	9,000			39,000
	SUBTOTAL - DIVISION 15						65,000		19,500			84,500
	DIVISION 16 - ELECTRICAL											
			25-Percent of Div 11, 13 and 15 costs	1	LS					138,873	138,873	86,759
	SUBTOTAL - DIVISION 16										138,873	86,759
	DIVISION 17 - INSTRUMENTATION											
			5-Percent of total cost	1	LS					36,150	36,150	36,150
	SUBTOTAL - DIVISION 17										36,150	36,150
	SUBTOTAL, ALL DIVISIONS						537,300		185,690		175,022	845,898

OPINION OF PROBABLE CONSTRUCTION COST — **KENNEDY/JENKS CONSULTANTS, INC.**

Project: BC - Newport Solids Master Planning
Building, Area: Aerobic Digester

Prepared By: wmh/BIB
Date Prepared: 31-May-23
KJ Proj. No. 2276008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @ ______ % Complete
- ☐ Construction
- ☐ Change Order

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
1		**General Site Work**	Clearing/Grubbing	0.10	Acre			5,642.60	587			587
3		**Digester**	Excavation: Large structures	396	BCY			15.59	6,174			6,174
7			Import fill: crushed rock and fill	218	LCY	26.14	5,709	7.30	1,594			7,303
12			Haul (offsite disposal of excess cut)	218	LCY			7.40	1,616			1,616
8			Fill (native)	41	LCY			7.30	299			299
10			Compact: Large structures	218	ECY			6.12	1,337			1,337
12			Haul (offsite disposal of excess cut)	437	LCY			7.40	3,232			3,232
31		Sidewalk	Sidewalk (4" concrete over 4" gravel	220	LF	20.92	4,602	15.55	3,421			8,023
		Digester, additional excavation										
3		Bring ground to grade	Excavation: Large structures	470	BCY			15.59	7,327			7,327
12			Haul (offsite disposal of excess cut)	510	LCY			7.40	3,771			3,771
8		backfill sloping cut	Fill (native)	101	LCY			7.30	740			740
3		Bring Digester slab down/lower TOW	Excavation: Large structures	896	BCY			15.59	13,969			13,969
3		Sloping	Excavation: Large structures	338	BCY			15.59	5,269			5,269
12			Haul (offsite disposal of excess cut)	896	LCY			7.40	6,630			6,630
8		backfill sloping cut	Fill (native)	338	LCY			7.30	2,467			2,467
10		backfill sloping cut	Compact: Large structures	338	ECY			6.12	2,069			2,069
		Digester Control/Blower Building										
3			Excavation: Large structures	50	BCY			15.59	780			780
7			Import fill: crushed rock and fill	33	LCY	26.14	850	7.30	237			1,087
12			Haul (offsite disposal of excess cut)	33	LCY			7.40	241			241
10			Compact: Large structures	33	ECY			6.12	199			199
12			Haul (offsite disposal of excess cut)	65	LCY			7.40	481			481
31		Sidewalk	Sidewalk (4" concrete over 4" gravel	110	LF	20.92	2,293	15.55	1,704			3,997
	SUBTOTAL - DIVISION 02						13,454		64,144			77,598
	DIVISION 03 - CONCRETE											
		Digester										
56		Base Slab (24")	SOG Large structures	187.00	CY	375.00	70,125	400.00	74,800			144,925
59		Walls (24")	Walls over 10' high	252.00	CY	450.00	113,400	600.00	151,200			264,600
61		Stairs	Stairs	11.00	RSR	30.00	330	130.00	1,430			1,760
		Drain Sumps	Sump addition	4.00	EA							
		Digester Control/Blower Building										
57		blower pads	SOG Small structures	3.00	CY	450.00	1,350	325.00	975			2,325
57		E-room Pads	SOG Small structures	2.00	CY	450.00	900	325.00	650			1,550
	SUBTOTAL - DIVISION 03						186,105		229,055			415,160
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
62		Handrails, Stairs	Railing - Aluminum	24.00	LF	93.00	2,232	11.13	267			2,499
62		Railing, Digester	Railing - Aluminum	800.00	LF	93.00	74,400	11.13	8,904			83,304
63		Decant Channel Grating	Grating - Aluminum	180.00	SF	63.00	11,340	2.92	526			11,866
			Miscellaneous Metals (incl. Pipe Sup	1.00	LS	10,000.00	10,000	2,000.00	2,000			12,000
66			Grating/Checker plate supports	102.00	LF	15.00	1,530	10.00	1,020			2,550
	SUBTOTAL - DIVISION 05						99,502		12,717			112,219
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
			Pipe Coatings	1.00	LS	7,500.00	7,500	750.00	750			8,250
	SUBTOTAL - DIVISION 09						7,500		750			8,250
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
		Digester Control/Blower Building										
		Blowers	Blowers, 150 hp	4.00	Ea	$78,000	312,000	$15,600	62,400			374,400
		Digester										
		Mixers	Flygt, 10 hp	4.00	Ea.	62,400.00	249,600	5,460.00	21,840			271,440
		Davit Crane	Davit Cranes for Mixers	4.00	Ea.	2,800.00	11,200	500.00	2,000			13,200
		Diffusers	Diffusers (304 SS branches + drop p	1.00	LS	186,200.00	186,200	10,500.00	10,500			196,700
78		Feed Box Slide Gates	Steel Slide Gate, Contained, 24"x24	8.00	EA	6,700.00	53,600	1,340.00	10,720			64,320
76a		Drainage gates	Steel Slide Gate, Contained, 12"x12	4.00	EA	4,650.00	18,600	930.00	3,720			22,320
		Digester Cover		1.00	LS	160,000.00	160,000	48,000.00	48,000			208,000
		Davit Cranes		4.00	EA	2,000.00	8,000	600.00	600			8,600
	SUBTOTAL - DIVISION 11						999,200		159,780			1,158,980
	DIVISION 12 - FURNISHINGS											

	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
		Digester Control/Blower Building										
84			Building (CMU)	668	SF					350.00	233,800	233,800
	SUBTOTAL - DIVISION 13										233,800	233,800
	DIVISION 14 - CONVEYING SYSTEMS											
	SUBTOTAL - DIVISION 14											
	DIVISION 15 - MECHANICAL											
		Digester Control/Blower Building										
			Air Piping Allowance	1.00	LS	17,000.00	17,000	24,000.00	24,000			41,000
		Digester										
87		feed, outlet piping, 4" DIP	4" DI	84.00	LF	72.89	6,123	7.08	594			6,717
		4" DIP Fitting and Valve Allowance		1.00	LS	50,000.00	50,000	25,000.00	25,000			75,000
89		Drain Piping, 6" DIP	6" DI	37	LF	89.51	3,312	8.84	327			3,639
116		Drain Piping, 8" DIP	8" DI	6	LF	161.13	967	12.39	74			1,041
			Drain Fitting Allowance	1	LS	5,000.00	5,000	1,000.00	1,000			6,000
		Utiltiy Water	Utiltiy Wash Stations	4.00	Ea	1,500.00	6,000	1,000.00	4,000			10,000
		Utiltiy Water	Piping and valve allowance	1.00	LS	10,000.00	10,000	2,000.00	2,000			12,000
		Utiltiy Water	Spray System Piping (per cell)	4.00	Ea	2,500.00	10,000	2,500.00	10,000			20,000
	SUBTOTAL - DIVISION 15						108,401		66,996			175,397
	DIVISION 16 - ELECTRICAL											
			25-Percent of Div 11, 14 and 15 cos	1	LS					333,594	333,594	333,594
	SUBTOTAL - DIVISION 16										333,594	333,594
	DIVISION 17 - INSTRUMENTATION											
			5-Percent of total cost	1	LS					109,070	109,070	109,070
	SUBTOTAL - DIVISION 17										109,070	109,070
	SUBTOTAL, ALL DIVISIONS						1,414,162		533,442		676,464	2,624,068

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: BC - Newport Solids Master Planning

Building, Area: Dewatering Centrifuges

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No. 2276008*00

Current at ENR 13,288.00
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ **Conceptual**
- ☐ **Preliminary (w/o plans)**
- ☐ **Design Development @**
- ☐ **Construction**
- ☐ **Change Order**
- **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0		0		0	0
SUBTOTAL - DIVISION 1						0		0		0	0
DIVISION 2 - SITE WORK											
	Demo										
		Remove centrifuges, conveyors, polymer system, controls	1	LS			20,000.00	20,000			20,000
		Haul	1	LS			1,000.00	1,000			1,000
		Disposal	1	LS			1,000.00	1,000			1,000
	Temporary										
		Dewatering Skid and Temp connections	6	Mo.	0.00	0	0.00	0	11,000	66,000	66,000
SUBTOTAL - DIVISION 2						0		22,000		66,000	88,000
DIVISION 3 - CONCRETE											
Equipment Bases											
		Concrete Base Slab on Grade	10	CY	300.00	3,000	300.00	3,000	0	0	6,000
		Grout at Equipment Bases	1	LS	2,000.00	2,000	500.00	500	0	0	2,500
SUBTOTAL - DIVISION 3						5,000		3,500		0	8,500
DIVISION 4 - MASONRY						0		0		0	0
SUBTOTAL - DIVISION 4						0		0		0	0
DIVISION 5 - METALS						0		0		0	0
Centrifuges											
		Dewatering Belt Modifications	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
SUBTOTAL - DIVISION 5						50,000		12,500		0	62,500
DIVISION 6 - WOOD AND PLASTICS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 6						0		0		0	0
DIVISION 7 - THERMAL AND MOISTURE PROTECTION						0		0		0	0
SUBTOTAL - DIVISION 7						0		0		0	0
DIVISION 8 - DOORS AND WINDOWS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 8						0		0		0	0
DIVISION 9 - FINISHES						0		0		0	0
		Concrete Finishes	1	LS	5,000.00	5,000	1,250.00	1,250	0	0	6,250
		Piping Coatings	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
SUBTOTAL - DIVISION 9						15,000		3,750		0	18,750
DIVISION 10 - SPECIALTIES						0		0		0	0
		Misc. signage	1	LS	500.00	500	500.00	500		0	1,000
SUBTOTAL - DIVISION 10						500		500		0	1,000
DIVISION 11 - EQUIPMENT						0		0		0	0
Centrifuge Replacement (Centrisys)						0		0		0	0
		Centrifuges, includes:	1	LS	985,500	985,500	246,375	246,375	0	0	1,231,875
		Power run-through option									
		Remote monitoring									
		Extended 15-year scroll warranty									
		Hydraulic Containment Pans									
		Stands	2	EA	21,560	43,120	5,390	10,780	0	0	53,900
		Polymer System	1	EA	21,756.00	21,756	5,439	5,439	0	0	27,195
		Centrifuge Discharge Conveyors	1	LS	66,500.00	66,500	16,625	16,625	0	0	83,125
		Spare Parts	1	LS	20,000.00	20,000	0	0	0	0	20,000
SUBTOTAL - DIVISION 11						1,136,876		279,219		0	1,416,095
DIVISION 12 - FURNISHINGS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 12						0		0		0	0
DIVISION 13 - SPECIAL CONSTRUCTIONS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 13						0		0		0	0
DIVISION 14 - CONVEYING SYSTEMS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 14						0		0		0	0
DIVISION 15 -MECHANICAL						0		0		0	0
Process Piping											
		Digested Sludge Piping	1.00	LS	25,000.00	25,000	7,500.00	7,500			32,500
		Feed Piping	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
		3W Piping	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
		Centrate Piping	1	LS	100,000.00	100,000	25,000.00	25,000	0	0	125,000
		Vent Piping	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
		Polymer Piping	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
SUBTOTAL - DIVISION 15						245,000		62,500		0	307,500
DIVISION 16 - ELECTRICAL						0		0		0	0
		25-Percent of Div 11, 14 and 15 costs	1	LS	$0.00	$0	$0.00	$0	$430,899	$430,898.75	$430,899
SUBTOTAL - DIVISION 16						0		0		430,899	430,899
DIVISION 17 - INSTRUMENTATION											
	Centrifuges										
		Flowmeters	2	EA	$7,056.00	14,112	$1,764.00	3,528	$0.00	0	17,640
SUBTOTAL - DIVISION 17						14,112		3,528		0	17,640
SUBTOTAL, ALL DIVISIONS						1,466,488		387,497		496,899	2,350,884
SUBTOTAL, ALL DIVISIONS, ESCALATED TO JUNE 2023						1,481,153		391,372		501,868	2,374,393

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project: **BC - Newport Solids Master Planning**
Building, Area: **Compost**

Prepared By: BB
Date Prepared: 26-May-23
KJ Proj. No. 2176008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type: ■ **Conceptual** ☐ **Construction**
☐ **Preliminary (w/o plans)** ☐ **Change Order**
☐ **Design Development @** ______ **% Complete**

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
			Site Prep									
			Clearing and Grubbing	18,000	SY			1.39	24,932			24,932
			Loading (Cut)	7,000	CY			1.19	8,295			8,295
			Removal of Soil - Haul and Disposal Offsite	7,000	CY			8.99	62,914			62,914
			Fill									
			Compaction	1,400	CY			1.17	1,637			1,637
			Surface Restoration									
			Hydroseeding	4,200	SY					1	4,788	4,788
			Paving									
			Base Course (6-inch)	12,300	SY	6.73	82,730	1.28	15,712			98,441
			5" - Site AC Pavement	110,000	SF	3.02	332,310	0.72	79,566			411,876
			AC Hauling	849	CY			6.73	5,708			5,708
			Headboard	812	LF	4.56	3,703	4.56	3,703			7,405
			Gravel Roadway									
			Base Course (4-inch)	920	SY	4.49	4,127	1.23	1,133			5,261
			Concrete SOG Subgrade									
			Crushed rock	10,000	SF	1.73	17,328	0.46	4,617			21,945
			Yard Piping :									
		SD	Trenching SD Pipes	670	LF			13.68	9,166			9,166
		SD	Bedding SD Pipes	670	LF	4.56	3,055	2.28	1,528			4,583
		SD	12" PVC Drain Piping	230	LF	22.80	5,244	11.40	2,622			7,866
		SD	10" PVC Drain Piping	440	LF	15.96	7,022	9.12	4,013			11,035
		SD	Catchbasin	6	EA	2,195	13,167	2,344.13	14,065			27,232
		D	Trenching Underdrain Pipes	220				9.12	2,006			2,006
		D	Bedding Pipes	220	LF	2.28	502	1.14	251			752
		D	4" HDPE Drain Piping	220	LF	3.42	752	6.16	1,354			2,107
		D	4" HDPE Drain wye	24	EA	45.60	1,094	68.40	1,642			2,736
		D	4" HDPE Drain Bend Fittings	28	EA	34.20	958	57.00	1,596			2,554
		D	Precast Concrete Manholes - 48", 9' deep	2	EA	3,830.40	7,661	2,850.00	5,700			13,361
		Drain Sump	Precast Concrete Manholes - 48", 8' deep	2	EA	3,420.00	6,840	2,850.00	5,700			12,540
		D	Cleanout	2	EA	456.00	912	342.00	684			1,596
		D	12" Outside Drop Connection	2	EA	2,850.00	5,700	1,140.00	2,280			7,980
		W	Trenching Water Pipes	500	LF			7.98	3,990			3,990
		W	Bedding Pipes	500	LF	2.28	1,140	1.14	570			1,710
		W	3" Water Piping	230	LF	2.29	527	5.36	1,232			1,759
		W	2" Water Piping	320	LF							
		W	1 1/2" Water Piping	30	LF	1.14	34	2.28	68			103
			Bollards	38	EA	399.00	15,162	456.00	17,328			32,490
			Demo Lime Silo	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
			Temporary Hauling Biosolids to Landfill	2,774	Wet Tons			96.00	266,304			266,304
	SUBTOTAL - DIVISION 02						514,968		570,316		4,788	1,090,073
	DIVISION 03 - CONCRETE											
			Compost Zones & Biofilter									
			Compost Bldg - Concrete SOG (Thickness - 12")	275	CY	285.00	78,375	285.00	78,375			156,750
			Compost Bldg - Spread Footings	25	CY	285.00	7,125	285.00	7,125			14,250
			Compost Bldg - Concete Pushwall & Piers	70	CY	285.00	19,950	684.00	47,880			67,830
			Compost Bldg - Equipment Slabs and Walkways	25	CY	285.00	7,125	285.00	7,125			14,250
			Biofilter - Pipe Support Footings	5	CY	285.00	1,425	285.00	1,425			2,850
			Amend Strg - Footings	45	CY	285.00	12,825	285.00	12,825			25,650
			Amend Strg - Piers	20	CY	285.00	5,700	684.00	13,680			19,380
			Amend Strg - Concrete SOG	50	CY	285.00	14,250	285.00	14,250			28,500
			Concrete Ecology Blocks - Both Bldgs & Biofilter	260	EA	142.50	37,050	57.00	14,820			51,870
			Bollard Footings	6	CY	285.00	1,583	342.00	1,900			3,483
	SUBTOTAL - DIVISION 03						185,408		199,405			384,813
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
			Compost Bldg - Electrical Canopy	1	LS	4,446.00	4,446	9,576.00	9,576			14,022
	SUBTOTAL - DIVISION 05						4,446		9,576			14,022
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
	SUBTOTAL - DIVISION 09											
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
			ECS Composting System	1	LS	890,000	890,000	267,000	267,000			1,157,000
			Utility Water Pump with Enclosure	1	LS	4,193	4,193	807	807			5,000
			Wheel Loader		EA	205,000.00						
			Wheel Loader Attachments: Sweep		EA	10,000.00						
			Trommel Screen		EA	230,000.00						

			Mobile Mixer & Conveyor	1	EA	217,100.00	217,100	10,855	10,855			227,955
	SUBTOTAL - DIVISION 11						1,111,293		278,662			1,389,955
	DIVISION 12 - FURNISHINGS											
	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
			Amendment and Compost Storage Building	1	LS					182,400	182,400	182,400
			Active Compost Area Building	1	LS					136,800	136,800	136,800
	SUBTOTAL - DIVISION 13										319,200	319,200
	DIVISION 14 - CONVEYING SYSTEMS											
			Conveyors to Compost	1	LS	260,555.00	260,555	39,083.25	39,083			299,638
	SUBTOTAL - DIVISION 14						260,555		39,083			299,638
	DIVISION 15 - MECHANICAL											
			Exposed Piping									
			2W Piping									
			Connection in Dewatering Building	1.00	LS	570	570	171.00	171			741
			2" Irrigation solenoid valves	9.00	EA	456	4,104	136.80	1,231			5,335
			2" Water Piping (Biofilter Irrigation)	90	LF	15.96	1,436	4.79	431			1,867
			3" Water Piping (at Composting)	140	LF	17.10	2,394	5.13	718			3,112
			2" Water Piping (at Composting)	330	LF	15.96	5,267	4.79	1,580			6,847
			Irrigation Spray Headers	24	EA	43.32	1,040	13.00	312			1,352
			Utility Water Stations	4	EA	684.00	2,736	205.20	821			3,557
			Associated Pipe Fittings and Appurtenances	1.00	LS	2,850	2,850	855.00	855			3,705
	SUBTOTAL - DIVISION 15						20,397		6,119			26,516
	DIVISION 16 - ELECTRICAL											
			25-Percent of Div 11, 14 and 15 costs	1	LS					429,027	429,027	422,906
	SUBTOTAL - DIVISION 16										429,027	422,906
	DIVISION 17 - INSTRUMENTATION											
			5-Percent of total cost	1	LS					176,211	176,211	176,211
	SUBTOTAL - DIVISION 17										176,211	176,211
	SUBTOTAL, ALL DIVISIONS						2,097,068		1,103,161		929,226	4,123,335

OPINION OF PROBABLE CONSTRUCTION COST — **KENNEDY/JENKS CONSULTANTS, INC.**

Project: BC - Newport Solids Master Planning

Building, Area: Sitework

Prepared By: BB
Date Prepared: 31-May-23
KJ Proj. No. 2276008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @ ________ % Complete
- ☐ Construction
- ☐ Change Order

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
	SUBTOTAL - DIVISION 02 - 10% OF CONSTRUCTION SUBTOTAL											1,092,190

Class A Compost Life Cycle Costs

Cost Element	Annual O&M
Operations and Maintenance Present Worth Cost	
Hauled Waste	($80,000)
Thickening	$70,000
Aerobic Digester	$80,000
Dewatering	$110,000
Compost	$180,000
O&M Present Worth Cost Subtotal	$360,000

Hauled Waste

Item	Annual Costs[(a)]
Labor[(b)]	$9,400
Electricity[(c)]	$400
Equipment Maintenance[(d)]	$9,900
Hauled Waste Revenue[(e)]	($100,000)
Total Annual Costs	($80,300)

Notes:

(a) Costs are rounded to the nearest $100

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Costs are annualized at 2% of equipment costs.

(e) Based on 2021 and 2022 hauled waste revenues, provided by the City via email dated 13 January 2023.

Labor

Item	Task	Frequency	Hours	Annual Total
Hauled Waste	Startup	4xweek	1	52
	Shutdown	4xweek	1	52
	Gen. Maintenance	4xweek	1	52
	Preventative Maintenance	4xyear	8	32
				188

Electricity

Item	Hrs/day	Days/weel	Operating Hp	Annual Total, kW-Hr
Drum	2	4	3	931
Wash Press	2	4	7.5	2,326
Grit Screws	2	4	1.5	465
Grease Pump	2	4	3	931
				4,653

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
Hauled Waste	495000	$9,900.00
		$9,900.00

Thickening

Item	Annual Costs[(a)]
Labor[(b)]	$20,000
Electricity[(c)]	$8,000
Chemical[(d)]	$32,700
Equipment Maintenance[(e)]	$7,200
Total Annual Costs	$67,900

Notes:

(a) Costs are rounded to the nearest $100

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Costs for liquid emulsion polymer, $4.20 per active lb. Assumes 8 active lbs polymer/dry ton.

(e) Costs are annualized at 2% of equipment costs.

Labor

Item	Task	Frequency	Hours	Annual Total
RDT 1&2	Startup	4xweek	2	104
	Shutdown	4xweek	2	104
RDT & Polymer	Gen. Maintenance	4xweek	2	104
RDT 1	Preventative Maintenance	4xyear	8	32
RDT 2	Preventative Maintenance	4xyear	8	32
Polymer	Preventative Maintenance	4xyear	6	24
				400

Electricity

Item	Hrs/day	Days/weel	Operating Hp	Annual Total, kW-Hr
RDT 1	19	7	2.5	12,891
RDT 2	0	0	2.5	0
Polymer 1	19	7	1	
Polymer 2	0	0	1	0
Feed Pump 1	19	7	15	77,349
Feed Pump 2	0	0	15	0
TWAS Pump 1	19	7	2	10,313
TWAS Pump 2	0	0	2	0
				100,553

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
RDTs & Polymer	242300	$4,846.00
Feed Pumps	80000	$1,600.00
TWAS Pumps	40000	$800.00
		$7,246.00

Aerobic Digester

Item	Annual Costs[a]
Labor[b]	$10,400
Electricity[c]	$53,000
Equipment Maintenance[d]	$12,000
Total Annual Costs	$75,400

Notes:

(a) Costs are rounded to the nearest $100

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Costs are annualized at 2% of equipment costs.

Labor

Item	Task	Frequency	Hours	Annual Total
Blower 1	Preventative Maintenance	4xyear	8	32
Blower 2	Preventative Maintenance	4xyear	8	32
Blower 3	Preventative Maintenance	4xyear	8	32
Blower 4	Preventative Maintenance	4xyear	8	32
Mixer 1	Preventative Maintenance	4xyear	4	16
Mixer 2	Preventative Maintenance	4xyear	4	16
Mixer 3	Preventative Maintenance	4xyear	4	16
Mixer 4	Preventative Maintenance	4xyear	4	16
DS Pump 1	Preventative Maintenance	4xyear	2	8
DS Pump 2	Preventative Maintenance	4xyear	2	8
				208

Electricity

Item	Hrs/day	Days/week	Operating Hp	Annual Total, kW-Hr
Blower 1	12	7	150	488,517
Blower 2	0	7	150	0
Blower 3	12	7	150	488,517
Blower 4	0	7	150	0
Mixer 1	12	7	10	32,568
Mixer 2	0	7	10	0
Mixer 3	12	7	10	32,568
Mixer 4	0	7	10	0
DS Pump 1	16	4	5	12,407
DS Pump 2	0	0	5	0
				1,054,577

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
Blowers	312000	$6,240.00
Mixers	249600	$4,992.00
Digested Solids Pumps	50000	$1,000.00
		$12,232.00

Dewatering Centrifuges

Item	Annual Costs[(a)]
Labor[(b)]	$31,000
Electricity[(c)]	$9,000
Chemical[(d)]	$52,000
Equipment Maintenance[(e)]	$20,000
Total Annual Costs	$112,000

Notes:

(a) Costs are rounded to the nearest $1,000

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Costs for liquid emulsion polymer, $4.20 per active lb. Assumes 20 active lbs polymer/dry ton, and an annualized average of 618 dry tons per year.

(e) Costs are annualized at 2% of equipment costs.

Labor

Item	Task	Frequency	Hours	Annual Total
Centrifuge 1	Startup	4xweek	4	208
	Shutdown	4xweek	4	208
Conveyor	Gen. Maintenance	4xweek	1	52
Polymer	Gen. Maintenance	4xweek	1	52
Centrifuge 1	Preventative Maintenance	4xyear	8	32
Centrifuge 2	Preventative Maintenance	4xyear	8	32
Polymer	Preventative Maintenance	4xyear	4	16
Conveyors	Preventative Maintenance	4xyear	6	24
				624

Electricity

Item	Hrs/day	Days/week	Operating Hp	Annual Total, kW-Hr
Centrifuge 1	16	4	75	186,102
Centrifuge 2	0	4	75	0
Polymer	16	1	1	620
Conveyor 1	16	1	1	620
Conveyor 2	0	8	1	0
				187,342

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
Centrifuges	908600	$18,172.00
Polymer	21756	$435.12
Conveyors	81894	$1,637.88
		$20,245.00

Compost

Item	Annual Costs[(a)]
Labor[(b)]	$50,800
Electricity[(c)]	$15,700
Equipment Maintenance[(d)]	$23,000
Biosolids Hauling	$94,200
Total Annual Costs	$183,700

Notes:

(a) Costs are rounded to the nearest $100

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Costs are annualized at 2% of equipment costs.

Labor

Item	Task	Frequency	Hours	Annual Total
Transport	Dewatered Cake Transport	4xweek	4	208
	Dewater Cake/Amendment Mixing	4xweek	6	312
	Mixed Material Transfer	4xweek	4	208
	Phase 1 to Phase 2 Transfer	4xweek	4	208
	Screening	4xweek	6	24
	Transfer to Storage	4xweek	4	16
Aeration Fans	Preventative Maintenance	4xyear	6	24
Odor Fans	Preventative Maintenance	4xyear	4	16
				1016

Electricity

Item	Hrs/day	Days/week	Operating Hp	Annual Total, kW-Hr
Conveyors	16	4	7	17,369
Aeration Fans	24	7	27.5	179,123
				196,492

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
Conveyors	260555	$5,211.10
Compost ECS	890000	$17,800.00
		$23,011.10

Biosolids Hauling

Item	Annual Qty, wet tons	Unit Cost	Annual Cost
Hauling	4879.8	$19.30	$94,180.14

Project: BC - Newport Solids Master Planning

Building: Class A Dryer Alternative

Prepared By: BIB
Date Prepared: 05.23.2023
K/J Proj. No.: 2276008*00

Estimate Type:
- ■ **Conceptual**
- ☐ **Preliminary (w/o plans)**
- ☐ **Design Development @**
- ☐ **Construction**
- ☐ **Change Order**

Current at ENR 13,288.00
Escalated to ENR
Mos. to Midpoint 60

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
	Hauled Waste Receiving		$530,050	$165,398	$200,522	$895,970
	Thickening		$537,300	$185,690	$175,022	$898,012
	Aerobic Digester		$1,414,162	$535,242	$677,004	$2,626,408
	Dewatering Centrifuge		$1,481,153	$391,372	$501,868	$2,374,393
	Dryer		$3,226,921	$882,256	$2,283,634	$6,392,811
	Sitework		$659,380	$659,380	$0	$1,318,759
	Utilities		$125,206	$151,598	$0	$276,803
	Subtotals		7,974,172	2,970,934	3,838,050	14,783,156
	Contractor Indirects	12%	956,901	356,512	460,566	1,773,979
	Subtotals		8,931,072	3,327,446	4,298,616	16,557,135
	Contractor OH&P @	15%	1,339,661	499,117	644,792	2,483,570
	Subtotals		10,270,733	3,826,563	4,943,409	19,040,705
	Estimate Contingency @	25%				4,760,176
	Subtotal					23,800,881
	Escalation to Mid-Pt of Construction	4%				5,156,530
	Subtotal					28,957,411
	Engineering, Administrative, Permits, Legal	38%				11,003,816
	Total Estimate					39,900,000

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$55,860,000	**$39,900,000**	**$31,920,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project: BC - Newport Solids Master Planning

Building, Area: Class A Biosolids Treatment: Belt Dryer (Centrisys)

Prepared By: BB
Date Prepared: 31-May-23
KJ Proj. No. 2276008

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type: ■ Conceptual ☐ Construction
☐ Preliminary (w/o plans) ☐ Change Order
☐ Design Development @ _________ % Complete

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
3			Excavation: Large structures	1,600	BCY			15.59	24,944			24,944
7			Import fill: crushed rock and fill	150	LCY	26.14	3,921	7.30	1,095			5,016
10			Compact: Large structures	150	ECY			6.12	918			918
12			Haul (offsite disposal of excess cut)	1,600	LCY			7.40	11,840			11,840
			Demo Lime Silo	1	LS	5,000.00	5,000	20,000.00	20,000			25,000
			Temporary Hauling Biosolids to Land	3,414	Wet Tons			96.00	327,759			327,759
	SUBTOTAL - DIVISION 02						8,921		386,556			395,477
	DIVISION 03 - CONCRETE											
			Misc concrete equip. slabs	1	LS	20,000.00	20,000	10,000.00	10,000			30,000
	SUBTOTAL - DIVISION 03						20,000		10,000			30,000
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
			Misc metals	1	LS	50,000.00	50,000	10,000.00	10,000			60,000
	SUBTOTAL - DIVISION 05						50,000		10,000			60,000
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
			Pipe coating	1	LS	10,000	10,000	5,000	5,000			15,000
	SUBTOTAL - DIVISION 09						10,000		5,000			15,000
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
			Belt dryer	1	EA	2,083,000	2,083,000	312,450	312,450			2,395,450
			Bagger (for super sacks)	1	EA	235,000	235,000	35,250	35,250			270,250
	SUBTOTAL - DIVISION 11						2,318,000		347,700			2,665,700
	DIVISION 12 - FURNISHINGS											
	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
84			Building (CMU)	3,200	SF					350.00	1,120,000	1,120,000
	SUBTOTAL - DIVISION 13										1,120,000	1,120,000
	DIVISION 14 - CONVEYING SYSTEMS											
			Screw conveyor - cake to hopper	1	EA	225,000.00	225,000	33,750.00	33,750			258,750
	SUBTOTAL - DIVISION 14						225,000		33,750			258,750
	DIVISION 15 - MECHANICAL											
			Odor control	1	EA	595,000.00	595,000	89,250.00	89,250			684,250
	SUBTOTAL - DIVISION 15						595,000		89,250			684,250
	DIVISION 16 - ELECTRICAL											
			25-Percent of Div 11, 14 and 15 costs	1	LS					902,175	902,175	627,501
	SUBTOTAL - DIVISION 16										902,175	627,501
	DIVISION 17 - INSTRUMENTATION											
			5-Percent of total cost	1	LS					261,459	261,459	261,459
	SUBTOTAL - DIVISION 17										261,459	261,459
	SUBTOTAL, ALL DIVISIONS						3,226,921		882,256		2,283,634	6,118,137

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project: **BC - Newport Solids Master Planning**
Prepared By: BB
Date Prepared: 31-May-23
Building, Area: **Sitework**
KJ Proj. No. 2276008*00
Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- [x] **Conceptual**
- [ ] **Preliminary (w/o plans)**
- [ ] **Design Development @** ______ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
	SUBTOTAL - DIVISION 02 - 10% OF CONSTRUCTION TOTAL											1,318,759

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project: BC - Newport Solids Master Planning

Building, Area: Utilities

Prepared By: BB
Date Prepared: 31-May-23
KJ Proj. No. 2276008*00

Current at ENR 13,288 May 2023
Escalated to ENR
Months to Midpoint of Construct 60

Estimate Type:
- ■ **Conceptual**
- ☐ **Preliminary (w/o plans)**
- ☐ **Design Development @**
- ☐ **Construction**
- ☐ **Change Order**
- _________ **% Complete**

Ref. No.	Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	DIVISION 02 - SITE WORK											
			Traffic Control	1.00	LS	2,500.00	2,500	2,500.00	2,500			5,000
			Saw Cut	15,200	LF	0.29	4,408	1.43	21,736			26,144
			Excavation	1,976	CY			9.38	18,535			18,535
			Import Fill	1,976	CY	31.92	63,074	5.15	10,176			73,250
			Compaction	1,976	CY			5.70	11,263			11,263
			Hauling	1,976	CY			11.24	22,210			22,210
			Tench Patch	1,254	SY	26.22	32,880	44.46	55,753			88,633
	SUBTOTAL - DIVISION 02						102,862		142,174			245,035
	DIVISION 03 - CONCRETE											
	SUBTOTAL - DIVISION 03											
	DIVISION 04 - MASONRY											
	SUBTOTAL - DIVISION 04											
	DIVISION 05 - METALS											
	SUBTOTAL - DIVISION 05											
	DIVISION 06 - WOOD AND PLASTICS											
	SUBTOTAL - DIVISION 06											
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION											
	SUBTOTAL - DIVISION 07											
	DIVISION 08 - DOORS AND WINDOWS											
	SUBTOTAL - DIVISION 08											
	DIVISION 09 - FINISHES											
	SUBTOTAL - DIVISION 09											
	DIVISION 10 - SPECIALTIES											
	SUBTOTAL - DIVISION 10											
	DIVISION 11 - EQUIPMENT											
	SUBTOTAL - DIVISION 11											
	DIVISION 12 - FURNISHINGS											
	SUBTOTAL - DIVISION 12											
	DIVISION 13 - SPECIAL CONSTRUCTION											
85												
	SUBTOTAL - DIVISION 13											
	DIVISION 14 - CONVEYING SYSTEMS											
	SUBTOTAL - DIVISION 14											
	DIVISION 15 - MECHANICAL											
			2" Poly Pipe - Natural Gas	3,800	LF	5.88	22,344	2.48	9,424			31,768
	SUBTOTAL - DIVISION 15						22,344		9,424			31,768
	DIVISION 16 - ELECTRICAL											
	SUBTOTAL - DIVISION 16											
	DIVISION 17 - INSTRUMENTATION											
	SUBTOTAL - DIVISION 17											
	SUBTOTAL, ALL DIVISIONS						125,206		151,598			276,803

Class A Dryer Life Cycle Costs

Cost Element	Annual O&M
Operations and Maintenance Present Worth Cost	
Hauled Waste	($80,000)
Thickening	$70,000
Aerobic Digester	$80,000
Dewatering	$110,000
Dryer	$380,000
O&M Present Worth Cost Subtotal	$560,000

Dryer

Item	Annual Costs[a]
Labor[b]	$36,000
Electricity[c]	$51,600
Natural Gas[d]	$129,163
Equipment Maintenance[e]	$146,000
Biosolids Hauling	$14,089
Total Annual Costs	$376,852

Notes:

(a) Costs are rounded to the nearest $100

(b) Costs assume burden rate of $50 per hour

(c) Costs assume $0.08 per kW-hr

(d) Assumes 10,333 MMBTU/yr and $1.25 per therm.

(e) Costs are annualized at 2% of equipment costs.

Labor

Item	Task	Frequency	Hours	Annual Total
Dryer	Startup	4xweek	4	208
	Shutdown	4xweek	4	208
Dryer	Gen. Maintenance	4xweek	4	208
Dryer	Preventative Maintenance	4xyear	24	96
				720

Electricity

Item	Hrs/day	Days/week	Operating Hp	Annual Total, kW-Hr
Conveyors	16	4	5	12,407
Dryer	16	4	255	632,746
				645,153

Equipment Maintenance

Item	Equipment Cost	Annual 2%, $
Dryer	6263215	$125,264.30
Bagging System	235000	$4,700.00
Conveyors	225000	$4,500.00
Odor Control	595000	$11,900.00
		$146,364.30

Biosolids Hauling

Item	Annual Qty, wet tons	Unit Cost	Annual Cost
Hauling	730	$19.30	$14,089.00

Appendix E Centrifuge Replacement TM

23 September 2022

Draft Technical Memorandum

To: Josh Johnson, Brown & Caldwell

From: Ben Bosse, Kennedy Jenks
Mark Cullington, Kennedy Jenks

Reviewed By: Shawn Spargo, Kennedy Jenks

Subject: Centrifuge Replacement Evaluation
Newport WWT Master Plan – Phase II, Brown & Caldwell Project No. 158211
City of Newport
K/J Project No. 2276008*00

Introduction

The City of Newport (City) owns and operates the Vance Avery Wastewater Treatment Plant (WWTP) constructed in 2002 and located in South Beach, Oregon. The WWTP is an activated sludge plant with a peak wet weather capacity of 15 million gallons per day (mgd) that currently receives an average annual flow of approximately 2 mgd. In 2022, the City authorized Brown & Caldwell (BC) to perform master planning for the WWTP. BC has subcontracted with Kennedy/Jenks Consultants (Kennedy Jenks) in an agreement dated 11 March 2022 to complete a Centrifuge Replacement Evaluation for replacement of the existing dewatering centrifuges. The existing centrifuges were identified in a 2018 BC capacity assessment as undersized to support current biosolids production rates and are reaching the end of their useful life.

The purpose of this Technical Memorandum (TM) is to present an evaluation for replacement of the existing dewatering centrifuges. The evaluation includes layouts of larger centrifuges to accommodate the projected solids loadings over a 20-year design period. The evaluation also includes replacement of the existing liquid emulsion polymer system, controls, conveyors, dewatering feed pumps, and electrical considerations. The evaluation makes a recommendation on new equipment sizing and presents capital, Operations and Maintenance (O&M) costs, and life-cycle costs for the recommended improvements.

Existing Conditions

The WWTP operates two Alfa Laval/Sharples dewatering centrifuges. Centrifuge 1 was installed between 1994 and 1996, and Centrifuge 2 was installed in 2001. Both centrifuges were re-built by CentriTEK in 2018 and 2019, including replacement of damaged scroll tiles, bearings and seals, cleaning and painting, and alignment and balancing.

The centrifuges receive Waste Activated Sludge (WAS), scum, and hauled waste conveyed from the sludge storage tank by two Wemco dewatering feed pumps.

Plant staff typically operate centrifuges 8 to 10 hours per day, and currently are forced to operate centrifuges beyond capacity to maintain operations. The dewatering feed solids concentration averages approximately 0.6 % Total Solids (TS). The dilute feed concentration is a result of an undersized storage tank that inhibits an effective decant and thickening of solids upstream of dewatering. The stated design capacity of the centrifuges is 65 gallons per minute (gpm); however, plant staff routinely feed centrifuges at a rate of 90 gpm.

A summary of existing plant operating data for centrifuges is included as Table 1. Design data for the existing centrifuges are summarized in Table 2. Centrifuge 1 is shown on Figure 1.

Table 1: Existing Dewatering Operating Data

Parameter	Value[(a)]
Average Feed Flow, Each, gpm[(b)]	90
Average Feed Solids Concentration, %	0.59
Average Feed, Each, pph[(c)] dry solids	266
Average Centrate Solids Concentration, %	0.013
Average Capture Rate, %	97
Cake Solids, %	26
Polymer Use, active lbs per dry ton	11

Notes:
(a) August 2022 operating data as provided by the City via email on 18 August 2022 and 12 September 2022.
(b) gpm = gallons per minute.
(c) pph = pounds per hour.

Table 2: Existing Centrifuge Design Data

Parameter	Value
Manufacturer	Alfa Laval/Sharples
Model No., Centrifuge 1	PM 38000
Model No., Centrifuge 2	ALDEC 406
Bowl Diameter, inches	13.8
Main Drive	
Hp	40
Drive Type	VFD
Drive Configuration	V-Belt
Back Drive	
Hp	10
Drive Type	Eddy Current Brake
Capacity, Each, gpm	65

Figure 1: Centrifuge 1

Projected Solids Loadings

The 20-year solids loading projections to dewatering were provided to centrifuge manufacturers for sizing and selection of new centrifuge equipment. Projected solids loadings were presented in the draft Basis of Design TM dated 1 July 2022, and are included in Table 3 for reference. Sizing of dewatering equipment is based on the 2040 maximum week loadings, as described in the draft Solids Basis of Design TM prepared by Kennedy Jenks on 1 July 2022. Maximum day loadings are not evaluated due to the storage provided by the upstream storage tank.

Table 3: Projected Dewatering Loadings

Parameter	Condition			
	2022 Average	2040 Average	2040 Maximum Month	2040 Maximum Week[(a)]
Waste Activated Sludge[(b)]				
Solids, ppd	3,200	3,561	4,451	5,341
Flow, gpd[(c,d)]	69,720	77,580	96,970	116,438
Hauled Waste[(e)]				
Solids, ppd	137	152	191	229
Flow, gpd	913	1,015	1,269	1,523
Combined Solids to Storage				
Solids, ppd	3,337	3,713	4,641	5,570
Flow, gpd	70,633	78,595	98,239	117,961
Decant[(f)]				
Solids, ppd	130	144	180	216
Flow, gpd[(g)]	14,135	15,733	19,665	23,598
Dewatering Feed[(h)]				
Solids, ppd	3,207	3,569	4,461	5,354
Flow, gpd	56,498	62,862	78,574	94,363

Notes:
(a) Based on maximum week WAS solids loading peaking factor of 1.5, per BC.
(b) Flows and loads values were developed by BC and provided via email dated 10 May 2022.
(c) gpd = gallons per day.
(d) Based on an average solids concentration of 0.55% per BC.
(e) 2022 average hauled waste flows and loads are based on WWTP annual biosolids reports (2018 through 2021) and an average solids concentration of 1.8%. Year 2040 hauled waste flows and loads are based on WAS peaking factors.
(f) Assumes a decant rate of 20% of influent to storage tank.
(g) Assumes a decant solids concentration of 0.11%, based on plant operating data for December 2021.
(h) Based on continuous feed to dewatering.

Manufacturer Proposals

Proposals for centrifuge replacement were obtained from two manufacturers: Andritz and Centrisys. Proposals were obtained from multiple manufacturers to understand the size, configuration, layout, and maintenance clearances required for equipment replacement. Additional manufacturers and proposals may be considered as the project moves into the design phase. Projected operating data and initial manufacturer equipment selections are summarized in Table 4.

Table 4: Dewatering Operating Characteristics

	Values		
Parameters	Scenario 1	Scenario 2	Scenario 3
Dewatering Feed			
Flow, gpd[(a)]		94,363	
Solids Concentration, %[(b)]		0.68	
Solids Loading, pph dry solids[(c)]		223	
Centrifuge Performance			
Solids Capture, %[(d)]		95	
Cake Solids, %[(d)]		0.16	
Operation			
Days/week[(e)]	4	4	4
Hour/day	16	16	8
No. of Centrifuges			
Duty	2	1	1
Total	2	2	1
Level of Redundancy[(f)]	50%	100%	0%
Flow, gpm, each	86	172	344
Solids Loading, dry pph, each	293	586	1,171
Andritz Selection	D4L	D5L	D6LX
Centrisys Selection	CS18-4	CS21-4HC	CS26-4

Notes:
(a) 2040 maximum week solids loading to dewatering, as presented in the Draft Basis of Design TM dated 1 July 2022.
(b) Based on a Storage Tank decant rate of 20% of influent flows.
(c) Based on continuous operation, 24 hours per day 7 days per week.
(d) Based on Andritz laboratory test results dated 26 May 2022, included in Attachment A.
(e) City's stated maximum operating days per week based on staffing availability.
(f) Redundancy expressed as a percentage of operating hours per 24-hour period. 100% represents full n+1 redundancy.

Three operating scenarios were provided to the manufacturers to select equipment of various sizes. The number of duty centrifuges and operating hours were varied to determine the largest process capacity centrifuge(s) that would fit within the existing centrifuge process area. A review of the general arrangement drawings for Scenario 3, Andritz D6LX and Centrisys CS26-4, indicated that the equipment footprints for both manufacturers were too large to fit within the existing centrifuge process area. As a result, Scenario 3 was eliminated from consideration. Scenario 2 selections from each manufacturer, Andritz D5L and Centrisys CS21-4HC, were found to each fit within the existing centrifuges replacement area. Based on preliminary discussions with the City, preference is to provide larger units with additional redundancy. As a result, the Scenario 1 selections from each manufacturer, Andritz D4L and Centrisys CS18-4, are not considered. A discussion of the physical constraints and considerations for each manufacturer selection is presented later in this TM. Proposal data for the Andritz and Centrisys selections are summarized in Tables 5 and 6, respectively.

Table 5: Andritz D5L Proposal Data

Parameter	Value
Manufacturer	Andritz
Model No.	D5L
Bowl Diameter, inches	20.5
Capacity(a)	
Flow, gpm	176
Solids, pph	600
Main Drive	
Hp	75
Type	VFD
Back Drive	
Hp	20
Type	VFD
Process Connections	
Feed	
Size, inches	2
Pressure, PSI(b)	7.5
Solids Discharge(c)	
Size, inches	12 x 25
Centrate(c)	
Size, inches	7 x 17
Wash Water(d)	
Size, inches	1
Flow, gpm	44 to 88
Pressure, PSI	45 to 60
Vent	
Size, inches	4.5
Air Flow, SCFM(e)	207
Polymer	
Size, inches	1
Usage, active lbs/dry ton(f)	16 to 20

Notes:
(a) Assumes feed solids concentration of 0.68%.
(b) Inlet pressure requirement at the feed connection flange.
(c) Rectangular, flanged connection.
(d) Plant 3W is applied for 15 minutes during shutdown and 10 minutes during a clean in place cycle.
(e) Minimum air flow requirement from centrate casing.
(f) Based on manufacturer testing performed by Andritz, dated 26 May 2022, included in Attachment A.

Table 6: Centrisys CS21-4HC Proposal Data

Parameter	Value
Manufacturer	Centrisys
Model No.	CS21-4HC
Bowl Diameter, inches	21.5
Capacity[(a)]	
Flow, gpm	200
Solids, pph	680
Main Drive	
Hp	75
Type	VFD
Back Drive	
Hp	15
Type	Hydraulic
Process Connections	
Feed	
Size, inches	2
Pressure, PSI[(b)]	10
Solids Discharge[(c)]	
Size, inches	18 x 37
Centrate[(c)]	
Size, inches	18 x 37
Wash Water[(d)]	
Size, inches	1-1/4
Flow, gpm	100 to 110
Pressure, PSI	40 to 80
Vent	
Size, inches	4
Air Flow, SCFM[(e)]	NA
Polymer	
Size, inches	3/4
Usage, active lbs/dry ton[(f)]	TBD
Air[(g)]	
Flow, SCFM	6
Pressure, PSI	80

Notes:
(a) Assumes feed solids concentration of 0.68%.
(b) Inlet pressure requirement at the feed connection flange.
(c) Rectangular, flanged connection.
(d) Plant 3W is applied for 15 to 20 minutes during shutdown and clean in place cycle.
(e) Minimum air flow requirement from centrate casing.
(f) Information to be provided by Centrisys.
(g) Required for air-oil lubrication system. Instrumentation air quality.

Andritz – Scenario 2

The Andritz D5L centrifuges include 2304 duplex stainless steel solids bowls, 316 stainless steel scroll with tungsten carbide tiles over the full length, 316 stainless steel wetted parts, carbon steel frame with epoxy coating, and FRP casing covers and drive guards. Flexible connectors are provided to convey solids discharge to inclined screw conveyors positioned below the centrifuges. Included with the Andritz proposal are two incline screw conveyors to transport dewatered solids from the solids discharge flange to the existing dewatering belt conveyor.

The Andritz proposal includes galvanized steel centrifuge stands positioning centrifuges approximately 3'-6" above the floor. At this height, maintenance platforms are not anticipated to be required. Flexible connectors to transition from the rectangular centrate discharge flange to an 8-inch-diameter centrate discharge pipe are also included.

Andritz also provides a 316 stainless steel pipe manifold on each unit for the connection of feed sludge, polymer, and wash water process connections fitted with flexible connectors. The Andritz centrifuges have manually greased bearings with an L-10 life of 100,000 hours. Centrate piping would require venting to prevent air lock. Total connected horsepower for the D5L is 190 hp for two centrifuges.

Lead time for the Andritz D5L is 6 weeks for shop drawings and 40 weeks from approved drawings. A figure of the Andritz D5L is shown on Figure 2. The Andritz D5L proposal is included with this TM as Attachment A, including drawings, equipment data, and installation list. Andritz performed sludge testing in May 2022, and the results are also included in Attachment A.

Figure 2: Andritz D5L

Centrisys – Scenario 2

The Centrisys CS214HC centrifuges include duplex stainless steel solids bowls, duplex stainless steel scroll shaft and 304 stainless steel flights, and 304 stainless steel wetted parts and powder coated carbon steel frame. Flexible connectors are provided to convey solids discharge to inclined screw conveyors positioned below the centrifuges. Included with the

Centrisys proposal are two incline screw conveyors to transport dewatered solids from the solids discharge flange to the existing dewatering belt conveyor.

The Centrisys proposal includes powder coated carbon steel stands positioning centrifuges approximately 3'-6" above the floor. Maintenance platforms are not anticipated to be required. Centrisys centrifuges include an automatic grease lubrication system incorporating low grease level sensors.

The Centrisys centrifuges also incorporate a standalone hydraulic back drive that powers the scroll. The hydraulic drive is a distinguishing component of the Centrisys proposal. Centrisys states that the hydraulic drive is more efficient and contains fewer moving parts than a gearbox. Total connected horsepower for the CS21-4HC is 180 hp for two centrifuges. The Centrisys proposal also includes an extended 15-year scroll warranty, and a power run-through option that allows the centrifuge to continue to drive the scroll for a limited time in the event of a power outage. This feature allows the centrifuge to discharge its contents before completely shutting down; however, additional investigation would be needed to verify whether this option can be implemented, including determining if solids conveyors and the RDP lime pasteurization process are currently on standby power or have the physical capacity to accept the volume of solids discharged during an outage.

Lead time for the Centrisys CS21-4HC is 6 weeks for shop drawings and 50 weeks from approved drawings. A figure of the Centrisys CS21-4HC is shown on Figure 3. The Centrisys CS21-4HC proposal is included with this TM as Attachment B, including drawings, equipment data, and installation list.

Figure 3: Centrisys CS21-4HC

Equipment Layouts

General arrangement drawings were provided by the centrifuge manufacturers and preliminary layouts were developed for each model to understand how centrifuges could be installed in the existing dewatering process area. Equipment layouts for Andritz and Centrisys for Scenario 2 are shown on Figures 4 and 5, respectively.

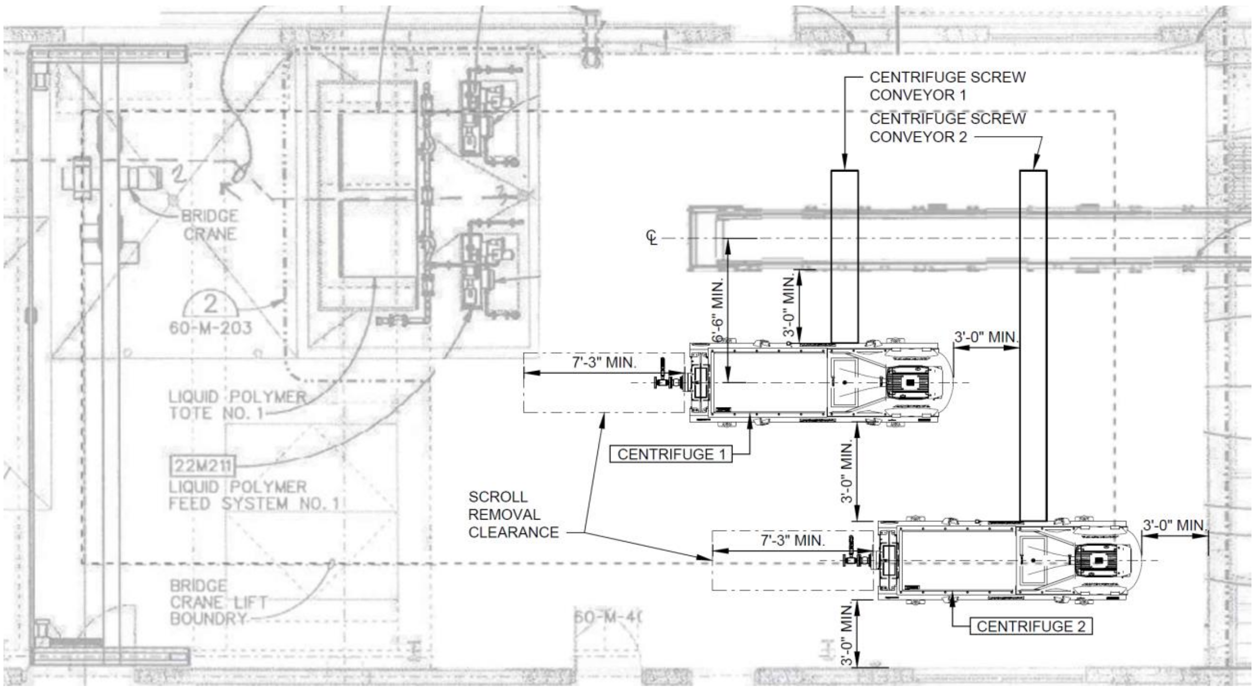


Figure 4: Scenario 2 Andritz D5L Equipment Plan

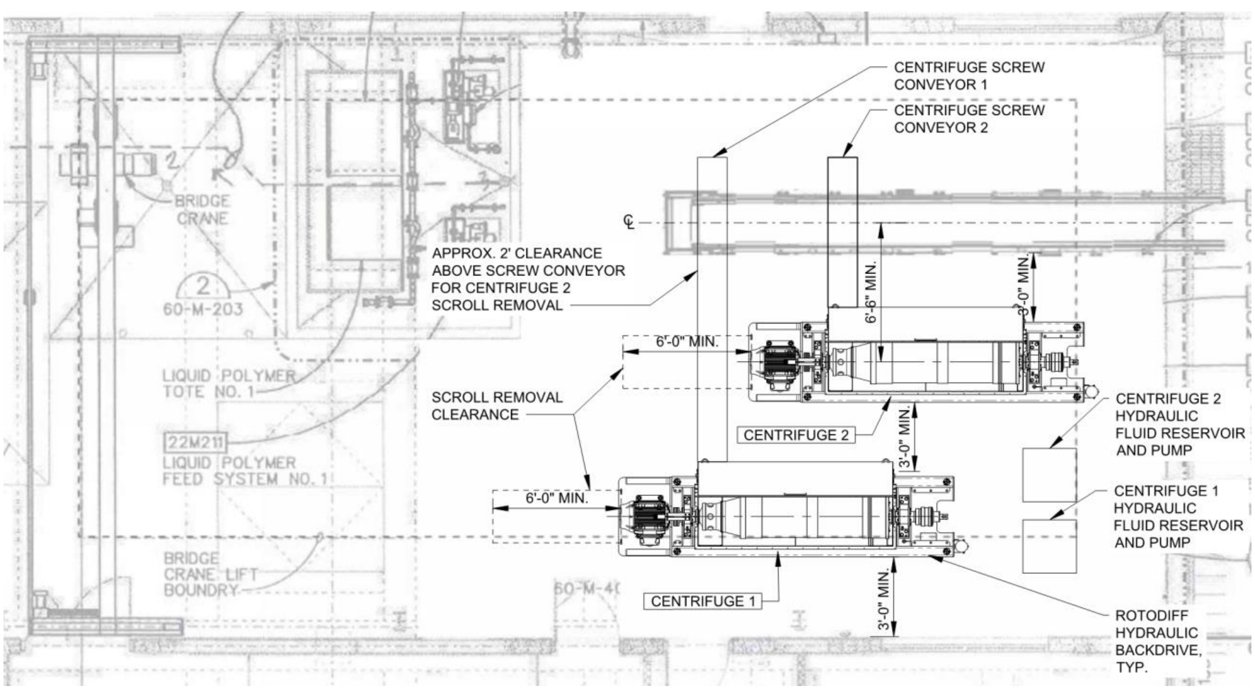


Figure 5: Scenario 2 Centrisys CS21-4HC Equipment Plan

Physical Considerations

An existing 2-ton bridge crane is located in the dewatering process area. Field measurements provided by the City indicate a maximum hook height of approximately 12 feet for removing components from the centrifuge frame when performing maintenance. A single roll-door to the dewatering area is located on the east side of the Solids Handling Building for egress of equipment. An equipment laydown area immediately west of the dewatering polymer area is provided for transport of centrifuge components. This area also contains a hatch to the lower pump gallery for the removal of equipment from the basement level and must remain clear.

The centrifuge replacement project anticipates that the existing dewatering belt conveyor which conveys dewatered solids to the RDP lime pasteurization process remains; however, modifications to the height of the belt conveyor may be required based on the geometry of the inclined screw conveyors and position of the centrifuges within the room. Initial City field measurements indicate that the existing stainless steel supports beneath the dewatering belt conveyor may be able to be cut down to lower the belt conveyor up to 12 inches if needed. If lowered, additional investigation would be required to coordinate the modified belt conveyor with the existing RDP conveyors. Discharge chutes would be provided at the incline screw conveyor discharge to guide solids to the belt surface.

Additionally, centrifuges and supporting equipment will need to be located within the lift boundary of the existing bridge crane, as shown on Figures 4 and 5. Housekeeping equipment pads would be provided under each centrifuge to facilitate room washdown.

Andritz

Physical data for the Andritz D5L centrifuges, along with maintenance clearances, lifting heights, and component weights, are summarized in Table 7.

In addition to placing centrifuge equipment within the bridge lift boundary and observing manufacturer recommendations for maintenance clearances around the units, the height of the existing dewatering belt conveyor is a controlling factor in determining the position of centrifuges within the process area. The recommended maximum incline of the screw conveyors is between 25 and 30 degrees. To position the screw conveyor discharges sufficiently above the dewatering belt conveyor will require a minimum horizontal distance of 6’-6” from centerline of the centrifuge to the centerline of the belt conveyor. This layout assumes that centrifuges are installed on stands anchored to the concrete floor, with a stand height of 3’-6”. An example section drawing of this configuration from another project is shown on Figure 6.

Process connections, such as feed and wash water, would be routed through the floor slab from the basement level below where piping is suspended from the ceiling/floor slab. Additionally, vent piping would need to be routed from the centrifuges to an air handling facility to dispose of foul air and to meet the electrical classification requirements of NFPA 820 for solids processing rooms.

Table 7: Andritz D5L Physical Data

Parameter	Value
Length, inches	147
Width, inches	48
Height, inches	70
Maintenance Clearance	
Length, inches	36
Location	All Sides
Scroll Removal Clearance	
Length, inches	87
Location	Main Drive End
Rotating Assembly	
Weight, lbs[(a)]	4,083
Minimum Hook Height, inches	132
Scroll	
Weight, lbs	1,034
Minimum Hook Height, inches	132
Main Drive	
Weight, lbs	1,248
Minimum Hook Height, inches	134

Notes:

(a) Weight when empty. The scroll would need to be removed separately before removing the centrifuge bowl.

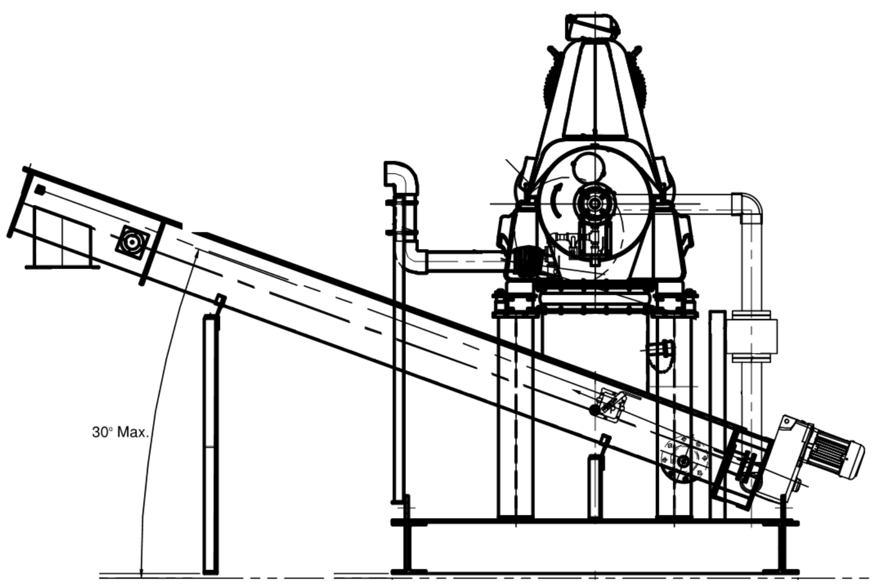


Figure 6: Example Centrifuge and Conveyor Section

Centrisys

Physical data for the Centrisys CS21-4HC centrifuges, along with maintenance clearances, lifting heights, and component weights, are summarized in Table 8.

Table 8: Centrisys CS21-4HC Physical Data

Parameter	Value
Length, inches	188
Width, inches	45
Height, inches	53
Maintenance Clearance	
Length, inches	36/24
Location	Motor Ends/Sides
Scroll Removal Clearance	
Length, inches	72
Location	Main Drive End
Rotating Assembly	
Weight, lbs[(a)]	3,700
Minimum Hook Height, inches	102
Main Drive	
Weight, lbs[(b)]	847

Notes:
(a) Weight when empty. The scroll cannot be removed independently from the rotating assembly.
(b) To be determined by Centrisys.

Similar to the Andritz discussion, Centrisys centrifuges will need to fit within the existing constraints of the dewatering process area. The layout shown on Figure 5 includes an overlap of the scroll removal clearance for Centrifuge 2 and the inclined screw conveyor for Centrifuge 1. A preliminary review of the inclined screw conveyor elevation at this point indicates approximately 24 inch clearance between the top of the inclined screw conveyor and bottom of the scroll of Centrifuge 2 when removed.

Electrical Considerations

The existing centrifuges are powered from 60MCC1 and 60MCC2, located in the electrical room on the ground level of the Solids Handling Building, immediately west of the dewatering process area. Centrifuge 1 is powered from 60MCC1, and Centrifuge 2 is powered from 60MCC2. 150A circuit breakers control power fed to control panels located in the control room that house 40 hp (main drive) and 10 hp (back drive) variable frequency drives (VFDs). A partial single line diagram for 60MCC1 is shown on Figure 7, depicting both the existing conditions and proposed load increases associated with the Andritz and Centrisys selections. Modifications to the 60MCC2 single line diagram are similar.

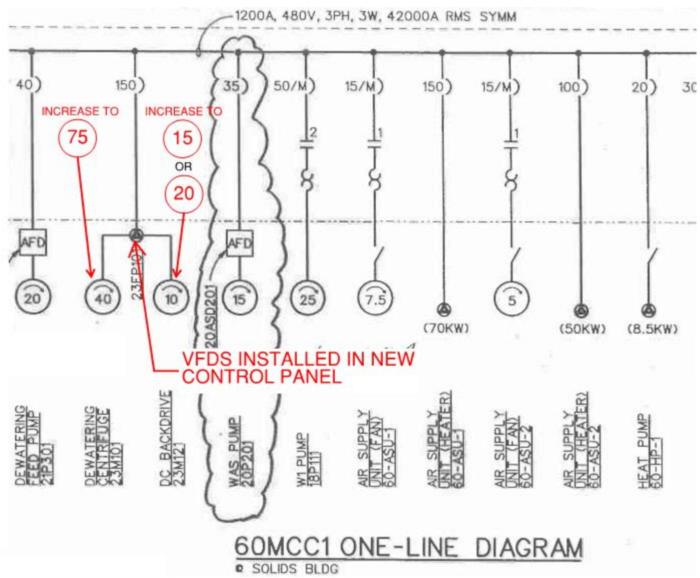


Figure 7: Partial 60MCC1 Single Line

A preliminary load evaluation of the motor control centers (MCCs) indicates that the existing equipment and feed breakers are sufficiently sized to accommodate the increased loads shown on Figure 7. A preliminary review of record drawings for 60SWGR1 indicate that the existing switchgear may be overloaded as it is. Additional investigation is recommended to determine if the Centrifuge Replacement Evaluation may trigger electrical improvements to 60SWGR1.

MCCs 60MCC1 and 60MCC2 are likely reaching the end of their service life, and replacement parts may become increasingly difficult to procure. We recommend the City consider MCC replacement with the Centrifuge Replacement Evaluation. If the City has not experienced maintenance issues with the existing MCCs their replacement could be deferred. The City may be considering a plant-wide electrical conditions assessment in the near future that will help to address these questions.

It is assumed that the Solids Handling Building is ventilated at a rate greater than 6 air changes per hour; however, this is unknown and will need to be verified. Per NFPA 820, the dewatering process area is then considered to be unclassified. Explosion proof motors, enclosures, and electrical connections have not been included with the manufacturers proposals.

Controls

The existing centrifuge control panels, shown on Figure 8, are located in the Control Room west of the dewatering process area. The control panels house VFDs, programmable logic controller (PLCs) and human machine interfaces (HMIs) for the operation of centrifuges, and include hardwire I/O. Existing PLCs are Allen-Bradley with SLC 500 processors. The City made programming improvements in 2017 to address issues with the automatic operation of centrifuges; however, it was determined that further control upgrades were recommended to provide integration with the plant's SCADA system and interlocks with support equipment such as dewatering feed pumps, polymer system, conveyors, and the RDP lime pasteurization process. Plant staff have indicated a preference for centrifuge manufacturers to provide new control panels with ethernet I/O that will support integration with the various support equipment and provide unit responsibility over these systems.

Andritz

Andritz provides a NEMA 4X junction box mounted to each centrifuge frame, along with bearing temperature sensors, vibration sensors, bowl speed sensors, and wash water solenoid valves. Two NEMA 12 starter panels equipped with fans and filters would be provided and are anticipated to be installed in the existing dewatering control room. Starter panels include Allen-Bradley PowerFlex 755 VFDs for the main and back drives. Two stainless steel NEMA 4X centrifuge control panels are provided, equipped with air conditioners. Control panels include Allen-Bradley CompactLogix PLCs with ethernet capability, 10-inch PanelView Plus HMI screens, and E-stops.

Centrisys

Centrisys provides air conditioned, 304 stainless steel NEMA 4X control panels for each centrifuge that houses the main circuit breaker, VFD for the main drive, Allen-Bradley CompactLogix PLC, and motor starter for the hydraulic back drive. Control panels are ethernet capable and include 10-inch PanelView Plus HMI screens. Control panels would be installed in the existing control room. Centrisys also provides vibration sensors, bearing temperature sensors, bowl speed sensors for the centrifuges and hydraulic oil level, temperature and pressure sensors for the hydraulic back drives.

Figure 8: Existing Centrifuge Control Panels

Dewatering Feed Pumps

The existing dewatering feed pumps are located in the pump gallery on the basement level of the Solids Handling Building, as shown on Figure 9. The existing pumps are Wemco recessed impeller pumps with slurry seal at mechanical seals, with a stated capacity of 50 to 100 gpm on plant record drawings; however, plant staff report the pumps likely have greater capacity and are capable of flowing 95 gpm at 30% speed. A pump curve for the Wemco pumps is included as Attachment E. The capacity of the existing pumps will need to be verified to confirm they can provide the required 172 gpm to each centrifuge under Scenario 2.

Plant staff also indicated a flow restriction on the pump discharge piping at the flow meters. The discharge piping necks down to 2 inches and has presented clogging issues in the past. It is recommended that an evaluation be performed for increasing meter size to 4 inches, or installing grinders upstream of the restriction.

Figure 9: Dewatering Feed Pumps

Polymer System

The existing liquid emulsion dewatering polymer system is located immediately north of the dewatering process area in the Solids Handling Building, as shown on Figure 10. The polymer system is a PolyBlend system manufactured by USFilter. Plant staff have experienced issues with the operation and control of the polymer system stemming from the lack of integration of the PolyBlend equipment with the Alfa-Laval/Sharples centrifuge control panels. Additionally, plant staff have experienced issues with monitoring polymer addition to the centrifuges, inhibiting the plant's ability to optimize the process. Plant staff have indicated a preference to replace the existing polymer system with new equipment supplied by the centrifuge manufacturer to eliminate the integration issues and provide unit responsibility over polymer addition.

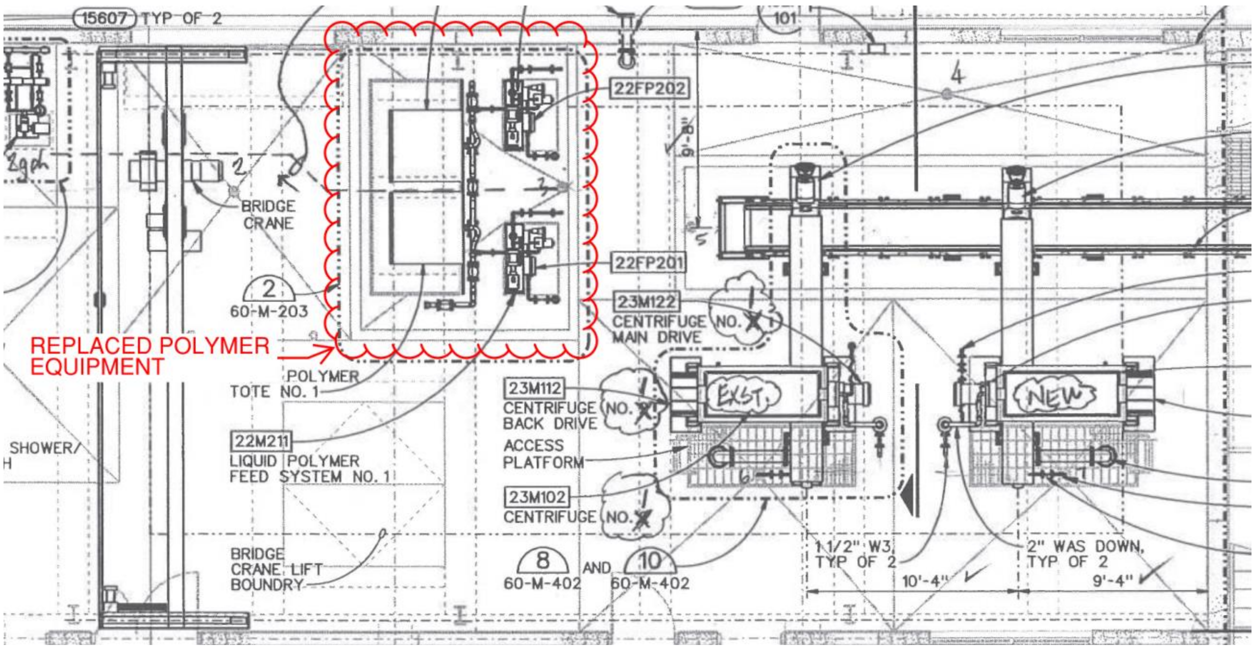


Figure 10: Existing Polymer Area

Additionally, plant staff have indicated that the curb containment surrounding the existing polymer system, shown on Figure 11, makes access into the polymer area for maintenance difficult and has potential for injury. Plant staff have indicated a preference to have the polymer area re-designed, eliminating the containment curbs and providing secondary containment of piping and polymer totes while improving maintenance access and the ability to washdown the polymer area.

Figure 11: Existing Dewatering Polymer System

Manufacturer proposals include a new liquid emulsion polymer system with feed controls integrated with the new centrifuge control panels. Additional considerations for tote storage and automated switching between polymer pumps may be considered during design. An example polymer system by Velodyne is included as Attachment C. Preliminary design data for the polymer system are summarized in Table 9. Additional discussion with plant staff is recommended to identify whether existing tote storage within the Solids Handling Building is adequate.

Table 9: Preliminary Polymer System Design Data

Parameter	Value
Polymer Flow Rate, gph	0.25 to 5
Dilution Water Flow, gph	120 to 1,200
Mixing Chamber	
Model	VeloBlend VM
Type	Staged Hydro-Mechanical
Mixer	
Hp	0.5
Materials of Construction	Stainless Steel
Polymer Metering Pump	
Type	Progressing Cavity
Hp	0.5
Control Panel	
Type	NEMA 4X
Voltage, V	120

Recommended Improvements

Based on the equipment layouts shown on Figures 4 and 5, both the Andritz D5L and Centrisys CS21-4HC selections appear to fit within the existing dewatering process area. Additional investigation is recommended to determine the exact locations, equipment stand heights and conveyor configurations, including angle of incline, for moving the project into detailed design.

Cost Estimate

An Engineer's Opinion of Probable Construction Cost was prepared for the Centrifuge Replacement Evaluation. The following markups were assumed for each alternative in preparation of the opinion of probable construction cost:

- Electrical, Instrumentation, and Controls Cost: 30% of electro-mechanical process areas. Costs do not include replacement of 60MCC1 or 60MCC2.
- Contractor Indirects: 12% of total construction cost (including electrical) to cover mobilization, bonds, insurance.
- Contractor Overhead and Profit (OH&P): 15% of above costs.
- Estimate Contingency: 25% of all costs listed above.
- Construction Cost Escalation: 6.5% per year, assuming 18 months to the mid-point of construction.
- Market Volatility: 10% of all above costs

Following preparation of construction costs, an additional 38% is added to account for soft costs such as engineering, legal, permitting, and administrative costs associated with design and construction. Detailed cost estimates are provided in Attachment D.

The opinions of probable cost presented in this section are Association for the Advancement of Cost Engineering (AACE) International Class 4 estimates, for which the stated range of accuracy is +40% to -20%. Estimates do not include hazardous materials removal or disposal. Costs assume that structural conditions are suitable and that special foundations are not required. Costs associated with replacement of dewatering feed pumps, installation of grinders, or re-configuration of discharge piping are also not included at this time. Costs for dewatering feed pump improvements may be determined following further investigation of pump capacities during the design stage.

The estimated capital costs for Scenarios 1 and 2 are presented in Table 10. Andritz and Centrisys costs are presented for comparison. Andritz equipment costs are lower in both scenarios, and generally Scenario 1 costs are lower than Scenario 2 due to smaller equipment. The shorter hook lifting heights associated with the smaller Scenario 1 centrifuges also eliminates the need to modify the existing dewatering belt conveyor. The level of redundancy is reduced however under Scenario 1, which requires two centrifuges to operate 16 hours per day at the 2040 maximum week solids loading. Total costs are rounded to the nearest $100,000, or $10,000 for areas with costs below $100,000. Costs presented are inclusive of all markups described above.

Table 10: Capital Costs

	Scenario 1		Scenario 2	
Area	**Andritz**	**Centrisys**	**Andritz**	**Centrisys**
Demo	$59,000	$59,000	$60,000	$60,000
Temporary Dewatering Skid	$230,000	$230,000	$230,000	$230,000
Concrete	$23,000	$23,000	$23,000	$23,000
Metals	$0	$0	$170,000	$170,000
High Performance Coatings	$50,000	$50,000	$51,000	$51,000
Signage	$3,000	$3,000	$3,000	$3,000
Centrifuges, Polymer, Conveyors	$3,180,000	$3,680,000	$4,190,000	$4,890,000
Spare Parts	$54,000	$54,000	$55,000	$54,000
Piping	$740,000	$740,000	$750,000	$750,000
Flow Meters	$62,000	$62,000	$63,000	$62,000
Total Capital Costs[(a,b)]	**$4,400,000**	**$4,900,000**	**$5,600,000**	**$6,300,000**

Notes:

(a) Capital costs are inclusive of the following markups:
1. Electrical, Instrumentation and Controls = 30% of electro-mechanical areas
2. Contractor Indirects = 12%
3. Contractor OH&P = 15%
4. Contingency = 25%
5. Escalation = 6.5% per year, assuming 18 months to mid-point of construction
6. Market volatility = 10%
7. Soft costs, including engineering, construction management, permits, legal, administrative = 38%.

(b) Capital costs do not include replacement of MCCs or sludge dewatering feed pumps. Additional investigation is recommended to better define potential improvements for MCCs and sludge dewatering feed pumps.

O&M costs are inclusive of operator labor, preventative maintenance, repair and replacement, electricity, and chemical usage. Labor costs assume 0.3 full-time employee (FTE) to perform maintenance duties at a burdened rate of $50 per hour. Electricity costs are based on a rate of $0.08 per kilowatt hour (kW-hr). The estimated annual O&M costs for Scenarios 1 and 2 are presented in Table 11. Total costs are rounded to the nearest $1,000.

Table 11: Annual O&M Costs

Item	Scenario 1[(a)]	Scenario 2[(a)]
Labor[(b)]	$31,000	$31,000
Electricity[(c)]	$10,000	$9,000
Chemical[(d)]	$52,000	$52,000
Equipment Maintenance[(e)]	$14,000	$20,000
Total Annual O&M Costs	**$107,000**	**$112,000**

Notes:

(a) Costs are rounded to the nearest $1,000.
(b) Costs assume burden rate of $50 per hour.
(c) Costs assume $0.08 per kW-hr.
(d) Costs for liquid emulsion polymer, $4.20 per active lb. Assumes 20 active lbs polymer/dry ton, and an annualized average of 618 dry tons per year.
(e) Costs are annualized at 2% of equipment costs.

Table 12 presents a planning level opinion of 20-year life-cycle costs, including annual O&M costs and capital costs for Scenarios 1 and 2. The Net Present Value (NPV) represents costs over 20 years in terms of 2022 dollars.

Table 12: Life-Cycle Costs

	Scenario 1		Scenario 2	
Item	Andritz	Centrisys	Andritz	Centrisys
Capital Costs	$4,400,000	$4,900,000	$5,600,000	$6,300,000
20-year O&M Costs NPV[(a)]	$2,200,000	$2,200,000	$2,300,000	$2,300,000
Total Life-Cycle Costs	**$6,600,000**	**$7,100,000**	**$7,900,000**	**$8,600,000**

Notes:

(a) NPV = Net Present Value includes 3% inflation rate. Discount rate is 2.5%, per OMB Circular A-94, Appendix C.

Next Steps

Next steps include a confirmation of equipment sizing and selection by the City, and a follow-up discussion with manufacturers related to ancillary equipment and various options available from the manufacturers, including extended warranties, to refine equipment scope of supply and pricing. Next steps may also include contacting manufacturer references and arranging site visits with reference installations to examine the equipment and speak with plant operators.

Attachment A: Andritz Proposal

City of Newport WWTP – Dewatering Upgrade
Option 1 - 2 x ANDRITZ D4L Centrifuges

For:	Kennedy Jenks	Date:	16-Aug-2022
To:	Ben Bossé	Ref:	3827073-1-Rev-A
	Benjamnin.Bosse@KennedyJenks.com		

Design Criteria

Sludge description:	Aerobically Digested
Feed Solids Concentration:	1.0-2.0% TS
Design Hydraulic Load:	40-60 gpm
Maximum Solids Load:	600 lb/hr dry solids

Equipment Selection and Expected Performance

Recommended Model:	ANDRITZ D4L Centrifuge
Dewatered Solids Concentration:	16-20% TS
Solids Capture Efficiency:	95% TSS
Estimated Polymer Dosage:	16-20 active lbs per ton dry solids

Note: Refer to ANDRITZ Lab Test L-14805

Scope of Supply

1. Two ANDRITZ D4L Centrifuges c/w:
    - 2304 duplex stainless steel solid bowl
    - SS316 scroll with tungsten carbide tiles over full length
    - SS316 wetted parts
    - Carbon steel frame with epoxy coating
    - FRP casing cover and drive guards
    - 40 HP Main drive / 10 HP Scroll Drive
    - Cyclo gearbox
    - Grease lubricated bearings, L-10 for 100,000 hours
    - Vibration Isolators

    Solids Discharge Connection:
    - Flexible connector to SS316 solids chute on conveyor (conveyor by others)

    Centrate Discharge Connection:
    - Centrate de-aerator supplied with top vent connection, bottom centrate discharge connection and sample port with flex connector between de-aerator and centrifuge

    Feed Connection:
    - SS316 pipe manifold connection for sludge, polymer and wash water c/w a flexible connector

    Centrifuge Machine Wiring and Instruments:
    - NEMA 4X SS terminal box mounted on centrifuge, with PVC Coated Conduit
    - Two Bearing Temperature Sensors
    - Two Vibration Sensors
    - One (1) Bowl Speed Sensor
    - Solenoid valve for centrifuge wash water, brass

ANDRITZ SEPARATION TECHNOLOGIES INC.
1010 Commercial Blvd. S.
Arlington, Texas 76001
Tel. (817) 465-5611
Fax (817) 468-3961
www.andritz.com

2. Two (2) Centrifuge Starter Panels:
    - NEMA 12 with fans and filters
    - Allen-Bradley PowerFlex 755 VFDs for main drive and back drive
3. Two (2) Centrifuge Control Panels:
    - NEMA 4X stainless steel panel with air conditioner
    - Allen-Bradley CompactLogix PLC with ethernet
    - Allne-Bradley Panelview Plus7 10” OIT
    - E-stop
4. Two (2) galvanized steel support stands to support centrifuge over inclined conveyor (no access platform)

5. Two (2) Emulsion Polymer Systems – Velodyne VM-3P-600-D-0-A-1

6. One Set of Special Tools Including Lubricants for First Year of Operation

7. Engineering and Documentation

8. Startup and Training Services – 2 trip x 5 days on site per trip

9. Freight to Jobsite (2 flatbed loads from ANDRITZ shop, Pittsburg, TX)

Not included: Sludge feed pump and flowmeter, inclined discharge conveyor, spare parts

Budget Pricing

Budget Price for Two (2) ANDRITZ D4L Centrifuge Packages: $640,000.00
Pricing in US Dollars, DDP Jobsite, Taxes Not Included.

Prepared By:
ANDRITZ Separation
Denis Piché
Tel: 403-650-4131
denis.piche@andritz.com

Local Representative:
APSCO
Shawn Clark
Tel: 541-602-3016
sclark@apsco-llc.com

DECANTER D4L

TECHNICAL DESCRIPTION

CHARACTERISTICS

Size (L x W x H)	3040 x 1100 x 1460 mm (120 x 43 x 58 in)
Empty weight with driving system	2284 kg (5,035 lb)
Full weight with water	2688 kg (6,042 lb)
Sludge inlet	2” 150# RF Flange
Solids outlet	Flange : 495 x 318 mm (19.5 x 12.5 in)

MATERIAL OF CONSTRUCTION

Bowl (Centrifugally Cast) :	2304 Duplex SS (1.4362)
Scroll and other wetted parts :	SS 316L
Frame	Epoxy coated carbon steel
Bowl Cover	FRP
Motor Cover	FRP

BOWL

Inner diameter	430 mm (16.9 in)
Total length	1591 mm (62.6 in)
L/D ratio	3.7
Maximum speed	3600 rpm
G-value at maximum speed	3115

POND DEPTH ADJUSTMENT

Type	Adjustable weir plates TurboJet nozzles optional

SCROLL

Type	Counter-current design, High Performance
Total length scroll with lifting beam for removal	2120 mm (83.5 in)
Total weight scroll with lifting beam for removal	384 kg (767 lb)

WEAR PROTECTION

Inner bowl surface	Integral machined grooves
Scroll edges	Field-Replaceable tungsten carbide tiles full length
Scroll feed chamber (distributor)	Tungsten carbide
Conveyor feed ports	Field-Replaceable tungsten carbide nozzles
Solids Discharge Ports	Field-Replaceable tungsten carbide nozzles
Bowl discharge (diffuser)	SS 316L

PAINT

Frame and parts in cast iron or steel	Epoxy coating (RAL 5015), Primary (60µ) – Finish (60µ)

SEALS AND LUBRICATION

Seals	BUNA N (Nitrile), maximum temperature 80°C
Lubrication	Main bearings are grease lubricated The scroll bearings are grease lubricated

DRIVE SYSTEM

Bowl speed + scroll speed adjustment	VFD
Main motor + frequency inverter	30 kW (40 HP)
Secondary motor + frequency inverter	7.5 kW (10 HP)
Connected load	30 kW (40 HP)
Cyclo reducer (gearbox), nominal torque	5000 N-m

MOTORS

Brand	BALDOR or similar
Voltage	460V / 3 ph / 60Hz (575V for Canada)
Speed	1800 rpm
Frame	Cast iron
Rating	NEMA MG-1
Service Factor	1.15
Insulation	Class F

CONTROLS

Control/Starter Panel (CCP)	NEMA 4X SS304 Panel, CSA/UL508 Listed
PLC	Allen-Bradley Compact Logix
OIT	Allen-Bradley PanelView Plus OIT
VFD	Allen-Bradley 755 Series
Communication	Ethernet
Area Classification for Centrifuge and Panel	General/Non-Hazardous

SCROLL SPEED ADJUSTMENT

Type	Frequency inverter with secondary motor
Differential Speed Range	0 - 15 rpm
Control Modes	Automatic torque control

FACTORY ACCEPTANCE TEST VALUES

Noise Level	<85 dB(A) sound pressure in free field, measured at operational speed from 1 meter while empty (according to specific data sheet, 20μPa).
Vibration Level	<4.5 mm/s max. (registered on test bench at operational speed according ISO 10816-1)

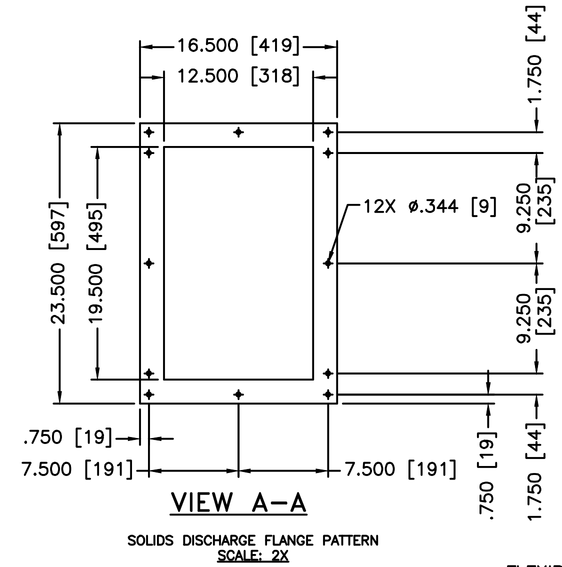
UTILITIES

Sludge feed pressure Wash water flow rate Wash water quality and pressure Wash time for clean-in-place and shutdown	0.5 bar (7.5 psi) at sludge feed connection 8 - 16 m3/hr (35-70 gpm) industrial water supply / 3-4 bars (40-50 psi) 10 minutes for cip / 15 minutes for shut-down
Air evacuation (de-aerator supplied)	200 m3/hr (120 cfm)
Average calorific emission	3010 Kcal/hr

MAINTENANCE EQUIPMENT

Special Tools Supplied with Equipment	1 Scroll lifting beam 1 Scroll thrust bearing extractor 1 Pin extractor 1 Greasing set 1 set of wrenches 1 set of threaded rods 1 grease pump 1 tool box

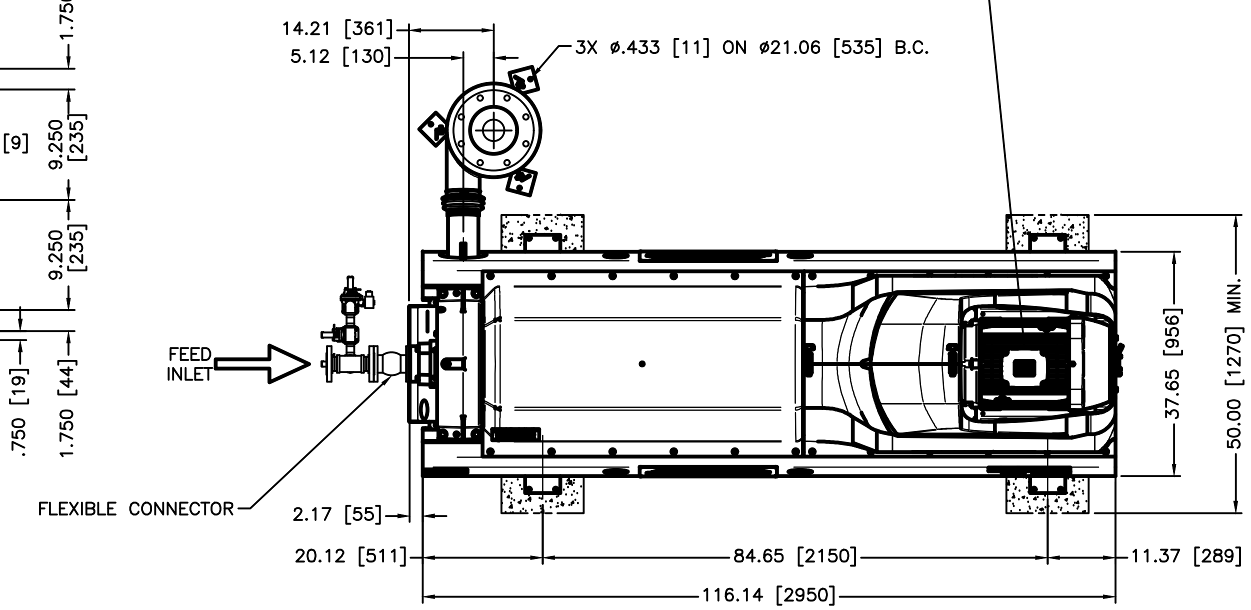
PIPING CONNECTIONS		
PORT	SIZE	DESCRIPTION
A	2" CLASS 150 ANSI RF FLANGE	FEED INLET
B	RECTANGULAR 12-1/2" x 19-1/2"	SOLIDS DISCHARGE
C	1" FNPT	SLUDGE SAMPLE
D	1" FNPT	POLYMER CONNECTION
E	1" FNPT	WASHWATER CONNECTION
F	8" CLASS 150 ANSI FF FLANGE	VENT
G	5" CLASS 150 ANSI FF FLANGE	CENTRATE DISCHARGE
H	ø1.181"	FRAME DRAIN

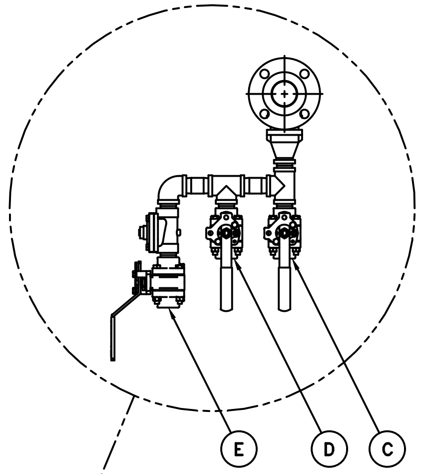


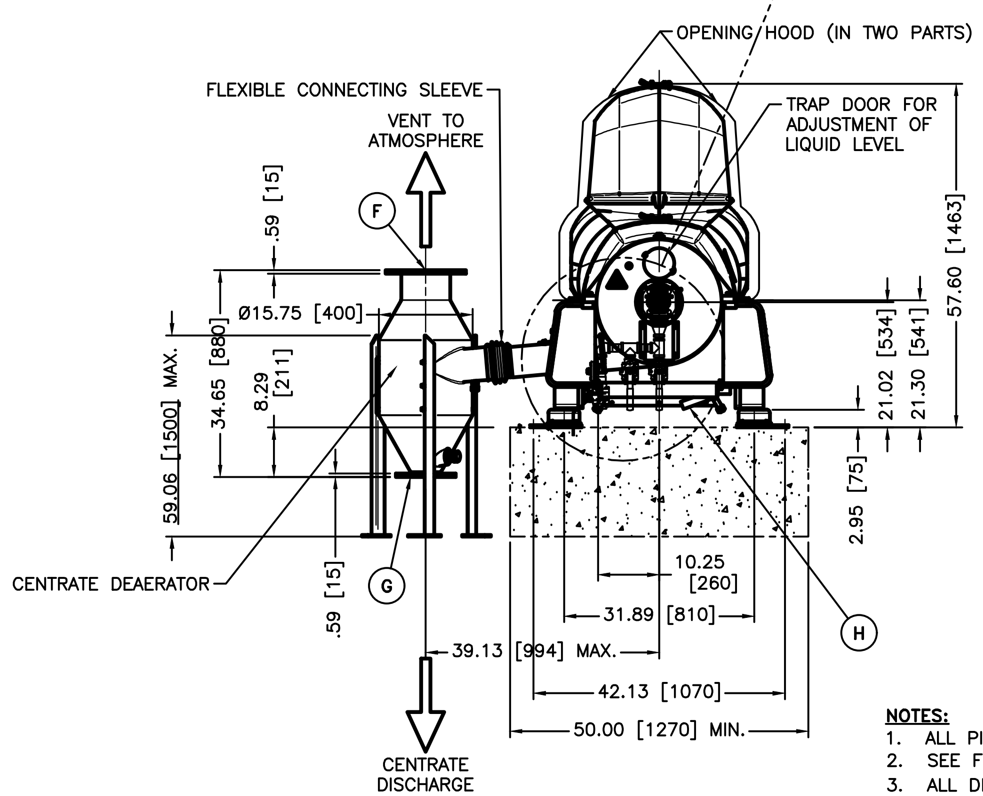
VIEW A–A

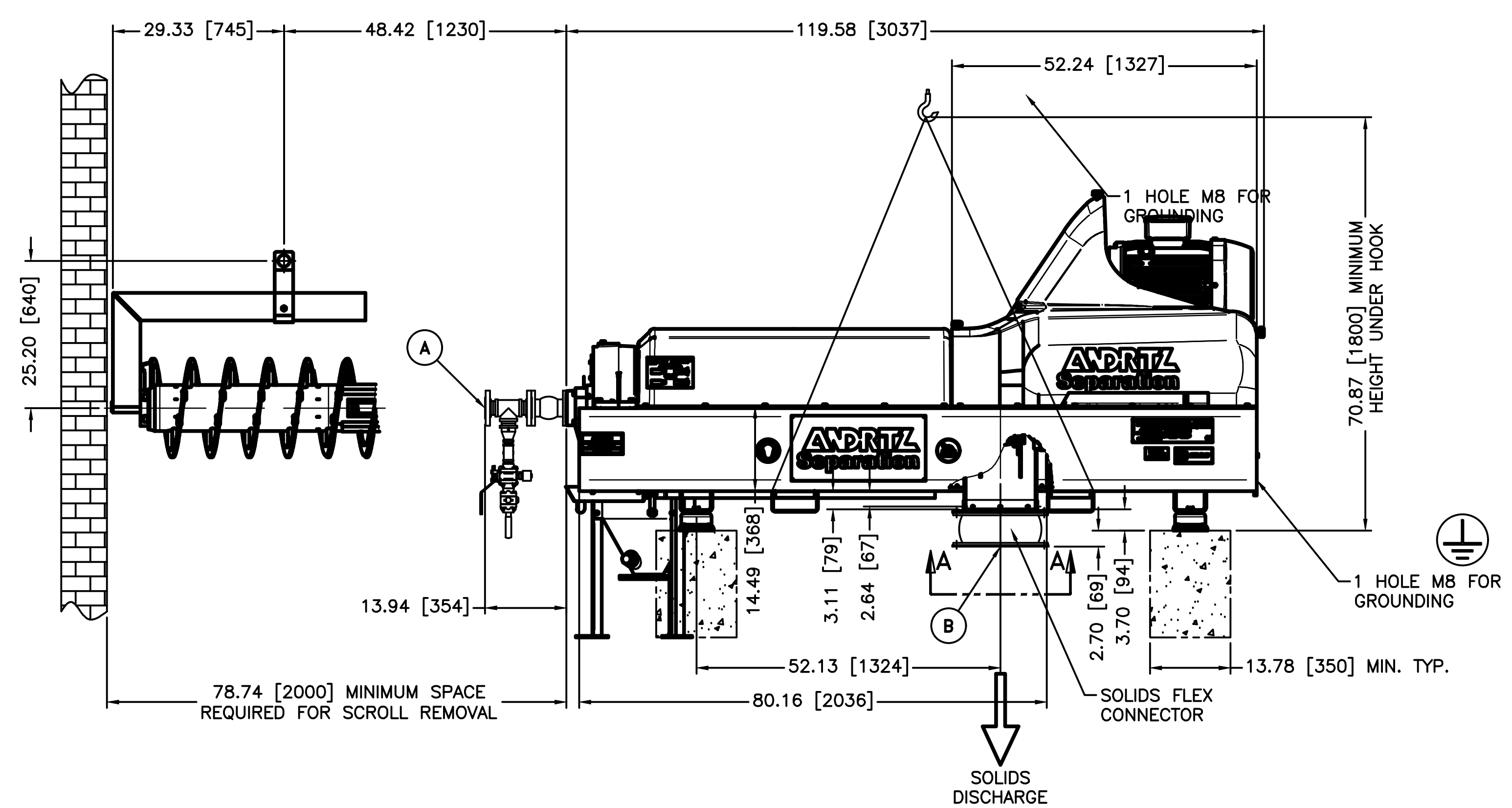
SOLIDS DISCHARGE FLANGE PATTERN
SCALE: 2X

NOTE: KEEP MOTOR CONDUITS AWAY FROM FRONT OF FIBERGLASS GUARDS. RUN MOTOR CONDUITS TOWARD REAR OF MACHINE TO ALLOW FOR COVER AND REMOVAL.









NOTES:

1. ALL PIPING TO AND FROM MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
2. SEE FOUNDATION DETAILS FOR DESIGN LOADS AND CONNECTION DETAILS.
3. ALL DIMENSIONS ARE IN INCHES WITH mm IN [ ].
4. DRY WEIGHT OF MACHINE: 5,035 LBS [2,284 KG] (1)
5. SCROLL+LIFTING BEAM: 767 LBS [348 KG]
6. NOISE LEVEL AT OPERATION SPEED: 82 dBA.
7. PROCESS REQUIREMENTS:
   WASHWATER: 35.2–70.4 GPM @ 43.5–58 PSI
   SHUTDOWN: 15 MIN
   CIP: 10 MIN
   AIR FLOW: 118 CFM
   MINIMUM SLUDGE INLET PRESSURE: 7.5 PSI AT CENTRIFUGE FEED FLANGE.
8. ALL CHUTES TO BE SUPPORTED BY OTHERS UNLESS NOTED OTHERWISE.
9. FRAME DRAIN TO BE CONNECTED TO CENTRATE PIPING WITH FLEXIBLE (1) TUBUNG (SUPPLIED BY OTHERS).

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

REV	EIR	REVISION	BY	APVD	DATE
1	NONE	REVISED MACHINE WEIGHTS & PIPING CONNECTIONS	QG	MW	08/27/18

AST No.–

SIMILAR TO DMA1643

ESTIMATED WEIGHT IN LBS: –	DRAWN BY: QG	DATE 02/28/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 / MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	APPROVED BY: KN	DATE 03/08/18
MILL FINISH ALL OVER	THIRD ANGLE PROJECTION	

ANDRITZ
ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: D4L CENTRIFUGE
D4L CENTRIFUGE GENERAL ARRANGEMENT

SIZE	DRAWING NUMBER	REV
D	DMA2764	1

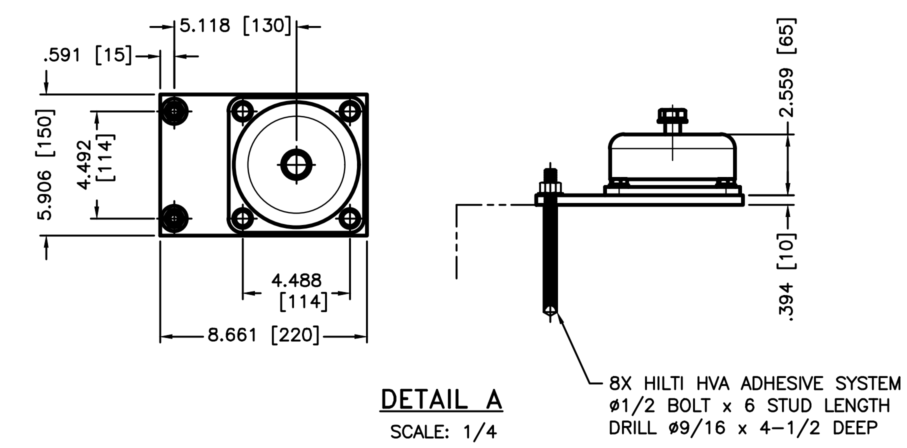
SCALE 1/16 | FILE DMA2764 | SHEET 1 OF 1

THEORETICAL TOTAL LOAD TO DISTRIBUTE AMONG THE 4 ISOLATORS (IN NORMAL OPERATION)						
STATIC LOAD		VERTICAL DYNAMIC LOAD IN LBS [N]. CYCLING FORCE EQUIVALENT TO UNBALANCE PERPENDICULAR TO THE ROTOR AXIS AND APPLIED TO THE CENTER OF GRAVITY.				
WEIGHT OF EMPTY MACHINE	5,035 LBS [22,397 N]		MACHINE SPEED	EQUI. FREQ.	BEFORE ISOLATOR	AFTER ISOLATOR
X 1.2 (WITH PRODUCT) =	6,042 LBS [26,876 N]	IN NORMAL OPERATION	2,500 RPM	41.7 HZ	+/− 635LBS +/− [2,825 N]	+/− 12.9 LBS +/− [57 N]
			3,000 RPM	50.0 HZ	+/− 783 LBS +/− [3,483 N]	+/− 15 LBS +/− [67 N]
			3,500 RPM	58.3 HZ	+/− 882 LBS +/− [3,923 N]	+/− 19.3 LBS +/− [86 N]
		AT ISOLATORS RESONANCE	400 RPM	6.7 HZ	+/− 72 LBS +/− [320 N]	+/− 503 LBS +/− [2,237 N]

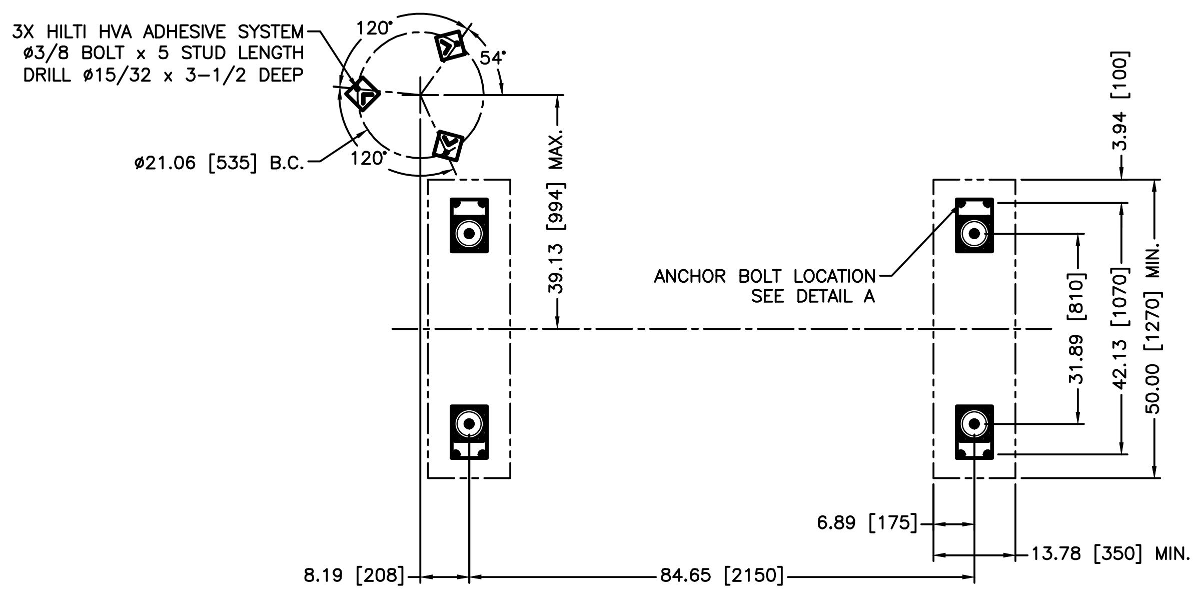
TOTAL PRACTICAL LOAD TO CONSIDER FOR CALCULATION OF THE FOUNDATION (TO DISTRIBUTE AMONG THE 4 ISOLATORS)				
VERTICAL	STATIC =	5,035 LBS [22,397 N]	X 1.2 =	6,042 LBS [26,876 N]
	+ DYNAMIC* =	6,042 LBS [26,876 N]	X 10% =	604 LBS [2,687 N]
	TOTAL =			6,646 LBS [29,563 N]
HORIZONTAL	DYNAMIC =	6,042 LBS [26,876 N]	X 10% =	604 LBS [2,687 N]
(*) WHILE SHUT DOWN OF MACHINE, AND IN CASE OF ABNORMAL OR ACCIDENTAL UNBALANCE				

ISOLATOR NOTE!

APPLY LOCTITE TO ALL VIBRATION ISOLATOR HARDWARE DURING INSTALLATION.



DETAIL A
SCALE: 1/4



GENERAL NOTES :

1. ALL DIMENSIONS ARE IN INCHES WITH mm IN [ ].
2. THE FOUNDATION DESIGN SHOWN INDICATES MINIMUM REQUIREMENTS FOR CLEARANCE AND DRAINAGE. ACTUAL FOUNDATION DESIGN, CONSTRUCTION AND BUILDING HARMONICS CALCULATIONS BY OTHER THAN ANDRITZ.
3. ALL CONNECTING PIPING MUST BE SELF SUPPORTING.
4. ALL FEED AND OUTLET CONNECTIONS TO THE D4L TO BE FLEXIBLE.
5. ALL VIBRATION ISOLATION PADS TO BE LEVEL TO WITHIN 1/32 INCH.
6. CLEARANCE REQUIRED AROUND D4L CENTRIFUGE FOR MAINTENANCE: 36 INCH PER SIDE UNLESS OTHERWISE SPECIFIED.
7. USE SPREADER BARS FOR LIFTING (OR MOVING) THE SKID.
8. APPROXIMATE WEIGHT:
   TOTAL MACHINE EMPTY : 5,035 LBS [2,284 KG]
   TOTAL MACHINE FULL (WATER): 6,042 LBS [2,741 KG]
   SCROLL+LIFTING BEAM : 767 LBS [348 KG]

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

REV	EIR	REVISION	BY	APVD	DATE
1	NONE	REVISED MACHINE WEIGHTS	QG	MW	08/27/18

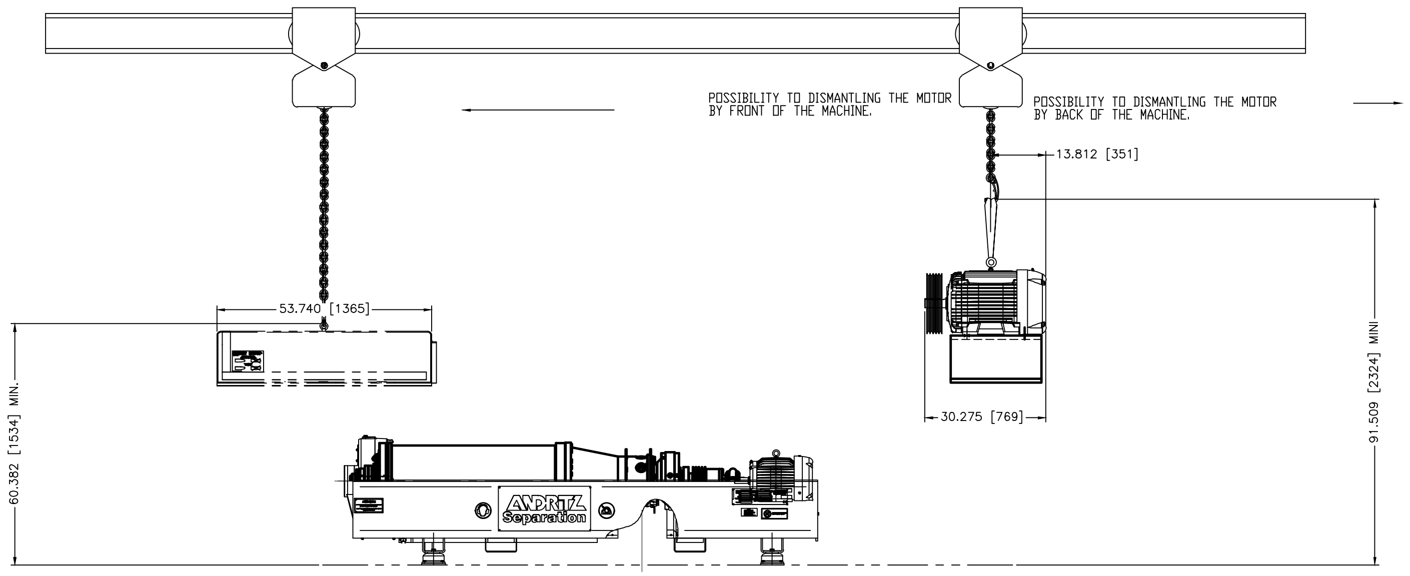
AST No.–

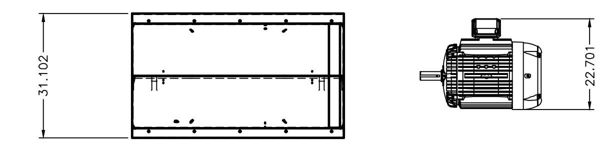
ESTIMATED WEIGHT IN LBS: –	DRAWN BY: QG	DATE 03/02/18	ANDRITZ
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: KN	DATE 03/08/18	PHONE: (817) 465-5611
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION		
MILL FINISH ALL OVER			

TITLE: D4L CENTRIFUGE
D4L CENTRIFUGE FOUNDATION DETAILS

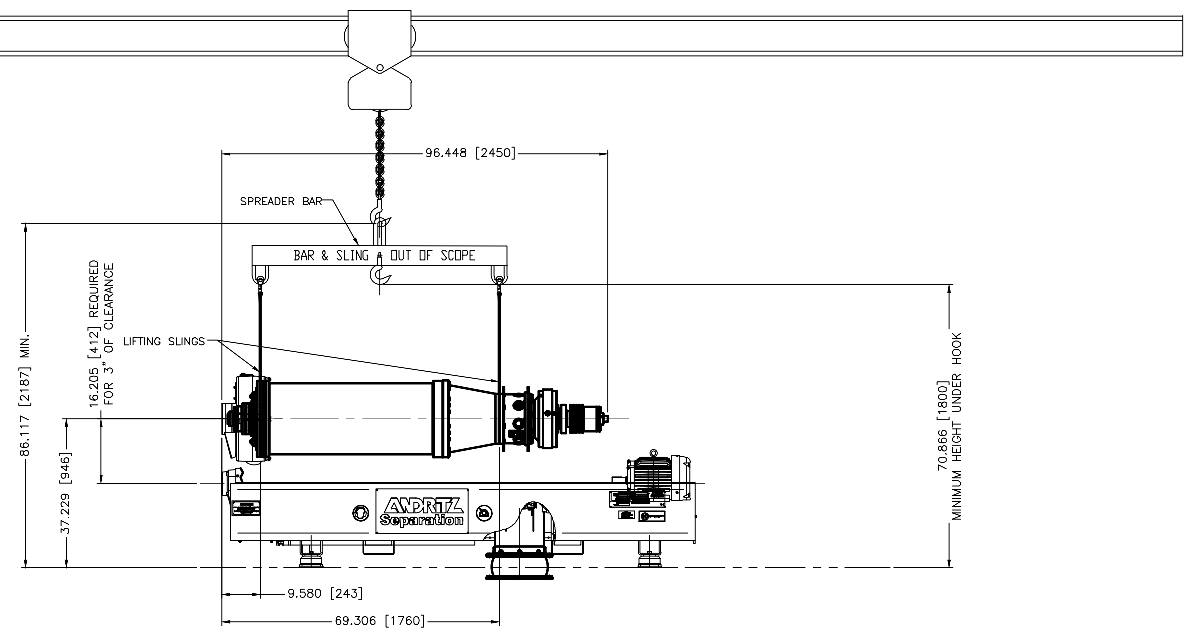
SIZE: D | DRAWING NUMBER: DMF1504 | REV: 1
SCALE: 1/16 | FILE: DMF1504 | SHEET 1 OF 1

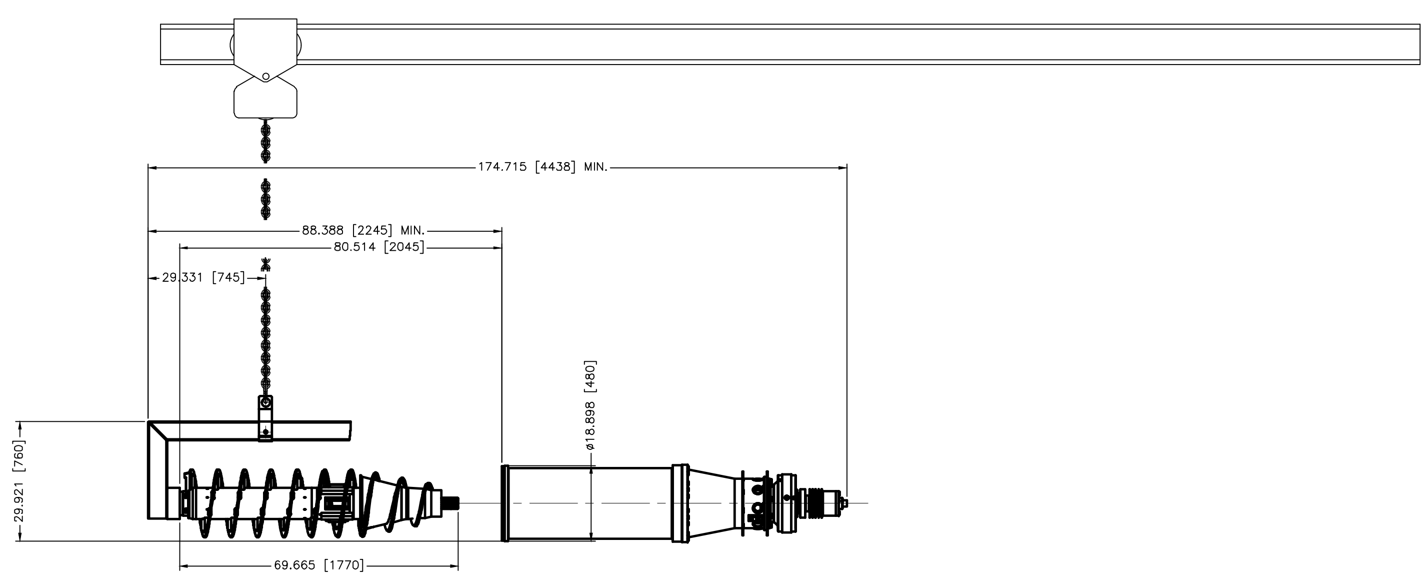
SIMILAR TO DMF1298





TOP VIEW





WEIGHTS FOR MAJOR COMPONENTS					
	MAJOR COMPONENT	EMPTY		FULL	
		UNITS		UNITS	
		lbs	kg	lbs	kg
1.	Main drive motor plus pulley and motor support (40HP)	818	371	N/A	N/A
2.	Scroll drive motor (10HP)	105	231	N/A	N/A
3.	Scroll plus standard Andritz supplied lifting beam	767	316	N/A	N/A
4.	Rotating assembly, including bowl, scroll, pillow blocks and gearbox	2075	941	2487	1128
5.	Slings and lifting bar for rotating assembly (if supplied by ANDRITZ)	161	73	N/A	N/A
6.	Frame	1907	865	N/A	N/A
7.	Motor and bowl cover	141	64	N/A	N/A
8.	Complete machine (empty)	5035	2284	N/A	N/A

Notes:
1. Millwright to determine required rating for all lifting devices used.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

ASAP DOCUMENT No.–

ESTIMATED WEIGHT IN LBS:	DRAWN BY: QG	DATE 1/23/19	ANDRITZ	TITLE D4L R17 CENTRIFUGE D4L R17 CENTRIFUGE LIFTING ARRANGEMENT
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE		
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	APPROVED BY: MW	DATE 1/25/19	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001 PHONE: (817) 465–5611	SIZE D · DRAWING NUMBER DMA2789 · REV 0
MILL FINISH ALL OVER	THIRD ANGLE PROJECTION			SCALE 1/24 · FILE DMA2789 · SHEET 1 OF 1

ANDRITZ Separation

City of Newport WWTP – Dewatering Upgrade
Option 2 - 2 x ANDRITZ D5L Centrifuges

For: Kennedy Jenks
To: Ben Bossé
Benjamnin.Bosse@KennedyJenks.com

Date: 22-Aug-2022
Ref: 3827073-2-Rev-B

Design Criteria

Sludge description:	Aerobically Digested
Feed Solids Concentration:	1.0-2.0% TS
Design Hydraulic Load:	60-100 gpm
Maximum Solids Load:	1000 lb/hr dry solids

Equipment Selection and Expected Performance

Recommended Model:	ANDRITZ D5L Centrifuge
Dewatered Solids Concentration:	16-20% TS
Solids Capture Efficiency:	95% TSS
Estimated Polymer Dosage:	16-20 active lbs per ton dry solids

Note: Refer to ANDRITZ Lab Test L-14805

Scope of Supply

1. Two ANDRITZ D5L Centrifuges c/w:
   - 2304 duplex stainless steel solid bowl
   - SS316 scroll with tungsten carbide tiles over full length
   - SS316 wetted parts
   - Carbon steel frame with epoxy coating
   - FRP casing cover and drive guards
   - 75 HP Main drive / 20 HP Scroll Drive
   - Cyclo gearbox
   - Grease lubricated bearings, L-10 for 100,000 hours
   - Vibration Isolators

   Solids Discharge Connection:
   - Flexible connector to SS316 solids chute on conveyor (conveyor by others)

   Centrate Discharge Connection:
   - SS316 centrate discharge chute to 8-in. dia. discharge flange, c/w flex connector

   Feed Connection:
   - SS316 pipe manifold connection for sludge, polymer and wash water c/w a flexible connector

   Centrifuge Machine Wiring and Instruments:
   - NEMA 4X SS terminal box mounted on centrifuge, with PVC Coated Conduit
   - Two Bearing Temperature Sensors
   - Two Vibration Sensors
   - One (1) Bowl Speed Sensor
   - Solenoid valve for centrifuge wash water, brass

ANDRITZ SEPARATION TECHNOLOGIES INC.
1010 Commercial Blvd. S.
Arlington, Texas 76001
Tel. (817) 465-5611
Fax (817) 468-3961
www.andritz.com

2. Two (2) Centrifuge Starter Panels:
   - NEMA 12 with fans and filters
   - Allen-Bradley PowerFlex 755 VFDs for main drive and back drive
3. Two (2) Centrifuge Control Panels:
   - NEMA 4X stainless steel panel with air conditioner
   - Allen-Bradley CompactLogix PLC with ethernet
   - Allne-Bradley PanelView Plus7 10" OIT
   - E-stop
4. Two (2) galvanized steel support stands to support centrifuge over inclined conveyor (no access platform)
5. Two (2) Emulsion Polymer Systems – Velodyne VM-5P-1200-D-0-A-1
6. One (1) 12" dia. x approx. 12' long run at 27 degree incline shaftless screw conveyor:
   - 12" dia x 3/16" formed U-trough, SS304
   - 12" dia. X 12" pitch shaftless double screw, 8620 high strength carbon steel
   - 12 ga. covers, SS304
   - 5HP @ 20 rpm Nord Drive
   - Flanged drain and wash water nozzle
7. One (1) 12" dia. x approx. 22' long run at 27 degree incline shaftless screw conveyor:
   - 12" dia x 3/16" formed U-trough, SS304
   - 12" dia. X 12" pitch shaftless double screw, 8620 high strength carbon steel
   - 12 ga. covers, SS304
   - 5HP @ 20 rpm Nord Drive
   - Flanged drain and wash water nozzle
8. One Set of Special Tools Including Lubricants for First Year of Operation
9. Engineering and Documentation
10. Startup and Training Services – 2 trip x 5 days on site per trip
11. Freight to Jobsite (2 flatbed loads from ANDRITZ shop, Pittsburg, TX)

Not included: Sludge feed pump and flowmeter, inclined discharge conveyor, spare parts

<u>Budget Pricing</u>

Budget Price for Two (2) ANDRITZ D5L Centrifuge Packages: $946,400.00
Pricing in US Dollars, DDP Jobsite, Taxes Not Included.

Prepared By:
ANDRITZ Separation
Denis Piché
Tel: 403-650-4131
denis.piche@andritz.com

Local Representative:
APSCO
Shawn Clark
Tel: 541-602-3016
sclark@apsco-llc.com

DECANTER D5L

TECHNICAL DESCRIPTION

CHARACTERISTICS

Size (L x W x H)	3732 x 1228 x 1784 mm (147 x 48 x 70 in)
Empty weight with driving system	4,241 Kg (9,350 lb)
Full weight with water	5,090 kg (11,220 lb)
Product inlet	DN50 (2 in)

MATERIAL OF CONSTRUCTION

Bowl	2304 Duplex SS
Scroll and other wetted parts	SS 316L
Frame	Painted carbon steel
Cover	FRP

BOWL

Inner diameter	520 mm (20.5 in)
Total length	1924 mm (75.7 in)
L/D ratio	3.7
Nominal speed	2800 rpm
Maximum speed	3300 rpm
G-value at maximum speed	3165

POND DEPTH ADJUSTMENT

Type	Adjustable weir plates TurboJet nozzles optional

SCROLL

Type	Counter-current design, High Performance HHP
Total length scroll with lifting beam for removal	2200 mm (86 in)
Total weight scroll with lifting beam for removal	470 kg (1034 lb)

WEAR PROTECTION

Inner bowl surface	Integral machined grooves
Scroll edges	Field-replaceable tungsten carbide tiles full length
Vickers hardness of tiles	2500 to 4000
Scroll feed chamber (distributor)	Tungsten carbide
Conveyor feed ports	Field-Replaceable tungsten carbide nozzles
Solids Discharge Ports	Field-Replaceable tungsten carbide nozzles
Bowl discharge (diffuser)	SS 316L

PAINT

Frame and parts in cast iron or steel	Epoxy coating (RAL 5015), Primary (60μ) – Finish (60μ)

SEALS AND LUBRICATION

Seals	BUNA N (Nitrile), maximum temperature 80°C
Lubrication	All bearing blocks are lubricated with grease The reducer is lubricated with grease

DRIVE SYSTEM

Bowl speed + scroll speed adjustment	VFD
Main motor + frequency inverter	55 Kw (75HP)
Secondary motor + frequency inverter	15 kW (20 HP)
Connected load with regenerative drive	55 kW (75 HP)
Cyclo reducer (gearbox), nominal torque	7960 N-m

MOTORS

Brand	BALDOR or similar
Voltage	460V / 3 ph / 60Hz (600V for Canada)
Speed	1800 rpm
Frame	Cast iron
Rating	NEMA MG-1
Insulation	Class F

CONTROLS

Control/Starter Panel (CCP) PLC OIT VFD Communication Area Classification Centrifuge and Panel	NEMA 4X SS304 Panel, CSA/UL508 Listed Allen-Bradley Compact Logix Allen-Bradley PanelView Plus 10” OIT Allen-Bradley PF755 Series Ethernet General/Non-Classified

SCROLL SPEED ADJUSTMENT

Type Differential Speed Range Control Modes	Frequency inverter with secondary motor 1 - 15 rpm Automatic torque control

FACTORY ACCEPTANCE TEST VALUES

Noise Level	<85 dB(A) sound pressure in free field, measured at operational speed from 1 meter while empty (according to specific data sheet, 20μPa).
Vibration Level	<4.5 mm/s max. (registered on test bench at operational speed according ISO 10816-1)

UTILITIES

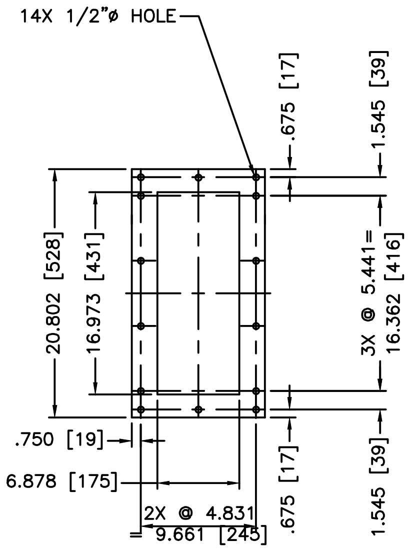
Sludge feed pressure Wash water flow rate Wash time required for shutdown / clean-in-place Wash water quality	0.5 bar (7.5 psi) at sludge feed connection 12-24 m3/hr (50-100 gpm) 15 minutes for shutdown / 10 minutes for cip Industrial water supply / 3 to 4 bars (40-50 psi)
Air vent (de-aerator supplied)	200 m3/hr (120 cfm)
Average calorific emission	5000 Kcal/hr

MAINTENANCE EQUIPMENT

Special Tools Supplied with Equipment	1 Scroll lifting beam 1 Scroll thrust bearing extractor 1 Pin extractor 1 Greasing set 1 set of wrenches 1 set of threaded rods 1 grease pump 1 tool box

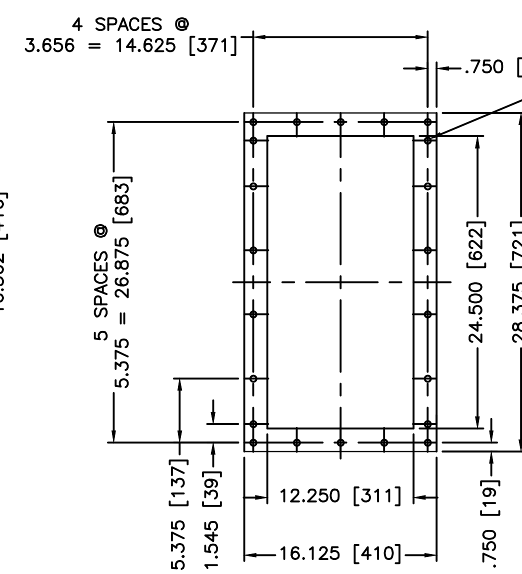
PIPING CONNECTIONS

PORT	SIZE	DESCRIPTION
A	2"– CLASS 150 ANSI RF FLANGE	FEED INLET
B	RECTANGULAR 12.25 x 24.50	SOLIDS DISCHARGE
C	1" FNPT	SLUDGE SAMPLE
D	1" FNPT	POLYMER CONNECTION
E	1" FNPT	WASHWATER CONNECTION
F	RECTANGULAR 6.878" X 16.973"	CENTRATE DISCHARGE
G	4-1/2" OD TUBE	VENT
H	1-3/8" OD TUBE	CENTRATE CASING DRAIN



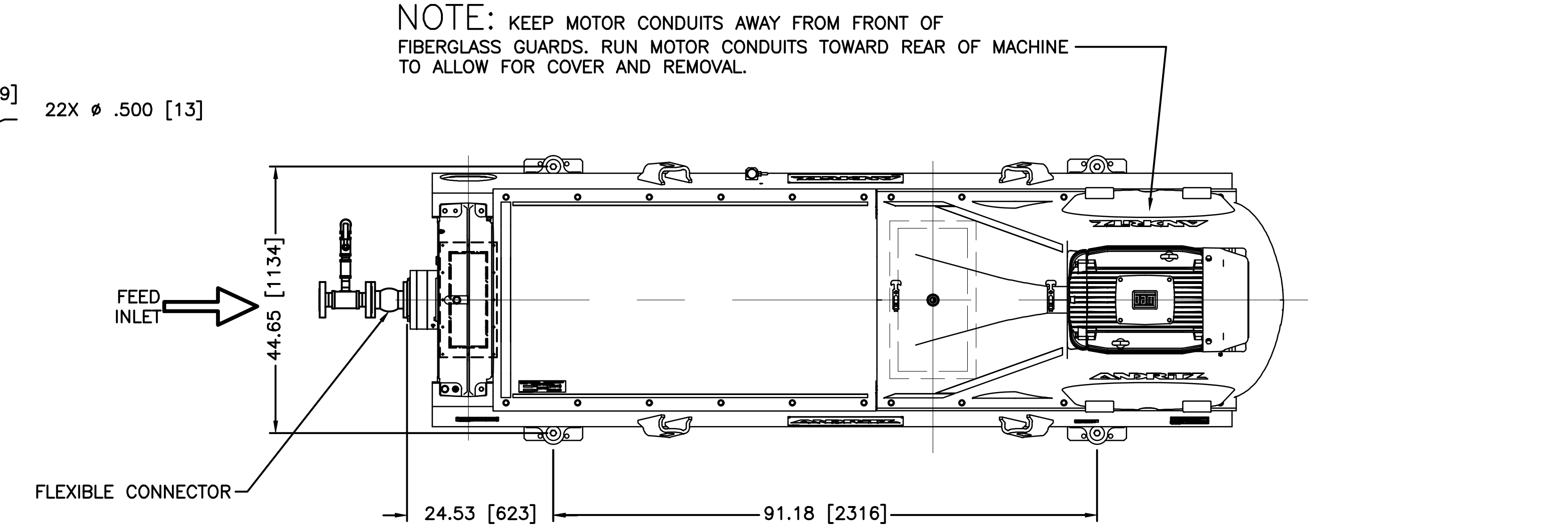
VIEW B–B

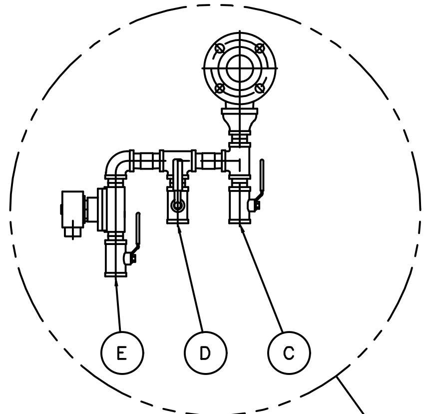
CENTRATE OUTLET FLANGE PATTERN

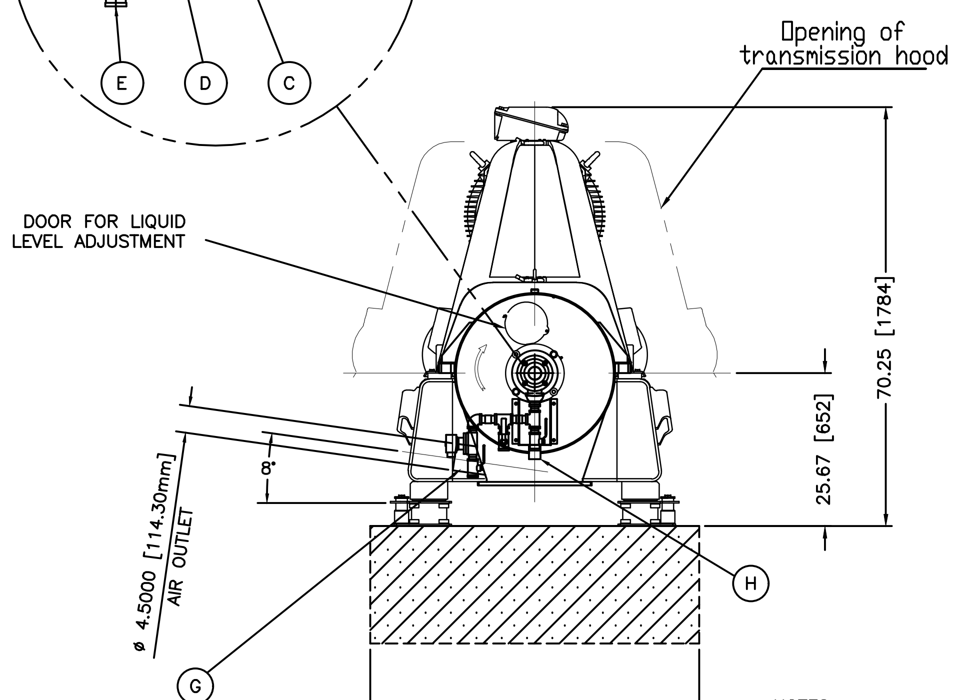


VIEW A–A

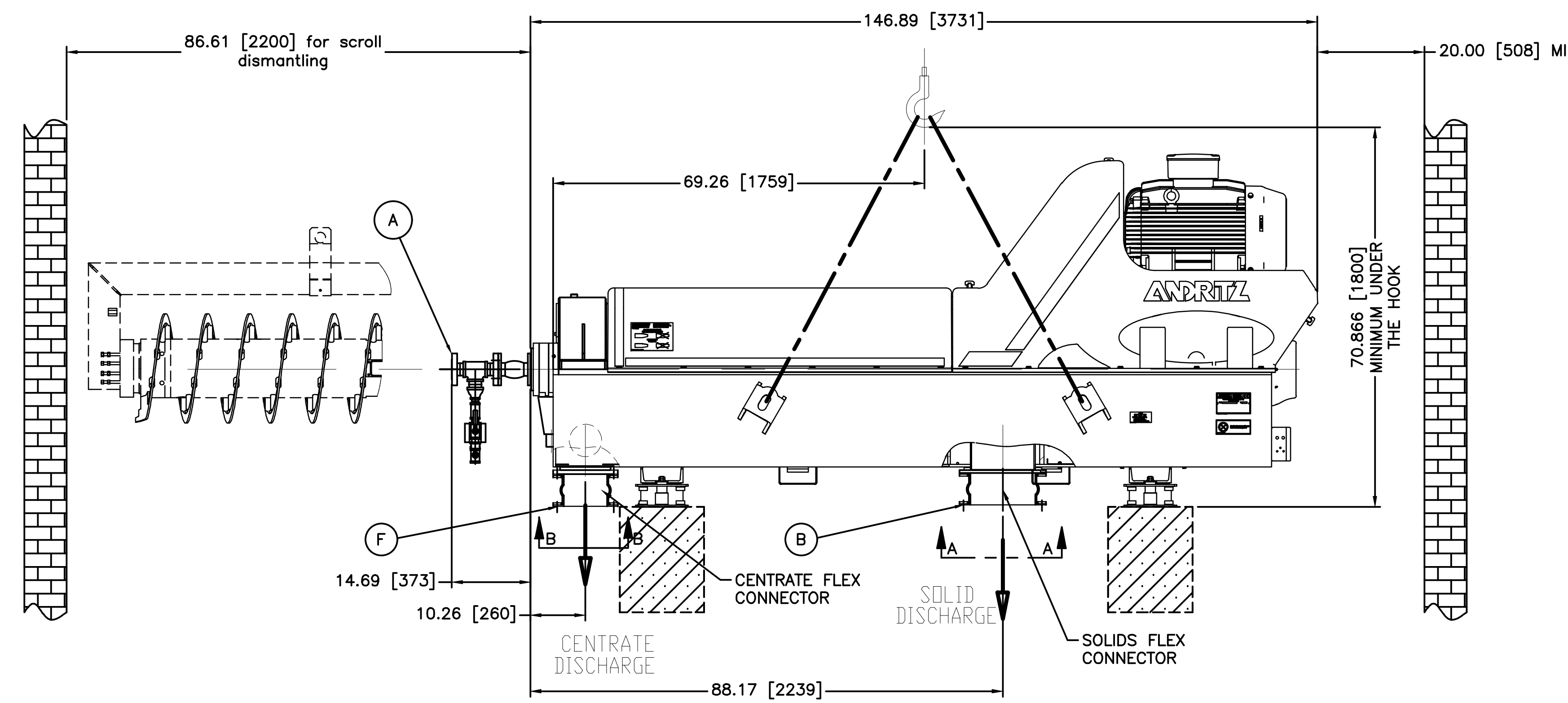
SOLIDS DISCHARGE FLANGE PATTERN







TO BE EXTENDED AND CONNECTED TO EXTERIOR VENT BY OTHERS (SEE NOTE 6 AIR FLOW)



NOTES:

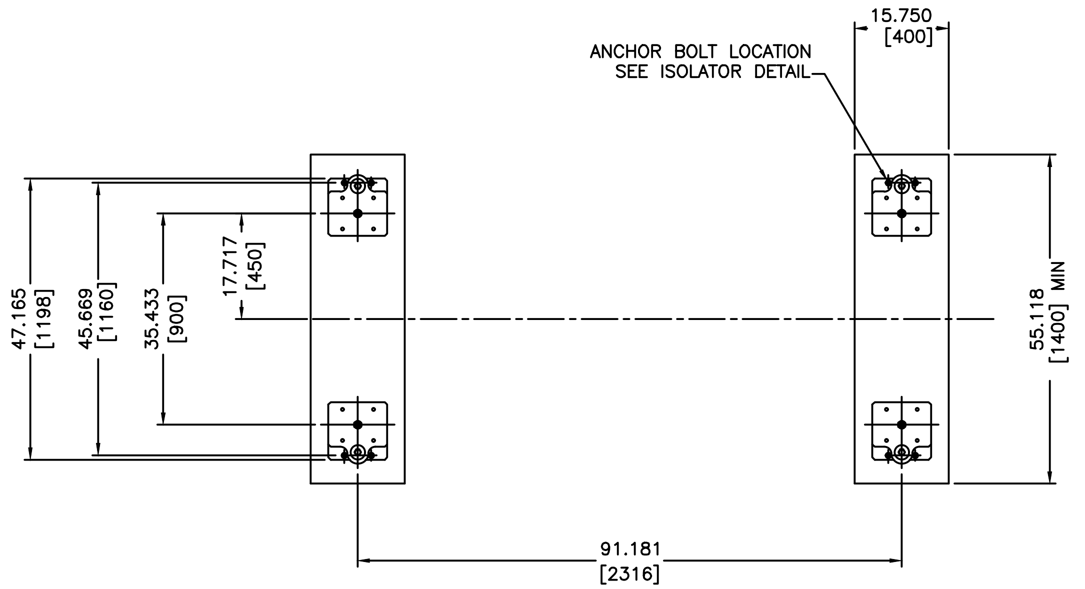
1. ALL PIPING TO AND FROM THE MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
2. SEE FOUNDATION DRAWING FOR DESIGN LOADS AND CONNECTION DETAILS.
3. ALL DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN [].
4. (1) DRY WEIGHT OF MACHINE 9,350 lbs [4,241 kg]
5. SCROLL+LIFTING BEAM 1,034 lbs [469 kg]
6. PROCESS REQUIREMENTS:
   WASH WATER: 44–88gpm @ 45–60psi
   DURATION: SHUT DOWN: 15min.
   C.I.P.: 10min.
   AIR FLOW FROM CENTRATE CASING: 207cfm
   MINIMUM SLUDGE FEED PRESSURE SHALL BE 7.5psi AT THE CENRIFUGE FEED FLANGE.
7. ALL CHUTES TO BE SUPPORTED BY OTHERS THAN ANDRITZ.
8. (1) CENTRATE CASING DRAIN TO BE CONNECTED TO CENTRATE PIPING WITH FLEXIBLE TUBING (SUPPLIED BY OTHERS).

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

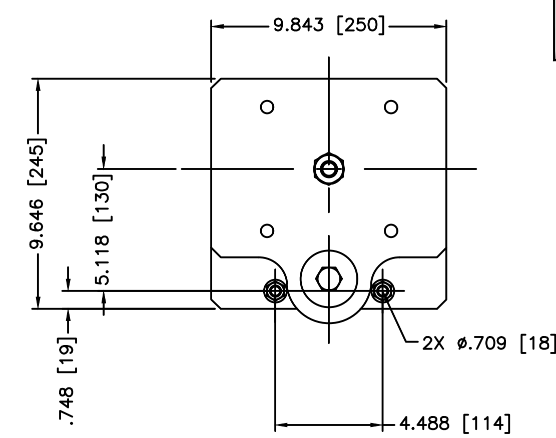
REV	EIR	REVISION	BY	APVD	DATE
1	NONE	REVISED MACHINE WEIGHTS IN NOTES AND ADDED NOTE	QG	MW	06/12/18

ASAP DOCUMENT No.–

ESTIMATED WEIGHT IN LBS:	DRAWN BY: JJA	DATE 5/19/16	ANDRITZ	TITLE D5L E2 CENTRIFUGE — D5L E2 CENTRIFUGE GENERAL ARRANGEMENT
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: AM	DATE 5/19/16		
FABRICATION TOLERANCES .XX±.040 ANG±1° HOLE±.020	APPROVED BY: AM	DATE 5/19/16	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001	SIZE D — DRAWING NUMBER DMA2720 — REV 1
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION		PHONE: (817) 465-5611	SCALE 1/16 — FILE DMA2720 — SHEET 1 OF 1
MILL FINISH ALL OVER				



FOUNDATION PLAN

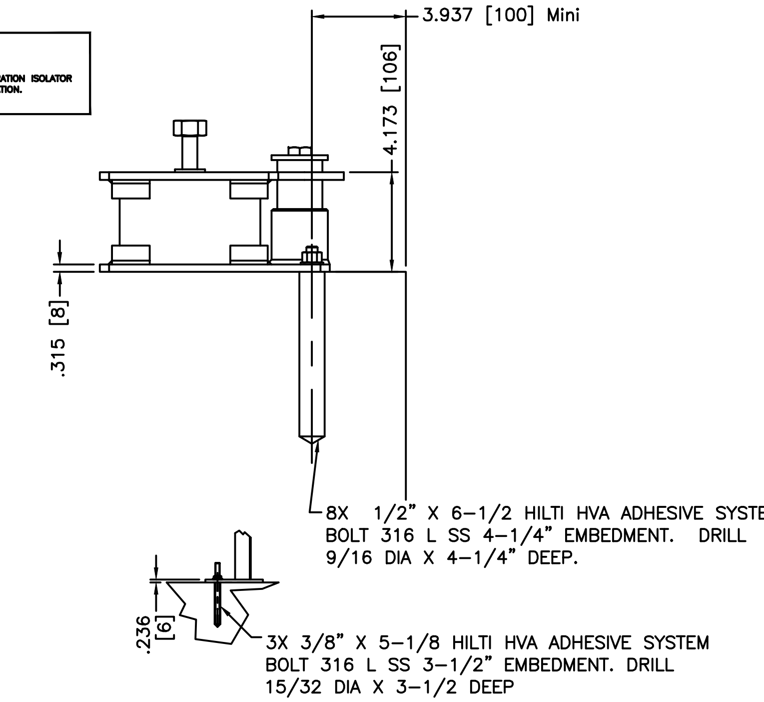


ISOLATOR DETAIL

SCALE: 1/4

ISOLATOR NOTE!

APPLY LOCTITE TO ALL VIBRATION ISOLATOR HARDWARE DURING INSTALLATION.



DEAERATOR PAD DETAIL

SCALE: 1/4

THEORETICAL TOTAL LOAD TO DISTRIBUTE AMONG THE 4 ISOLATORS (IN NORMAL OPERATION)

STATIC LOAD		VERTICAL DYNAMIC LOAD IN LBS [N]. CYCLING FORCE EQUIVALENT TO UNBALANCE PERPENDICULAR TO THE ROTOR AXIS AND APPLIED TO THE CENTER OF GRAVITY.				
WEIGHT OF EMPTY MACHINE	9,350 LBS [41,590 N]		MACHINE SPEED	EQUI. FREQ.	BEFORE ISOLATOR	AFTER ISOLATOR
X 1.2 (WITH PRODUCT) =	11,220 LBS [49,909 N]	IN NORMAL OPERATION	2,750 RPM	45.8 HZ	+/- 5,735 LBS +/- [25,510 N]	+/- 115 LBS +/- [512 N]
			3,000 RPM	50.0 HZ	+/- 6,255 LBS +/- [27,822 N]	+/- 125 LBS +/- [556 N]
			3,300 RPM	55.0 HZ	+/- 6,882 LBS +/- [30,611 N]	+/- 138 LBS +/- [614 N]
		AT ISOLATORS RESONANCE	350–500RPM	8.5–8.3 HZ	+/- 160 LBS +/- [712 N]	+/- 1,122 LBS +/- [4,491 N]

TOTAL PRACTICAL LOAD TO CONSIDER FOR CALCULATION OF THE FOUNDATION (TO DISTRIBUTE AMONG THE 4 ISOLATORS)

VERTICAL	STATIC =	9,350 LBS [41,590 N]	X 1.2 =	11,220 LBS [49,909 N]
	DYNAMIC* =	11,220 LBS [49,909 N]	X 10% =	1,122 LBS [4,991 N]
	TOTAL =			12,342 LBS [54,900 N]
HORIZONTAL	DYNAMIC =	11,220 LBS [49,909 N]	X 5% =	561 LBS [2,495 N]

(*) WHILE SHUT DOWN OF MACHINE, AND IN CASE OF ABNORMAL OR ACCIDENTAL UNBALANCE

NOTES:

1. ALL DIMENSIONS ARE IN INCHES WITH mm IN [ ].
2. THE FOUNDATION DESIGN SHOWN INDICATES MINIMUM REQUIREMENTS FOR CLEARANCE AND DRAINAGE. ACTUAL FOUNDATION DESIGN AND CONSTRUCTION TO BE FURNISHED BY OTHERS.
3. ALL PIPING TO AND FROM THE MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
4. ALL VIBRATION ISOLATION PADS TO BE LEVEL TO WITHIN 1/32".
5. APPROXIMATE WEIGHT:
   TOTAL MACHINE EMPTY: 9,350 lbs [4,241 kg]
   SCROLL+LIFTING BEAM: 1,034 lbs [469 kg]

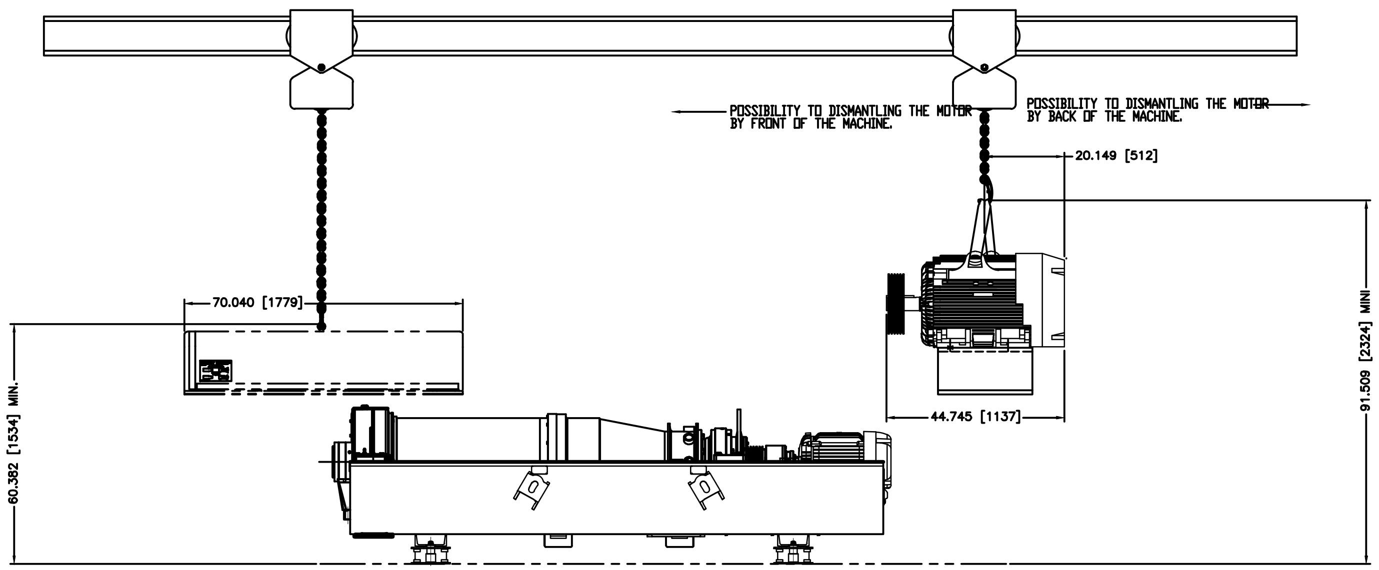
FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

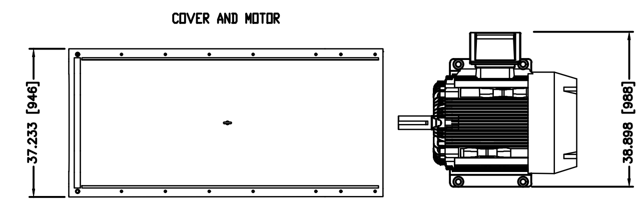
REV	EIR	REVISION	BY	APVD	DATE
1	NONE	REVISED MACHINE WEIGHTS	QG	MW	06/12/18

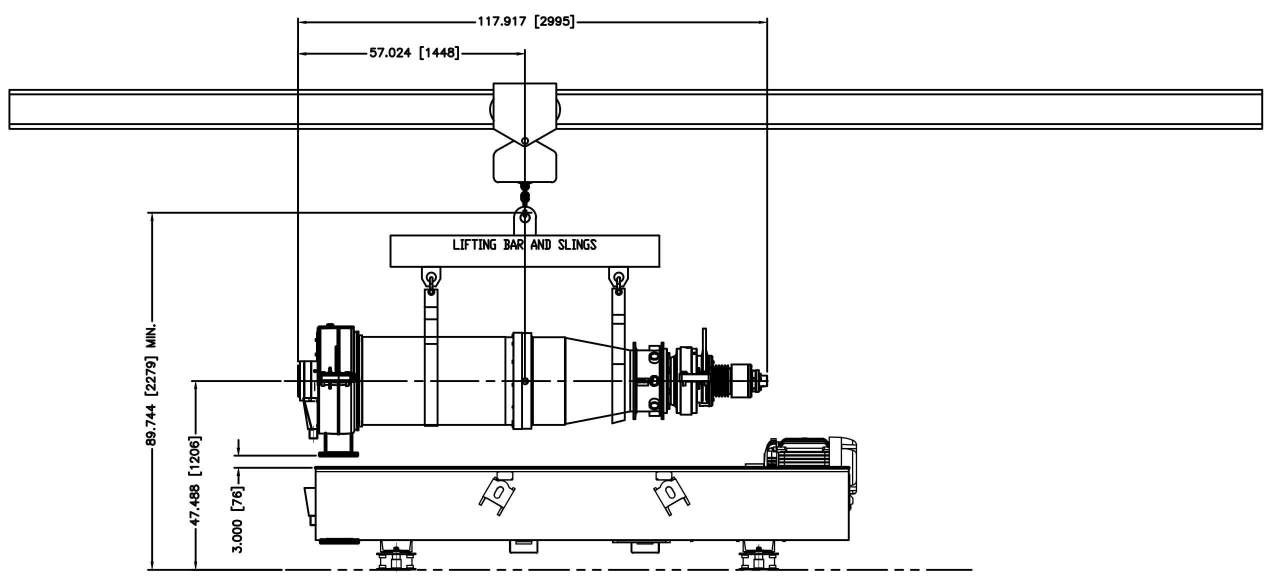
ASAP DOCUMENT No.–

ESTIMATED WEIGHT IN LBS:	DRAWN BY: JJA	DATE 5/19/16	ANDRITZ	TITLE D5L E2 CENTRIFUGE — D5L E2 CENTRIFUGE FOUNDATION DETAILS
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: AM	DATE 5/19/16	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001	SIZE D — DRAWING NUMBER DMF1493 — REV 1
FABRICATION TOLERANCES .XX±.040 ANG±1° HOLE±.020 / MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	APPROVED BY: AM	DATE 5/19/16	PHONE: (817) 465-5611	SCALE 1/16 — FILE DMF1493 — SHEET 1 OF 1
MILL FINISH ALL OVER	THIRD ANGLE PROJECTION			

REF. 702442974

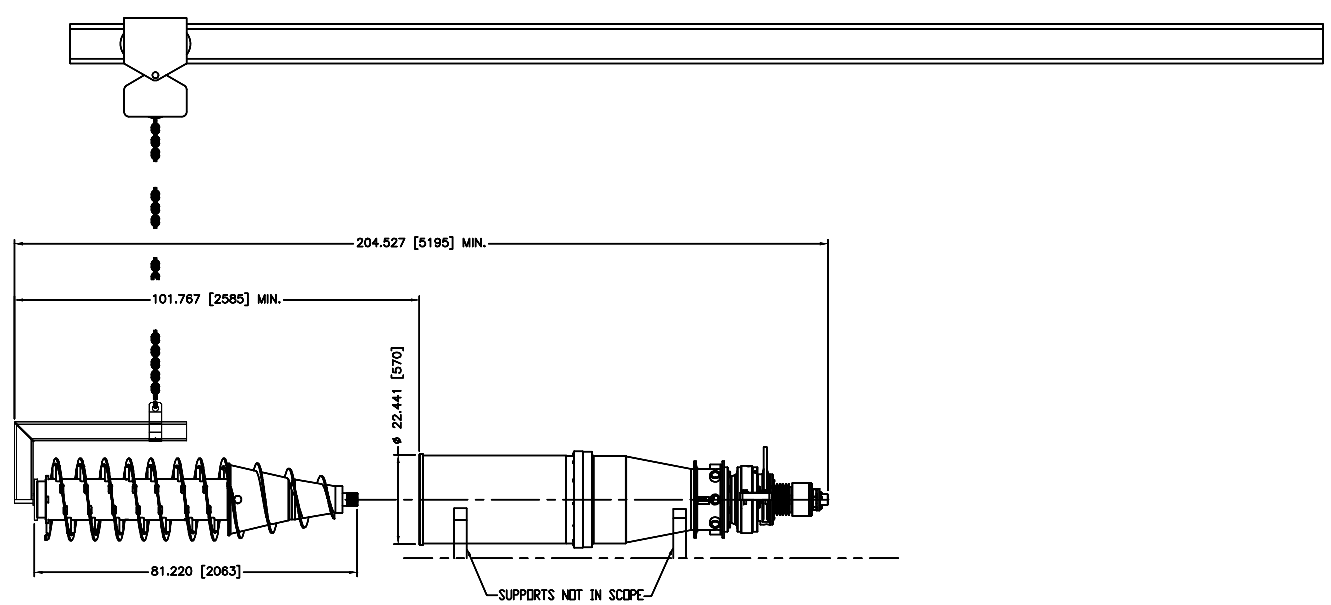






WEIGHTS FOR MAJOR COMPONENTS					
MAJOR COMPONENT		EMPTY		FULL	
		UNITS		UNITS	
		lbs	kg	lbs	kg
1.	Main drive motor plus pulley and motor support (75HP)	1248	566	N/A	N/A
2.	Scroll drive motor (20HP)	358	162	N/A	N/A
3.	Scroll plus standard Andritz supplied lifting beam	1034	469	N/A	N/A
4.	Rotating assembly, including bowl, scroll, pillow blocks and gearbox	4083	1852	4440	2214
1 5.	Slings and lifting bar for rotating assembly (if supplied by ANDRITZ)	348	158	N/A	N/A
6.	Frame	3667	1663	N/A	N/A
7.	Motor and bowl cover	144	65	N/A	N/A
8.	Complete machine (empty)	9350	4241	N/A	N/A

Notes:
1. Millwright to determine required rating for all lifting devices used.



FOR INFORMATION ONLY
NOT FOR CONSTRUCTION PURPOSES

REV	EIR	REVISION	BY	APVD	DATE
1	NONE	REVISED COMPONENT WEIGHTS	QG	MW	06/12/18

ASAP DOCUMENT No.–

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES

FABRICATION TOLERANCES .XX±.040 ANG±1° HOLE±.020

MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020

MILL FINISH ALL OVER

DRAWN BY: QG — DATE 03/13/18

CHECKED BY: QG — DATE 5/2/18

APPROVED BY: — DATE

THIRD ANGLE PROJECTION

ANDRITZ

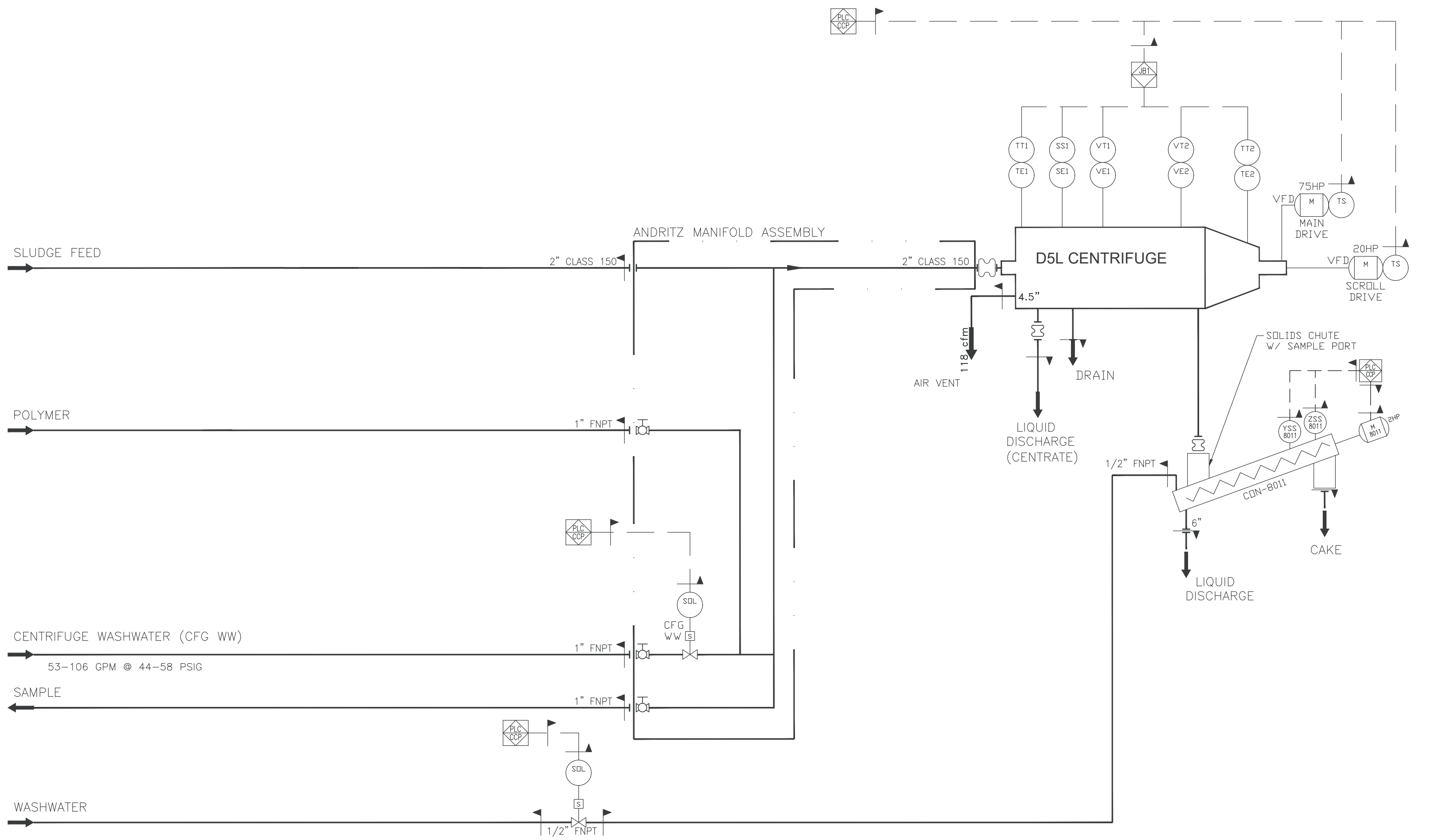
ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001

PHONE: (817) 465-5611

TITLE: D5L E2 CENTRIFUGE
D5L E2 CENTRIFUGE
LIFTING ARRANGEMENT

SIZE D — DRAWING NUMBER DMA2766 — REV 1

SCALE 1/24 — FILE DMA2766 — SHEET 1 OF 1



REFER TO ANDRITZ PROPOSAL FOR SCOPE OF SUPPLY

ESTIMATED WEIGHT IN LBS: N/A	DRAWN BY: JLW	DATE 6/12/20	ANDRITZ	TITLE D5L CENTRIFUGE P&ID
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: RA	DATE 6/12/20	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001	SIZE D — DRAWING NUMBER 839750-PID — REV 0
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: MW	DATE 6/12/20	PHONE: (817) 465-5611	SCALE 1/1 — FILE 839750-PID — SHEET 1 OF 1
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION			
MILL FINISH ALL OVER				

Laboratory Report

CITY OF NEWPORT WASTEWATER TREATMENT PLANT

Report No.: L-14805
Application: 2997-0017
Product Home/Group: 502, 546, 532
Division: 41

Date Report Issued: May 25, 2022
Date Sample Received: May 11, 2022
Author: Katie Murphy
Copy: Hurst, Piche

City of Newport
City of Newport WWTP
5525 S South Pl
Newport, OR 97366
(541) 574-3371
a.grant@newportoregon.gov
www.newportoregon.gov

APSCO LLC
Shawn Clark
922 NW Circle Blvd. Box #405, Ste. 160
Corvallis, OR 97330-1410
(541) 754-7292
sclark@apsco-llc.com
www.apsco-llc.com

ANDRITZ Separation Technologies Inc.
Denis Piche
1010 Commercial Blvd S.
Arlington, TX 76001
(403) 650-4131
denis.piche@andritz.com
www.andritz.com

ENGINEERED SUCCESS

TABLE OF CONTENT

ENGINEERED SUCCESS

ANDRITZ

ANDRITZ LABORATORY REPORT

COMPANY	:	City of Newport
PLANT	:	City of Newport Wastewater Treatment Plant, Newport, OR
SAMPLE TYPE	:	Aerobically Digested Sludge, Centrate, Cake, Polymer
DATE	:	May 25, 2022

1. Introduction:

A five (5) gallon Aerobically Digested Sludge Sample, one (1) liter Centrate Sample, a Cake Sample and a Polymer Sample were received in the ANDRITZ laboratory on May 11, 2022, from City of Newport Wastewater Treatment Plant (WWTP) in Newport, OR. The sludge sample was sent in for Centrifuge, Screw Press (SP) and Belt Filter Press (BFP) dewatering evaluation.

City of Newport WWTP has a design flow rate of 15 mg/d with an average flow rate of 2.05 mg/d. The existing centrifuge has a flow rate of 180 gallons per minute (3 dry tons/day) with a reported discharge solids of about 20 % Total Solids (TS). They are using an emulsion polymer. After ¼“ fine screens and removing grit in the headworks, the sludge is treated with nitrification in an oxidation ditch with mechanical aeration. The sludge is aerobically digested for 9 days.

The current plan is to keep the existing Centrifuge 2, and to replace Centrifuge 1 with a larger unit based on the following design criteria.

Feed Solids Concentration:	1.0 – 1.2 % TS
Maximum Solids Load:	1,000 lb/hr dry solids
Design Hydraulic Load:	200 gpm

2. Objectives:

The specific objectives of these laboratory tests were to:

2.1 Analyze the physical properties of the sludge sample received.
2.2 Conduct polymer evaluation with the sludge sample received.
2.3 Conduct Belt Filter Press (BFP) testing with the sludge sample received.
2.4 Conduct Centrifuge spin-down testing with the sludge sample received.
2.5 Conduct Screw Press (SP) simulation testing with the sludge sample received.

3. Sample Analysis Test Results and Observations:

3.1 Sample Analysis

The aerobically digested sludge sample received contained 0.66 % Total Solids (TS) and Total Suspended Solids (TSS). The sludge appeared brown and murky with a musky odor. Volatile Solids content of the sludge was 85.5 % of TS. Capillary Suction Time (CTS) was 15.7 seconds, and the conductivity of the sludge was measured at 0.61 mS/cm. When spun at 1,000 – 4,000 Gs for 5 minutes, the spin-down volume ranged from 8.5 – 15.5 % and the plug solids contained 3.4 – 6.0 % TS.

Photo 1 – Sludge as Received

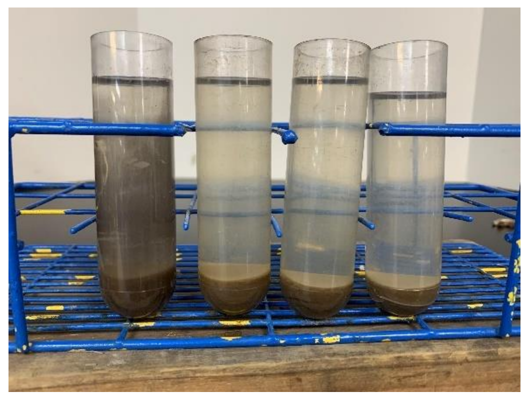


Photo 2 – Spin-Down as Received

The cake sample received had 18.3 % TS.

Photo 3 – Cake as Received

The centrate had visible floating floc that settled quickly causing a high 0.22 % TSS.

Photo 4 – Centrate as Received

Photo 5 – Centrate Settled

Photo 6 – Floating Floc in Centrate

3.2 Sample Analysis

Total Solids* (%TS @ 105ºC)	0.66	
Suspended Solids** (%SS @ 105ºC)	0.66	
Plug Solids (%TS, @ 1000 G's and 5 min)	3.4	
Plug Solids (%TS, @ 2000 G's and 5 min)	4.5	
Plug Solids (%TS, @ 3000 G's and 5 min)	5.2	
Plug Solids (%TS, @ 4000 G's and 5 min)	6.0	
Spin-Down Volume (%, 1000 G's, 5 min)	15.5	
Spin-Down Volume (%, 2000 G's, 5 min)	14.1	
Spin-Down Volume (%, 3000 G's, 5 min)	10.1	
Spin-Down Volume (%, 4000 G's, 5 min)	8.5	
pH @ 20°C	6.2	
Conductivity (mS/cm)	0.610	
Specific Gravity	0.985	
Solids Specific Gravity (Calculated)	0.3	
Ash Content of Total Solids* (% of TS)	14.5	
Volatile Solids Content* (% of TS)	85.5	
Capillary Suction Time (sec)	15.7	
Screened Solids:		Description
+30 Mesh Fraction (% of SS)	2.3	Debris
30 x 50 Mesh Fraction (% of SS)	0.6	Debris/Fibers
50 x100 Mesh Fraction (% of SS)	< 0.1	Grit
100 x 140 Mesh Fraction (% of SS)	5.7	Fines
140 x 230 Mesh Fraction (% of SS)	28.3	Biomass
230 x 325 Mesh Fraction (% of SS)	12.8	Biomass
-325 Mesh Fraction (% of SS)	50.4	
Sludge Volume Index (SVI ml/g)	151	
Settled Solids (1000 ml @ 30 min)	990	
Color	Brown, Murky	
Odor	Musky	

Table 1 Sludge Sample Analysis as Received
EPA Methods: *1684, **160.2

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3.3 Sample Compressibility – Centrifuge Volume Index

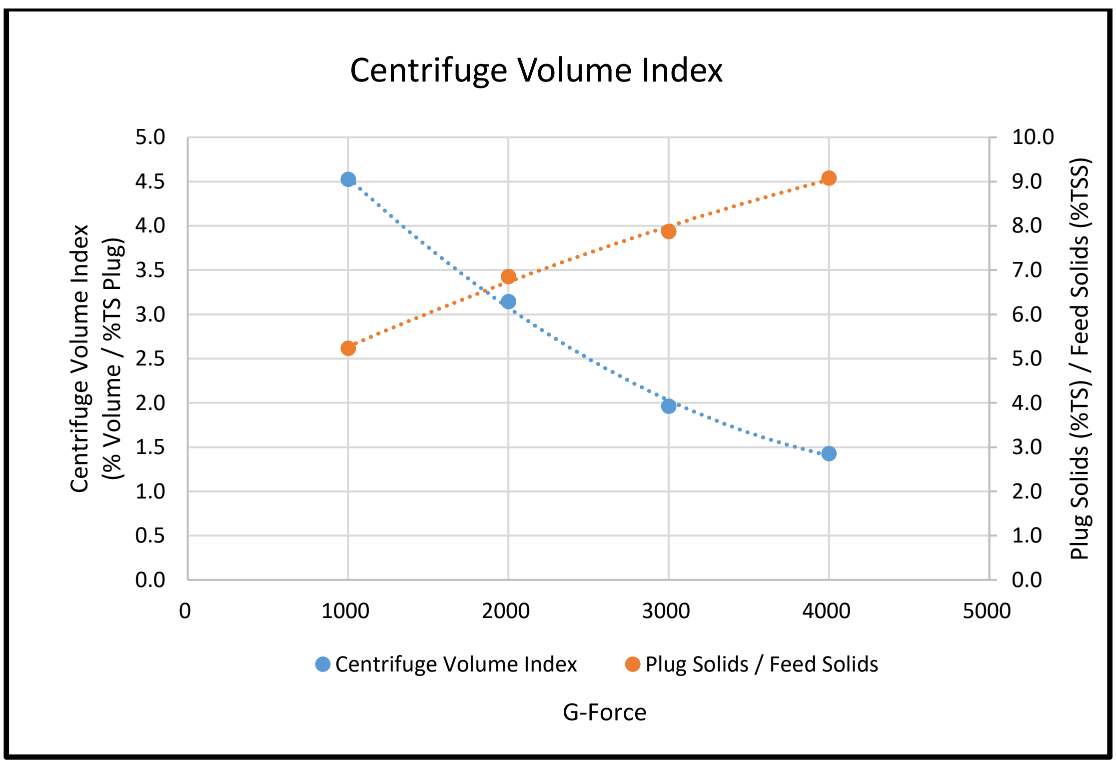
The sludge sample was compressible and increased in plug strength at high end G-forces.

3.4 Sample Compressibility – Centrifuge Volume Index

Spin Time	G-Force	Settled Solids Volume (%)	Plug Solids (%TS)	Volume (%) / Plug Solids (%TS)	Plug Solids (%TS) / Feed Solids (%TSS)
5	1000	15.5	3.4	4.52	5.23
5	2000	14.1	4.5	3.14	6.85
5	3000	10.1	5.2	1.96	7.87
5	4000	8.5	6.0	1.43	9.08

Table 2 Sludge Spin-Down Compressibility as Received

3.5 Sample Compressibility – Centrifuge Volume Index



Graph 1 Sludge Centrifuge Volume Index as Received

4. Polymer Evaluation Test Results and Observations:

4.1 Polymer Evaluation

Six (6) polymers, including the plant provided polymer, were evaluated with the sludge sample. Solenis 8848FS and Polydyne C-6266 and plant provided polymer (L-14805) were the most effective in flocculating the sludge sample.

Photo 7 - Plant L-14805
15.2 active lb/ton TSS

Photo 8 - Plant L-14805
15.2 active lb/ton TSS Sheared

Photo 9 – Polydyne C-6266
15.6 active lb/ton TSS

Photo 10 – Polydyne C-6266
15.6 active lb/ton TSS Sheared

4.2 Polymers Evaluated

Plant Provided	L-14805
Polydyne	C-9530, C-6266, C-6288
Solenis	8848FS, K144L

Table 3 Polymers Evaluated with Sludge Sample

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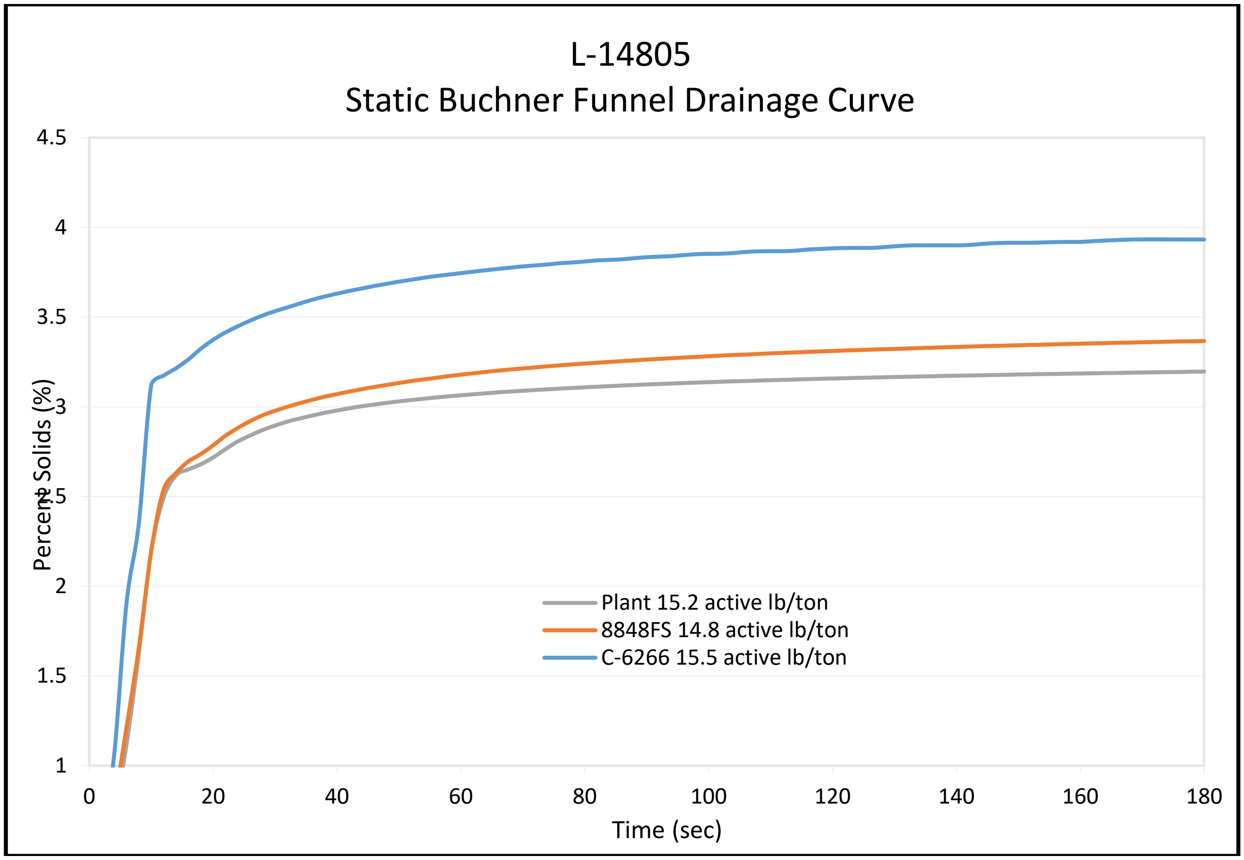
4.3 Polymer Evaluation – Drainage Curves



Graph 2 Drainage Curves of Flocculated Sludge

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5. Laboratory Belt Filter Press (BFP) Test Results and Observations:

5.1 Laboratory BFP Test

A Belt Filter Press (BFP) test was conducted with the sludge sample. Simulating the ANDRITZ 2m SMX®-S8 Quanum BFP at a throughput 148 gallons per minute (gpm) (478 dry lbs/hr), a cake dryness of 14,.8 % TS was achieved in the laboratory.

5.2 Laboratory BFP Test Results

BFP Type	SMX®-S8 Quantum 2m
Polymer Utilized	C-6266
Makeup Polymer Dilution (%)	0.5
Neat Polymer Dosage (lbs/ton TSS)	38.1
Active Polymer Dosage (lbs/ton TSS)	15.6
Recommended Belt Type	GSM 6093
Throughput (lb TSS/hr)	478
Throughput (GPM)	148
Belt Speed (FPM)	5
Cake Thickness (mm)	8
Cake Solids (%TS)	14.8
Anticipated Capture Rate (%)	≥ 95

Table 4 Belt Filter Press Evaluation on Flocculated Sludge

6. Laboratory Centrifuge Test Results and Observations:

6.1 Laboratory Centrifuge Test

Centrifuge spin-down testing was conducted with the sludge sample. With the plant polymer L-14805 at 15.5 active lb / ton TSS and Polydyne C-6266 at 15.6 active lb per ton TSS, the cake dryness ranged from 15 – 17 % TS in the laboratory.

Photo 11 – Polydyne C-6266 15.6 active lb / ton TSS
Centrifuge Cake 15 min 3000Gs

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6.2 Laboratory Centrifuge Test Results

Spin Time (Minutes)	G-Force	Type of Test	Polymer Type	Polymer Dosage Rate (active lbs/ton)	Plug Solids (%TS)	Anticipated Cake Solids (%TS)	Anticipated Capture Rate (%)
5	3000	Glass Tube	None	None	4.2		
5	3000	Glass Tube	L-14805	15.3	5.1	15 -17	≥ 95
10	3000	Screen			15.3		
15	3000	Screen			16.8		
20	3000	Screen			16.9		
5	3000	Glass Tube	None	None	4.6		
5	3000	Glass Tube	C-6266	15.6	4.6	15 - 17	≥ 95
10	3000	Screen			15.4		
15	3000	Screen			15.8		
20	3000	Screen			17.3		

Table 5 Centrifuge Spin-Down on Flocculated Sludge Sample

7. Laboratory Screw Press (SP) Test Results and Observations:

7.1 Laboratory SP Test

Screw Press (SP) testing was conducted with the sludge sample by applying gradual pressure to the flocculated sludge sample. At polymer dosage rate of 15.6 active lb / ton TSS, a cake dryness of 12 – 14 % TS was achieved. High amounts of extrusions were observed at the high and low pressure stages in the laboratory indicating a lower capture rate. A cake with 8 – 10 mm thickness was stabilized.

Photo 12 – Extrusions at High Pressure Stage

Photo 13– Filtrate at High Pressure Stage

Photo 14– Screw Press Dewatering Cake 10 minute

7.2 Laboratory SP Test Results

Test #	1	2
Polymer Utilized	C-6266	
Makeup Polymer Concentration (%)	0.5	
Polymer Dosage (Neat lbs/ton TSS)	38.1	
Polymer Dosage (Active lbs/ton TSS)	15.6	
Maximum Pressure Applied (psia)	15	15
Retention Time (min)	20	10
Cake Thickness (mm)	10	8
Cake Solids (%TS)	14.3	12.4
Anticipated Capture Rate (%)	≤ 85	

Table 6 Screw Press Evaluation on Flocculated Sample

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8. Conclusions:

The sludge sample at 0.66 % Total Suspended Solids (TSS) was dewatered with the Belt Filter Press (BFP), Centrifuge, and Screw Press (SP) evaluation. The BFP achieved a cake dryness of 15 % in the laboratory with the Polydyne C-6266. The Centrifuge achieved a cake dryness of 15 – 18 % TS with the plant polymer and Polydyne C-6266. The SP Simulation had a significant amount of capture loss due to extrusions and achieved a cake dryness of 12- 14 % TS with Polydyne C-6266.

	Centrifuge		Screw Press	Belt Filter Press
Polymer	Plant	C-6266	C-6266	C-6266
Polymer Demand (active lb / ton TSS)	15.3	15.6	15.6	15.6
Cake Dryness (% TS)	15 – 17	15 – 17	12 - 14	15
Anticipated Capture Rate (%)	≥ 95		≤ 85	≥ 95

Table 7 Summary of Results for Dewatering Evaluation

Attached are photographs of the screen analysis, lab sample data sheets for reference and comparison.

9. Sample Disposition:

The remaining untested sludge will be disposed in accordance with local regulations.

Report Prepared by : Katie Murphy
Title : Process Engineer

KAM/sl

Copies of this report have been distributed to the following:

Original +1cc/ Lab
1 cc/ Sales
Shaun Hurst

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Attachments:
A. Photographs

Photo #1: +30 Mesh Fraction

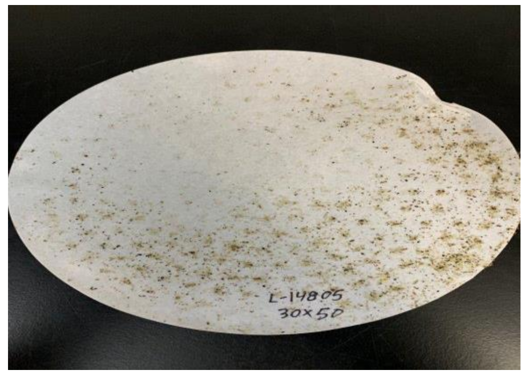

Photo #2: 30X50 Mesh Fraction

Photo #3: 50X100 Mesh Fraction

Photo #4: 100X140 Mesh Fraction

Photo #5: 140X230 Mesh Fraction

Photo #6: 230X325 Mesh Fraction

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B. Lab Sample Data Sheets

4. ANDRITZ LABORATORY MUNICIPAL WASTEWATER SAMPLE DATA SHEET

DATE: 5-9-2022 **OPPORTUNITY #:**

ANDRITZ Representative and/or Salesman:
Shawn Clark APSCO

CLIENT:

Company: City of Newport WWTP Contact:

Plant/Mill Address: 5525 SE 50th Pl

City: Newport State: OR Zip: 97366

Phone: 541-574-3371 Email/Fax: A.Grant@newportoregon.gov

Sample Characteristics: (This information is to be supplied by Customer to determine whether sample is typical of normal operation).

Date Collected: 5-9-22

Sludge or Slurry Consistency (% Total Solids): 0.06 (% Suspended Solids): 652mg/l

Circle One: Ash or Volatile Solids Content (% of Total Solids):

pH @ Temperature (___ °F or ___ °C): Specific Gravity:

Capillary Suction Time (sec)

****Please include a process flow sheet of the facility with this data sheet.**

PLEASE CHECK ALL BOXES THAT APPLY

1) Plant Influent

- ☐ Design Flow (mgd) 15
- ☐ Average Flow (MGD) 2.05
- ☐ Industrial Influent Type Brewery
- ☐ Industrial Influent Percentage Flow 3% load 20%

2) Headworks

- ☐ Coarse ☑ Fine
- Screen Opening Size 1/4"
- ☑ Grit Removal ☐ None

3) Primary Treatment

- ☐ Gravity Settled
- ☐ Dissolved Air Flotation
- ☐ Lagoon
- ☐ Other________
- ☑ None
- ☐ Chemical Aid
- ☐ Type ________
- ☐ Dosage ________

4) Secondary Treatment

Type of Treatment

- ☐ Nitrification/Denitrification ☑ Nitrification Only
- ☐ Chemical Phosphorous Removal Chem. Type ________
- ☐ Biological Phosphorous Removal

Type of Equipment

- ☐ Aerated Basin ☑ Oxidation Ditch
- ☐ Rotating Biological Contactor ☐ Trickling Filter
- ☐ Sequence Batch Reactor ☐ MBR
- ☐ Other________

Type of Aeration

- ☐ Diffused Air ☐ Pure Oxygen ☑ Mechanical

5) Sludge Description

- ☐ 100% Primary
- ☑ 100% Secondary
- ☐ Blend ☐ by weight ☐ by volume
- ☐ _____% Primary
- ☐ _____% Secondary
- ☐ Co-settled Primary/ Secondary
- ☐ Other________

6) Sludge Treatment

- ☐ Anaerobic Digestion ☐ Mesophilic ☐ Hermophilic
- ☑ Aerobic Digestion ☐ Volaties Reduction _____%
- ☐ Zimpro — Solids Retention Time 9 days
- ☐ ATAD ☐ Chemical Addition
- ☐ Lime ☐ Type ________
- ☐ Raw/None ☐ Dosage ________
- ☐ Other________

7) Existing Sludge Dewatering

- ☐ Belt Filter Press ☑ Centrifuge ☐ Vacuum Filter
- ☐ Plate and Frame ☐ Drying Bed ☐ Other ________
- ☐ Gravity Belt Thickener ☐ None

Throughput (Dry Tons/day) 3
Flow Rate (Gallons per Minute) 180
Discharge Solids (%TS) ~20

Polymer Type ☑ Emulsion ☐ Dry ☐ Mannich
Polymer Name Polydyne Clarifloc WE-2012
Polymer Dosage (active lbs/ton) ________

Chemical Addition Prior to Polymer Injection

☐ Ferric ☐ Lime ☐ Permanganate ☐ Other________ ☑ None

ANDRITZ

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Purpose for Laboratory Evaluation (please check):

☑ Preparation for Pilot/Demonstration Testing
☐ Performance Evaluation for Existing Installation ANDRITZ Job#____________________
☑ Performance Evaluation for Sales Quotation
☐ Other________________

Testing Objectives:

Equipment to be tested: ☐ Belt Filter Press ☑ Centrifuge ☐ Rotary Screen Thickener
☐ Screw Press ☐ Filter Press ☐ Gravity Belt Thickener

Hazardous Materials:

Hazardous or Non-hazardous: OSHA - EPA - DOT.
If Hazardous the following must be completed or sample will not be received:

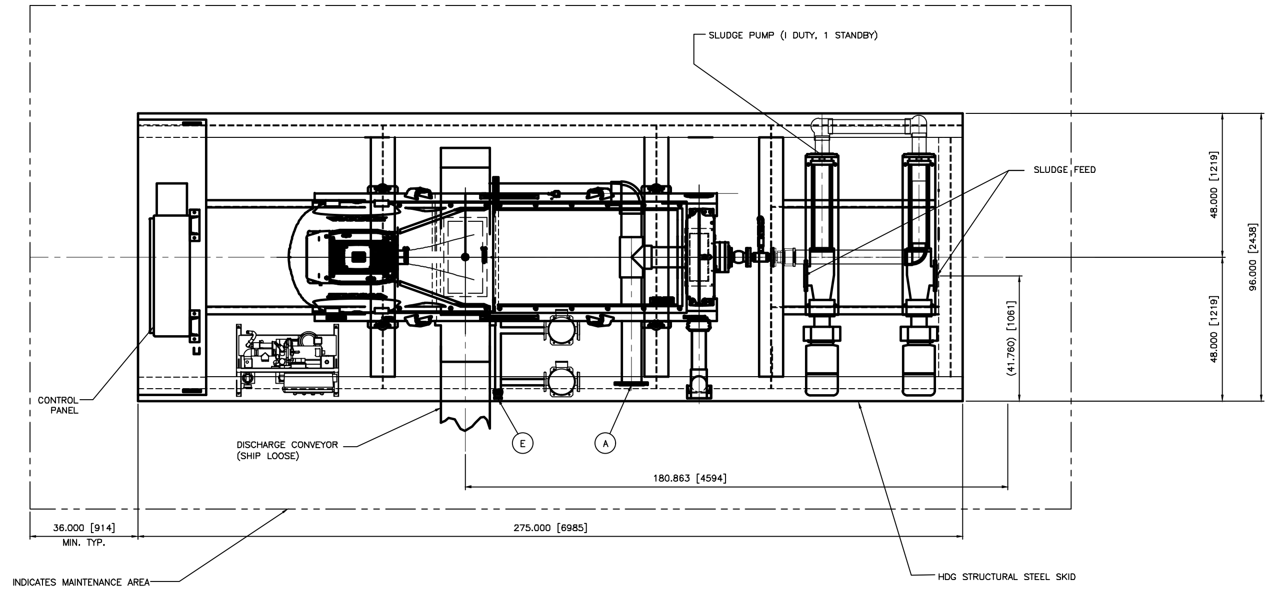
- Prior notification to authorized ANDRITZ Laboratory Personnel 45 days before sample shipment. (Per EPA CFR 40 Regulations)
- MSDS supplied.
- List hazardous components and relative concentration and/or Chemical Analysis Data if available

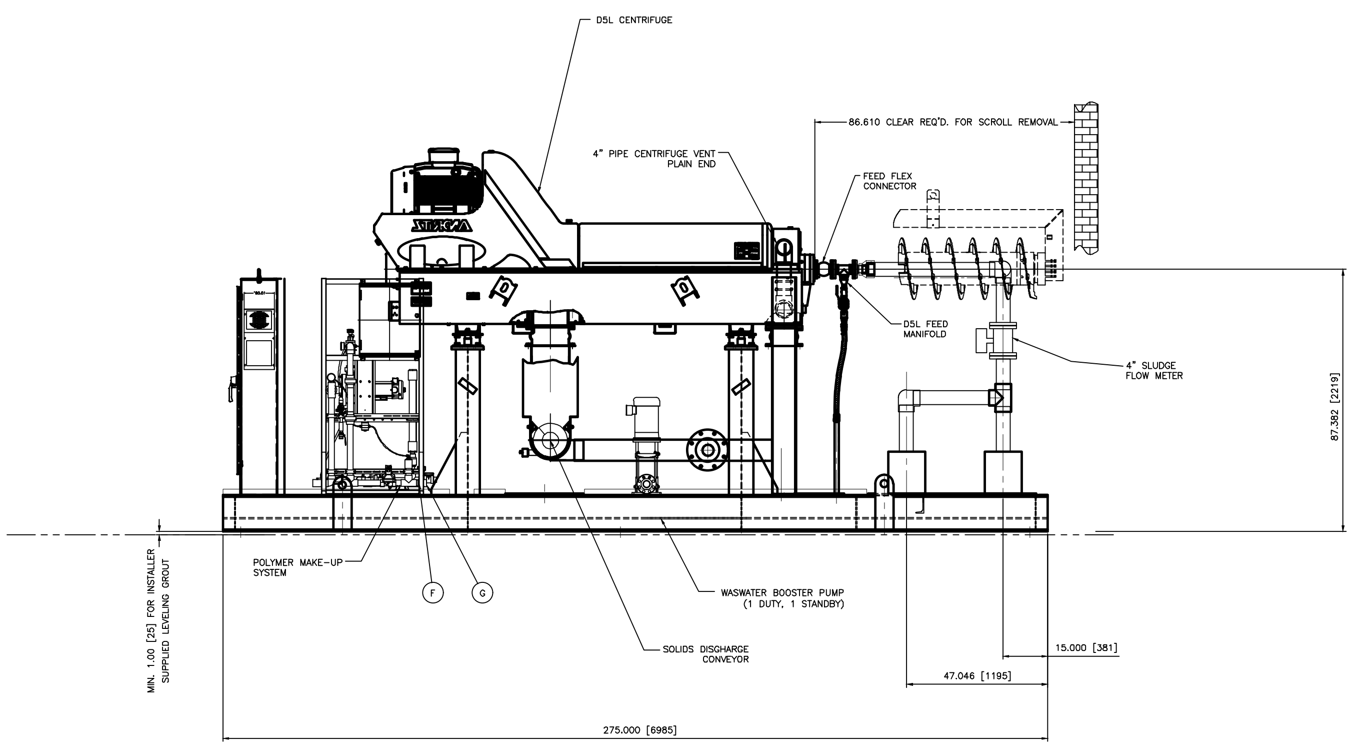
N/A

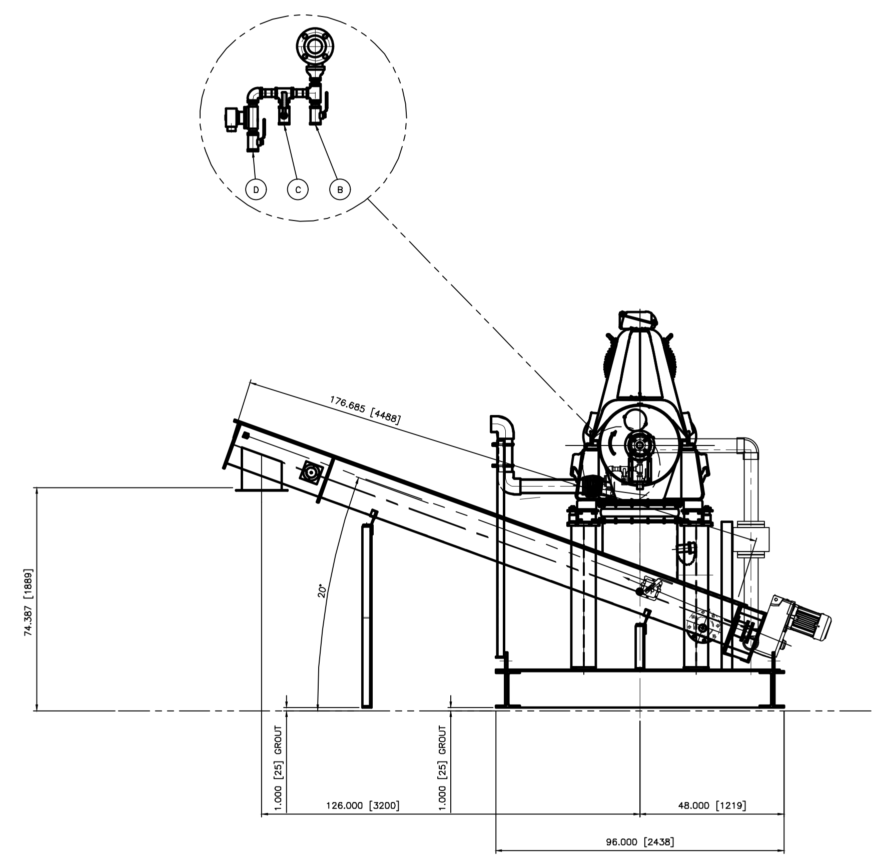
I acknowledge that the information provided above is truthful and accurate to the best of my knowledge.

Name: Andrew Grant Title: WWTP Supervisor

Signature: [signature] Date: 5-9-2022







NOTES:

1. ALL PIPING TO AND FROM THE MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
2. PROCESS REQUIREMENTS:
   WASH WATER: 44–88gpm @ 45–60 psi
   DURATION: SHUT DOWN: 15min.
   C.I.P.: 10min.
   AIR FLOW FROM CENTRATE CASING: 207 cfm [352 cubic meter/hr]
3. MINIMUM SLUDGE FEED PRESSURE SHALL BE 7.5 psi AT THE CENRIFUGE FEED FLANGE.
4. ALL VIBRATION PADS TO BE LEVEL WITHIN 1/32" [0.79 mm].
5. APPROXIMATE WEIGHT:
   TOTAL MACHINE EMPTY: 9,350 lbs [4,241 kg]
   BOWL EMPTY, SCROLL, PILLOW BLOCKS, GEARBOX: 4,083 lbs [1,852 kg]
   SCROLL+LIFTING BEAM 1,034 lbs [469 kg]
6. ALL DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN [ ].

PIPING CONNECTIONS

PORT	SIZE	DESCRIPTION
A	6" CLASS 150 FLANGE	CENTRATE DISCHARGE
B	1" FNPT	SLUDGE SAMPLE
C	1" FNPT	POLYMER CONNECTION
D	1" FNPT	WASHWATER CONNECTION
E	2" MALE QUICK CONNECT	WASHWATER FEED INLET
F	1" FNPT	POLYMER MAKE-UP INLET
G	2" FNPT	POLYMER WATER INLET

ESTIMATED WEIGHT IN LBS: –	DRAWN BY: MDW	DATE 8/9/19	ANDRITZ	TITLE D5L – E2 CENTRIFUGE OBG – PUYALLUP LEACHATE SKID LAYOUT
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE	ANDRITZ SEPARATION, INC. 1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001	SIZE D · DRAWING NUMBER 3177470–1 · REV 0
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: MW	DATE 8/9/19	PHONE: (817) 465–5611	SCALE 1/16 · FILE 3177470–1 · SHEET 1 OF 1
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION			
MILL FINISH ALL OVER				

ANDRITZ - MAINTENANCE / SPARE PARTS REQUIRED - DECANTER TYPE D5L or D5LX - GREASE LUBE

January 2020

CUSTOMER:

1 - MACHINE

OPERATING TIME	SERVICE REQUIREMENT	PARTS REQUIRED		PRICE DOLLARS	
AT 3,000 HRS	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
	Belt Tension		Parts Total	$	347.00
			Estimated Onsite Labor Hours		1 Technician x 8 hrs
AT 6,000 HRS	Replace Feed End Bearing	Bearing & Seals		$	462.00
	Belt Replacement	1 set of 5 belts		$	330.00
	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease & 1 Quart Oil		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
			Parts Total	$	1,139.00
			Estimated Onsite Labor Hours		1 Technician x 16 hrs
AT 9,000 HRS	Grease Scroll Bearings	2 grease cartridge SKF2			42.00
	Gearbox and Redex lubrication change	5 KG - Energrease			280.00
	Copper Seals	6 Copper Seals			25.00
	Belt Tension		Parts Total		347.00
			Estimated Onsite Labor Hours		1 Technician x 8 hrs
AT 12,000 HRS	Replace Drive and Feed High Speed Bearing	2 Bearings		$	780.00
	Replace Scroll Thrust Bearing	1 Bearing		$	175.00
	Grease for Bearing Replacement	7 grease cartridge SKF2 or NBU15 for LX		$	1,512.00
	Seals Set for 12K HRS Service	Complete Seals for service		$	1,022.00
	Replace Eccentric Bearing in Gear Box	1 Eccentric Bearing		$	2,676.00
	Replace Bowl Nozzles	8 Nozzles		$	5,082.00
	Repalce Scroll Nozzles	4 Nozzles		$	3,504.00
	Gearbox and Redex lubrication change	5 KG - Energrease & 1 Quart Oil		$	280.00
	Copper Seals	6 Copper Seals		$	15.00
	Belt Replacement	1 set of 5 belts		$	330.00
			Parts Total	$	15,376.00
			Estimated Onsite Labor Hours		2 Technicians x 32 hrs
AT 15,000 HRS	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
	Belt Tension		Parts Total	$	347.00
			Estimated Onsite Labor Hours		1 Technician x 8 hrs

AT 18,000 HRS	Replace Feed End Bearing	Bearing & Seals		$	462.00
	Belt Replacement	1 set of 5 belts		$	330.00
	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease & 1 Quart Oil		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
			Parts Total	$	1,139.00
			Estimated Onsite Labor Hours		1 Technician x 16 hrs
AT 21,000 HRS	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
	Belt Tension		Parts Total	$	347.00
			Estimated Onsite Labor Hours		1 Technician x 8 hrs
AT 24,000 HRS	Replace Drive and Feed High Speed Bearing	2 Bearings		$	780.00
	Replace Scroll Thrust Bearing	1 Bearing		$	175.00
	Gease for Bearing Replacement	7 grease cartridge SKF2 or NBU15 for LX		$	1,512.00
	Seals Set for 12K HRS Service	Complete Seals for service		$	1,022.00
	Replace All Internal Parts in Gear Box	1 Set Internal Parts		$	15,856.00
	Replace Bowl Nozzles	8 Nozzles		$	5,082.00
	Repalce Scroll Nozzles	4 Nozzles		$	3,504.00
	Gearbox and Redex lubrication change	5 KG - Energrease & 1 Quart Oil		$	280.00
	Copper Seals	6 Copper Seals		$	42.00
	Belt Replacement	1 set of 5 belts		$	330.00
			Parts Total	$	28,583.00
			Estimated Onsite Labor Hours		2 Technicians x 40 hrs
AT 27,000 HRS	Grease Scroll Bearings	2 grease cartridge SKF2		$	42.00
	Gearbox and Redex lubrication change	5 KG - Energrease		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
	Belt Tension		Parts Total	$	347.00
			Estimated Onsite Labor Hours		1 Technician x 8 hrs
AT 30,000 HRS	Replace Feed End Bearing	Bearing & Seals		$	462.00
	Belt Replacement	1 set of 5 belts		$	330.00
	Grease Scroll Bearings	2 grease cartridge SKF2		$	24.00
	Gearbox and Redex lubrication change	5 KG - Energrease & 1 Quart Oil		$	280.00
	Copper Seals	6 Copper Seals		$	25.00
			Parts Total	$	1,121.00
			Estimated Onsite Labor Hours		1 Technician x 16hrs

CENTRIFUGE REFERENCES – WASTEWATER SLUDGE DEWATERING

Washington / Oregon / Idaho

LOCATION OF INSTALLATION	MODEL	TYPE OF SLUDGE	YEAR INSTALLED
Meridian WWTP City of Meridian, ID	3 x D5L	Anaerobically Digested	2013
Kamilche WRP Lake Oswego, OR	1 x D2L	WAS from MBR	2008
Tri-City WPCP Oregon City, OR	1 x D5LX	Anaerobically Digested	2011
Pierce County WWTP University Place, WA	2 x D5LL	Anaerobically Digested	2004
Sunnyside WWTP Lake Stevens, WA	2 x D5LL	Anaerobically Digested	2009
Sumner WWTP Sumner, WA	1 x D4L	Anaerobically Digested	2004
Shelton WWTP Shelton, WA	2 x D4LL	Aerobically Digested	2010
King County - Renton WWTP Renton, WA	3 x D7LL	Anaerobically Digested	2004
King County - Brightwater WWTP Woodinville, WA	2 x D6LL	Anaerobically Digested	2009
LOTT Clean Water Alliance Olympia, WA	2 x D6LX	Anaerobically Digested	2017
Snoqualmie WWTP Snoqualmie, WA	1 x D4L	Aerobically Digested WAS	2018
Lincoln City WWTP Lincoln City, OR	1 x D4L	Aerobically Digested	2019
Willow Lake WPCF Salem, OR	2 x D5LX	Anaerobically Digested	2020
Sumner WWTP Sumner, WA	1 x D5L	Anaerobically Digested	2020

ANDRITZ SEPARATION INC.
1010 Commercial Blvd. S.
Arlington, Texas 76001
Tel. (817) 465-5611
Fax (817) 468-3961
separation.us@andritz.com

Attachment B: Centrisys Proposal

TO: Benjamin Bossé, P.E.
Kennedy Jenks
240 Country Club Road, Suite A
Eugene, OR 97401
Direct: (541) 844-7802 | Mobile: (541) 321
Email: BenjaminBosse@KennedyJenks.com

DATE: 7/28/2022
REF.: Dewatering Centrifuge

Budget Proposal
NewPort, OR Dewatering
CS18-4 2PH

Centrisys Contact
Jerod Swanson
Regional Sales Manager
Frisco, CO 80443
Direct: (612) 401-2006
Email: Jerod.swanson@centrisys.us

Centrisys Representative
Chris McCalib
Treatment Equipment Company
249 Main Ave. S Ste. 107 #322
North Bend, WA 98045
Direct: (206) 909-1546
Email: chris@tec-nw.com

Disclaimer: Please note that this is a very preliminary budget proposal .Centrisys would require basis of design, existing facility information and any lab or pilot testing data to confirm the sizing before moving forward with the design stage.

Centrisys is pleased to provide this budget quotation for the following:

ITEM 1 TWO (2) DECANTER CENTRIFUGE UNIT COMPLETE WITH AUTOMATIC HYDRAULIC BACKDRIVE

1.A Centrifuge Specification

No. of units:	2
Model:	CS18-4 2PH
Inside bowl diameter (in):	18
Bowl length (in):	70
Bowl length to diameter ratio:	4.0:1
Beach angle (deg):	15
Maximum Bowl speed (RPM):	3400
Type of lubrication:	Automatic Grease
Main Motor HP:	40
Back Drive Motor HP:	10
*Max. Hydraulic Loading (gpm)	100
*Max. Solids Loading (lb/hr)	1485

*Maximum loading rates for standard municipal sludges. Does not apply to all applications. Optimal performance does not occur at maximum loading levels.

1.B. Scope of supply

1. Each unit will be provided based on the attached drawing
   (i) Duplex SS Solid bowl
   (ii) Scroll conveyor with Duplex SS Scroll shaft; 304SS flights
   (iii) 304 SS lower and upper casing
   (iv) Solid and liquid flexible connectors
   (v) Dewatered Sludge and Centrate Chutes/Hoppers
   (vi) Powder coated carbon steel base/frame
   (vii) Vibration isolators
   (viii) Spare parts/tools
   (ix) Control Panel (water cooled)
      A. 304SS NEMA 4X Enclosure for each centrifuge
      B. Main circuit breaker
      C. VFD for main drive motor
      D. Allen Bradley PLC (compact logix), valve amplifier and motor starter for automatic hydraulic back drive system
      E. Ethernet communication and historical trending of key parameters
      F. 10” Allen-Bradley panel view touch screen
   (x) Instrumentation
      A. One (1) vibration sensor per unit
      B. One (1) main bearing temp sensor, type PT100 on each bearing
      C. One (1) each Bowl/Scroll speed sensor/unit
      D. One (1) Hydraulic oil level/temp, hydraulic pressure sensor/unit
   (xi) Automatic Grease Lubrication System
      A. One (1) low grease level sensor per unit
   (xii) One (1) trip and 5 days of startup assistance

Budget Price:

All the above for... **$ 735,200.00**

F.O.B. Job Site, freight included, Taxes Excluded

Optional Ancillary Equipment per unit:

Feed Pump	Adder	$	12,997
Polymer System	Adder	$	18,620
Diverter Gate	Adder	$	14,112
Flowmeter	Adder	$	6,272
4 ft. Stand	Adder	$	11,760
4 ft. Stand, Walkway,ladder	Adder	$	18,620
Conveyor (16 ft.)	Adder	$	31,780

PAYMENT TERMS:

30% with order; 60% upon shipment; 10% after startup not to exceed 90 days after shipment.

Lead Time: 20-22 weeks following receipt of the Approved drawings

BUYER/OWNER RESPONSIBILITY (UNLESS INCLUDED AS ADDER):

- Stand
- Feed pump
- Polymer system
- Flow meter
- Cake conveyor
- Anchor bolts.
- Building and building plans (Centrisys provides only the layout drawings without any responsibility of updating any plans or building)
- Building modifications
- Structural and Civil engineering labor
- Lubricants
- All utilities that are required for operation
- Unloading, uncrating, installation and installation supervision. Installation will, at minimum, require a forklift and possibly a crane/hoist.
- Readiness of the Equipment before requesting start-up service. Non-readiness may incur additional charges.
- Compatibility of Equipment materials of construction with process environment.
- Piping connections, platforms, gratings and railings unless stated otherwise.
  Any other auxiliary equipment or service not detailed above.

NUMBER: 12526 **DATE:** 8.29.22

TO: Benjamin Bossé, P.E.
Kennedy Jenks
240 Country Club Road, Suite A
Eugene, OR 97401
Direct: (541) 844-7802
Mobile: (541) 321-3355
Email: BenjaminBosse@KennedyJenks.com

Budget Proposal
Newport, Oregon Dewatering
CS21-4HC 2PH

Centrisys Contact
Jerod Swanson
Regional Sales Manager
9586 58th place
Kenosha, WI 53144
Ph: (262) 654-6006
Direct: (612) 401-2006
Email: Jerod.swanson@centrisys.us

Centrisys Representative
Chris McCalib
Treatment Equipment Company
249 Main Ave S, Ste 107 #322
North Bend, WA 98045
Direct: (206)909-1546
Email: chris@tec-nw.com

Centrisys is pleased to provide this budget quotation for the following:

ITEM 1. TWO (2) DECANTER CENTRIFUGE UNITS, MODEL CS21-4HC 2PH COMPLETE WITH AUTOMATIC HYDRAULIC BACKDRIVE

1.A Basis of Design – Sludge Feed Characteristics

Industry Type:	Municipal Wastewater
Application:	Aerobic Sludge
Number of units:	Two (one duty, one standby)
Design Feed Flow rate/Unit:	172 gpm (excluding polymer flow)
Hydraulic throughput/Unit:	225 gpm
Dry Solids loading:	585.3 lbs/hr
Feed Concentration:	0.68%
Operation time:	64 hrs/week

1.B Anticipated Performance*

Solids capture rate/recovery:	≥95%
Cake dryness:	20-22%
Max Polymer consumption:	19-22 lbs/Dry Ton

*- Lab sample testing is recommended to confirm

1.C Centrifuge specification

Model:	CS21-4 HC 2PH
Inside bowl diameter (in):	22
Bowl length (in):	100
Bowl length to diameter ratio:	4.3:1
Beach angle (deg):	15
Maximum Bowl speed (RPM):	3150
Type of lubrication:	Grease
Main Motor HP:	75
Back Drive Motor HP:	15

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1.D Scope of supply

1. Each unit will be provided based on the attached drawing CS21-4HC 2P Centrifuge GA.pdf
   - (i) Centrifugally Casted Duplex SS Solid bowl
   - (ii) Scroll conveyor with Duplex SS Scroll shaft; 316SS flights
   - (iii) 316SS lower and upper casing
   - (iv) Solid and liquid flexible connectors
   - (v) Dewatered Sludge and Centrate Chutes/Hoppers
   - (vi) Powder coated carbon steel base/frame
   - (vii) Vibration isolators
   - (viii) Spare parts/tools
   - (ix) Control Panel (water cooled)
     - A. 304SS NEMA 4X Enclosure for each centrifuge
     - B. Main circuit breaker
     - C. VFD for main drive motor
     - D. Allen Bradley PLC (compact logix), valve amplifier and motor starter for automatic hydraulic back drive system
     - E. Ethernet communication and historical trending of key parameters
     - F. 10” Allen-Bradley panel view touch screen
   - (x) Instrumentation
     - A. One (1) vibration sensor per unit
     - B. One (1) main bearing temperature sensor, type PT100 on each bearing
     - C. One (1) each Bowl/Scroll speed sensor/unit
     - D. One (1) Hydraulic oil level/temp, hydraulic pressure sensor/unit
   - *(xi)* Automatic Grease Lubrication System
     - A. One (1) low grease level sensor per unit
   - (xii) Two (2) trips and 10 days or 80 hours (whichever occurs first) of startup assistance

1.E Optional Adders

- (i) One (1) 16 foot u-trough conveyor, 9”diameter, approx. 25° incline. Includes motor

- (ii) One (1) 11 foot u-trough conveyor, 9”diameter, approx. 25° incline. Includes motor

- (iii) Power run through equipped on two (2) units.
  - A. This feature allows the centrifuge to create its own power during power loss to allow self-cleaning without plant power input. Also, allows the machine to return to operating speed immediately upon power restore.

- (iv) Remote monitoring equipped on two (2) units.
  - A. This feature is to keep track of the operational and alarm status using plant computer. Also provides real-time text and/or email alerts for any significant system status changes on 32 key operating parameters.

- (v) Two (2) HPU Containment Pans, stainless steel construction.

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BUDGET PRICE:

All of the above for .... $**948,600** USD

OPTIONAL PRICE ADDERS – NOT INCLUDED IN BASE SCOPE OF SUPPLY

One (1) 16 foot u-trough conveyor, 9” diameter	$**38,300** USD
One (1) 11 foot u-trough conveyor, 9” diameter	$**28,200** USD
Two (2) Power run-through features equipped	$**14,200** USD
Two (2) Remote monitoring feature equipped	$**16,900** USD
Two (2) HPU oil containment pans	$**5,800** USD

F.O.B. Job Site, freight included, taxes excluded.

PAYMENT TERMS:

30% with order; 60% upon shipment; 10% after startup not to exceed 90 days after shipment.

Lead Time: 40-45 weeks following receipt of the Approval drawings

Warranty

Five (5) Year Mechanical Warranty

So long as the decanter centrifuge is used for the applications it was designed for and operated, serviced, and maintained per documented Centrisys guidelines, Centrisys shall warrant mechanical centrifuge equipment (centrifuge frame housing and structural rotor components) to be free of manufacturing defects in material and workmanship for a period of five (5) years. Consumables, wear repairs, preventative service from normal use, and provided ancillary equipment is not covered in this extended warranty

Fifteen (15) Year Bowl Warranty

Centrisys provides a fifteen (15) year warranty on the bowl center section, conical, and headwalls. This warranty will be in place as long as the customer has documented inspection and service compliance every 15,000 hours of operation and service is conducted per the supplied O&M manual.

Costs provided with Centrisys quote dated 8/2/2022:

Polymer System	Adder	$	21,756
4 ft. Stand	Adder	$	21,560

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BUYER/OWNER RESPONSIBILITY:

- Stand
- Feed pump
- Polymer system
- Flow meter
- Cake conveyor (adder)
- Anchor bolts.
- Building and building plans (Centrisys provides only the layout drawings without any responsibility of updating any plans or building)
- Building modifications
- Structural and Civil engineering labor
- Lubricants
- All utilities that are required for operation
- Unloading, uncrating, installation and installation supervision. Installation will, at minimum, require a forklift and possibly a crane/hoist.
- Readiness of the Equipment before requesting start-up service. Non-readiness may incur additional charges.
- Compatibility of Equipment materials of construction with process environment.
- Piping connections, platforms, gratings and railings unless stated otherwise.
- Any other auxiliary equipment or service not detailed above.

Issued by

Ethan Banks
Applications Engineer

Date:8.29.22

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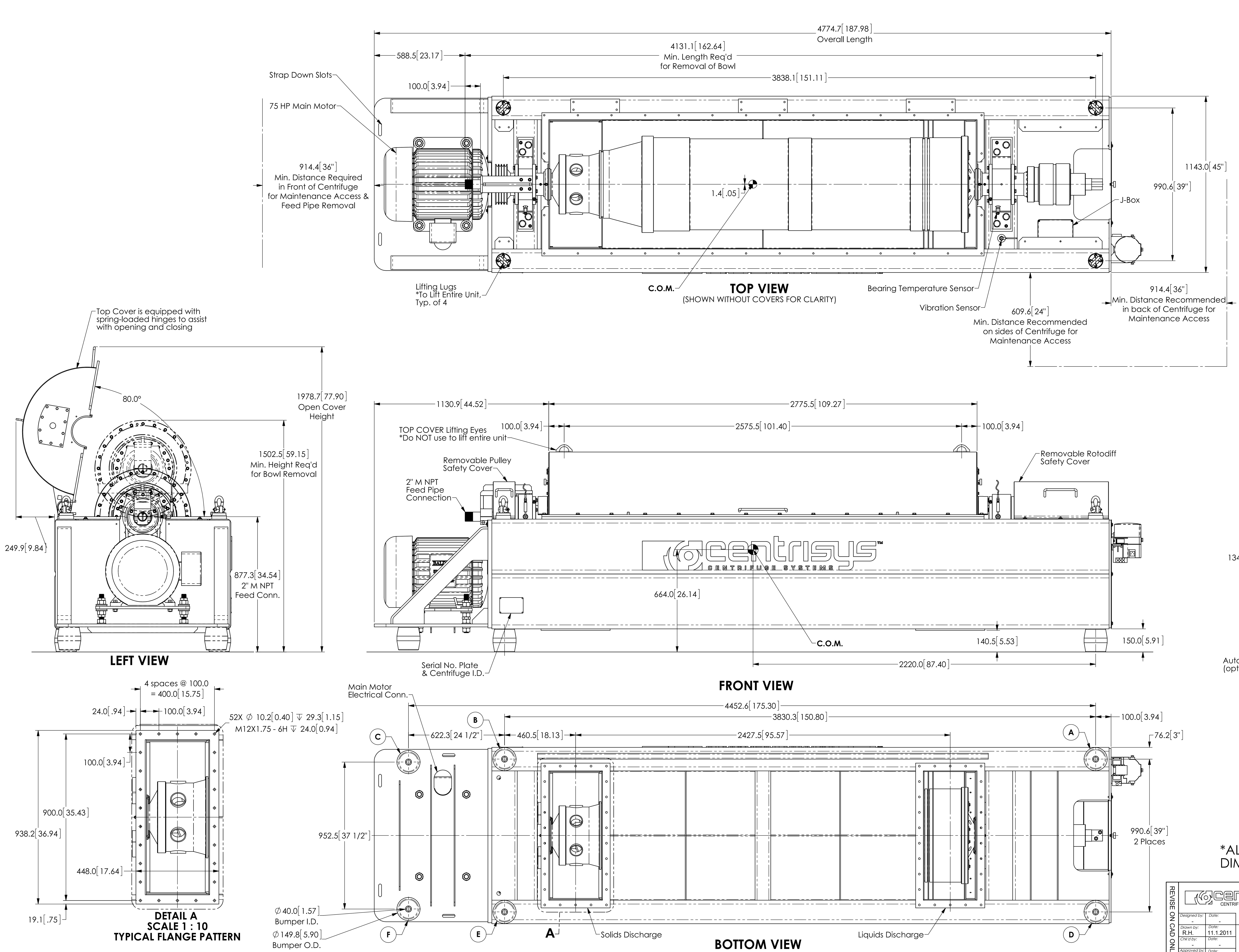
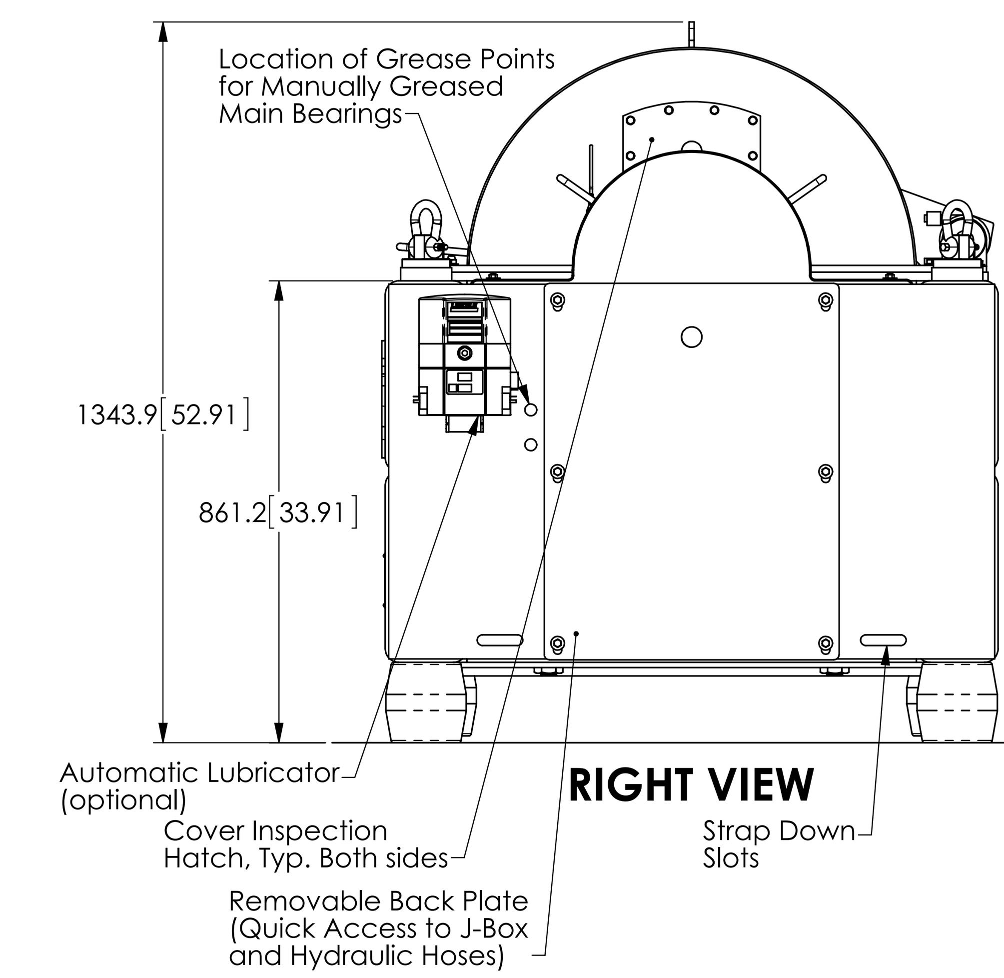


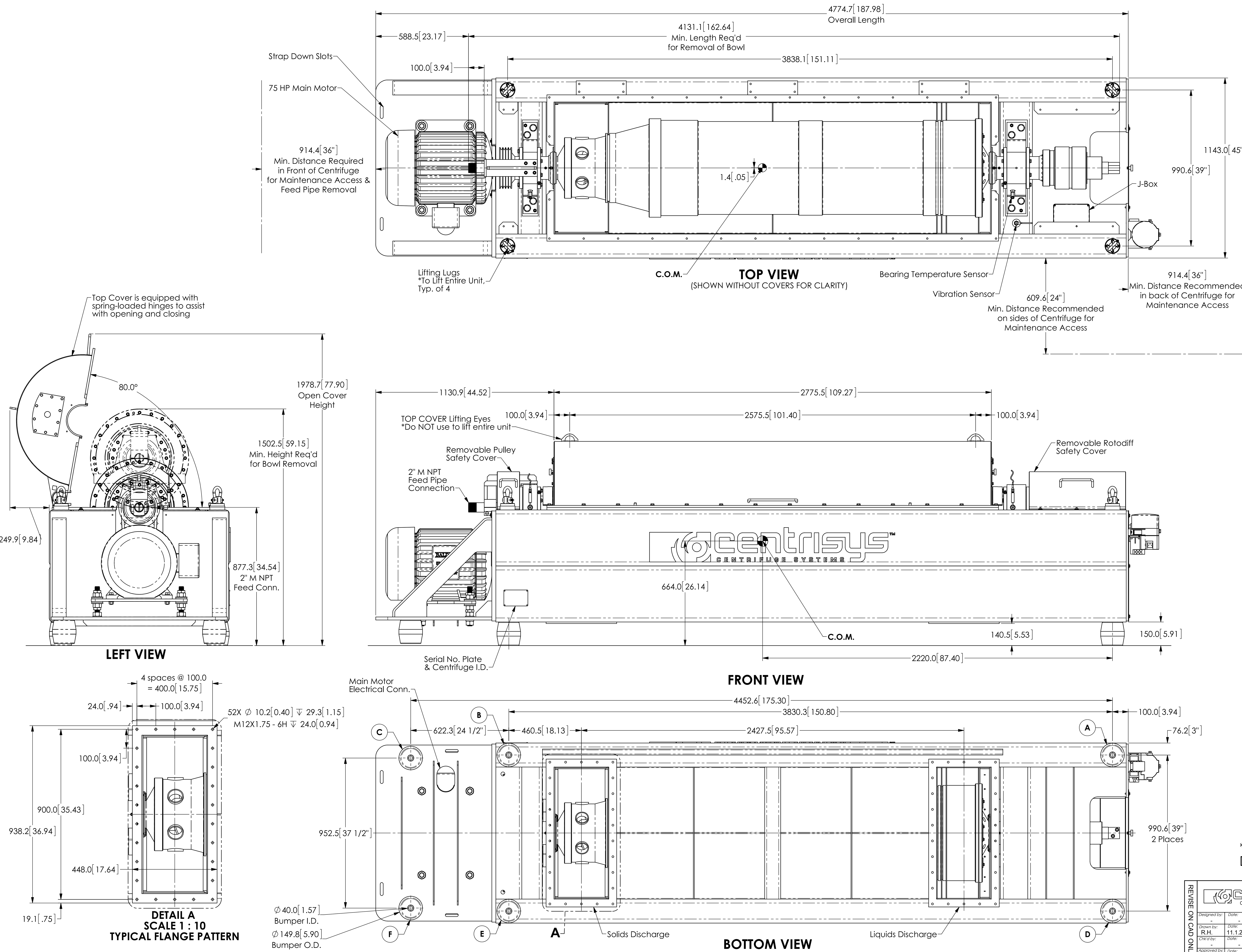
Weights:	lbs. [kg]
Rotating Assembly	3700 [1678.3]
Bowl filling with SP 1.0	785 [356.0]
Complete Centrifuge (w/o filling)	10000 [4536.0]
Static loads below each corner of complete centrifuge:	lbs. [kg]
A	2132.6 [967.4]
B	2230.9 [1011.9]
C	625.0 [283.5]
D	2132.6 [967.4]
E	2230.9 [1011.9]
F	625.0 [283.5]
Dynamic loads below each corner of complete centrifuge:	lbs. [kg]
A	2365.1 [1072.8]
B	2385.0 [1081.8]
C	630.0 [285.8]
D	2365.1 [1072.8]
E	2385.0 [1081.8]
F	630.0 [285.8]
Dynamic loads below each corner of complete centrifuge w/o filling @ start-up during critical:	lbs. [kg]
A	2665.8 [1209.2]
B	2788.6 [1264.9]
C	781.3 [354.4]
D	2665.8 [1209.2]
E	2788.6 [1264.9]
F	781.3 [354.4]

*All Horizontal loads are approximately 5% of vertical loads.



*ALL DIMENSIONS ARE IN MILLIMETERS.
DIMENSIONS IN [ ] BRACKETS ARE IN INCHES.

REVISE ON CAD ONLY	CENTRISYS CENTRIFUGE SYSTEMS	9586 58th Place Kenosha, WI 53144 Tel: (262) 654-6006 Fax: (262) 764-8705			THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF CENTRISYS.
	Designed by: -	Date: -			Title: Cs21-4HC 2-Phase Centrifuge General Arrangement
	Drawn by: R.H.	Date: 11.1.2011	GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply	3rd Angle Projection	Project:
	Chk'd by: -	Date: -		Material(s): See BOM	Part #: 21300 / Drawing #: M-D21300
	Approved by: -	Date: -		Estimated weight (lbs): ~10,000	Sht: 1 OF 1 / Scale: 1:12 / REV



Weights:	lbs. [kg]
Rotating Assembly	3700 [1678.3]
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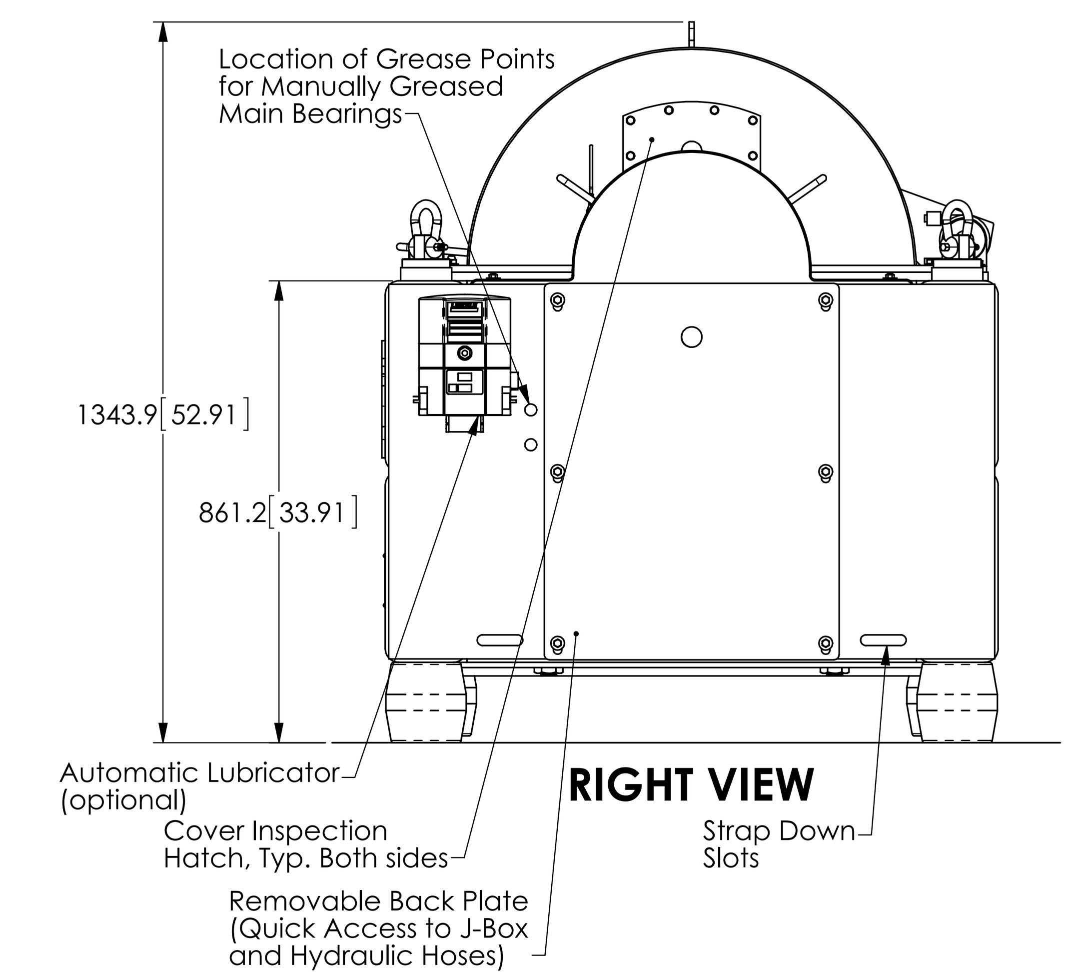

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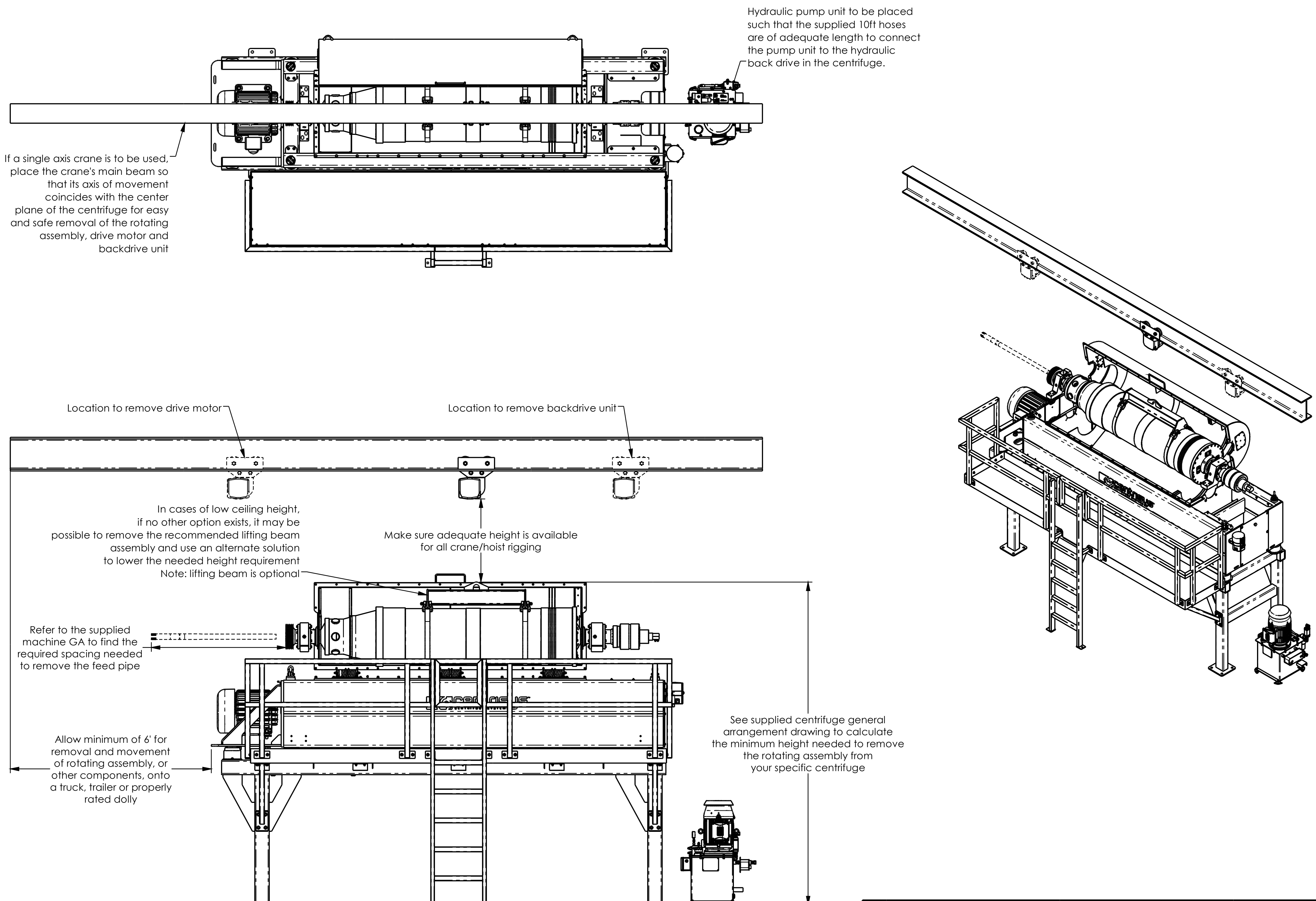
REVISE ON CAD ONLY

centrisys CENTRIFUGE SYSTEMS
9586 58th Place
Kenosha, WI 53144
Tel: (262) 654-6006
Fax: (262) 764-8705

Title: Cs21-4HC 2-Phase Centrifuge General Arrangement
Project:

Designed by:	Date:					
Drawn by: R.H.	Date: 11.1.2011	GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply	3rd Angle Projection	Material(s): See BOM	Part #: 21300	Drawing #: M-D21300
Chk'd by: -	Date: -			Estimated weight (lbs): ~10,000	Sht: 1 OF 1	Scale: 1:12
Approved by: -	Date: -					REV



REVISE ON CAD ONLY

centrisys CENTRIFUGE SYSTEMS

9586 58th Place
Kenosha, WI 53144
Tel: (262) 654-6006
Fax: (262) 764-8705

Designed by: -	Date: -	
Drawn by: DMIKULSKI	Date: -	GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply
Chk'd by: -	Date: -	3rd Angle Projection
Approved by: -	Date: -	Material(s): See BOM
		Estimated weight (lbs): 7990

Title: Recommended general crane or hoist layout and positioning

Project:

Sheet Size: C	Drawing #: GA30681
Sht: 1 OF 1	Scale: 1:30 / REV

The Centrisys-Viscotherm Scroll Drive is the **Most Efficient** in the Centrifuge Industry

Benefits of the Centrisys Hydraulics

Our hydraulic scroll drive is powerful and precise, achieving the highest torque-to-weight ratio with the best process control. By using hydraulics we eliminate the gearbox, and as a result simplify the design, radically reducing the number of moving parts and wear components. The Centrisys scroll drive delivers unmatched reliability with lower operating costs— a direct benefit to our customers.

1 Hydraulics is a Trusted Technology: Whether we realize it or not, hydraulics is a part of our daily lives. It is a reliable and precise technology that delivers maximum power using the smallest footprint. Hydraulic components are a fundamental part of the steering and braking system in every car manufactured today. Hydraulics are used in nearly all forms of daily travel: planes, trains, boats and cars. It is commonly used in manufacturing facilities from heavy lifting to material handling.

2 Hydraulics is a Versatile Application: It is used in industrial, military and transportation applications where there is no room for error, and where work is dangerous, dirty or unforgiving. Examples include jet airliners, railways, ships, nuclear submarines, elevators, construction equipment, mining, drilling, and more. This technology is so versatile that it can be used in widely differing environmental conditions – from the most sterile to the dirtiest.

3 Hydraulic Scroll Drive Increases Capacity: Precise speed control and the highest torque capabilities allow for increased through-put capacities.

4 Hydraulic Scroll Drive Maximizes Recovered Energy: The Centrisys CERS (Centrifuge Energy Recovery System) concept is equivalent to technology used in today's hybrid automobiles, high-performance race cars, and the aerospace industry. The Centrisys system captures energy from the rotating bowl. This recovered energy powers the hydraulic scroll drive at shutdown or power failure, allowing for seamless backup continued operation with controlled scroll speed. Since the scroll continues to unload solids from the bowl, it prevents costly dismantling to free up a blocked centrifuge.

5 Our Hydraulic Technology Offers the Highest Energy Efficiency: Hydraulic technology operates independently from the main drive. Gearbox machines generally rely on the main drive; using solids removal mechanisms that apply braking (additional drag) to the bowl and maindrive. (Think of driving a car with the parking brake on.) Unnecessary braking with gearbox technology results in the need for larger main drive motors. Commonly, a centrifuge requires a main drive motor that is 50% larger in comparison to a centrifuge with our hydraulic scroll drive system to accomplish the same job. For every one horsepower needed to move solids out of the machine, one horsepower must be added to the main drive to overcome this braking action. The Centrisys scroll drive uses only the energy needed to drive the scroll; it is independent of the main drive, therefore no energy from the main drive is wasted.

Centrisys-Viscotherm Hydraulic Scroll Drive Based on ROTODIFF Technology **Outperforms** Our Competitors' Gearbox Drive

	Centrisys-Viscotherm Hydraulic Scroll Drive	Competitors' Gearbox Drive	Centrisys Hydraulic Advantage
1	Highest torque-to-weight ratio; allows for proper balance to handle solids and hydraulic flow capacity	Lower torque-to-weight ratio; limits loading of solids, requiring larger or multiple machines	Powerful and Efficient Operation
2	Simple, compact, lightweight design	Complex, heavy design	Lower Maintenance
3	No gears, uses only slow-moving parts; creates less friction	Multiple gears and moving parts at higher speeds; creates more friction and higher power consumption	Long-term Reliability
4	Robust and reliable; process control with direct torque reading. The direct measurement of scroll torque and speed allows immediate response to process changes	Complicated calculations of different speeds through multiple gear reductions/ increases error/ dramatically slows response to process changes	Lower Maintenance, Energy Efficient
5	Simple and accurate measurement of scroll speed; provides precise control of differential with unlimited bowl speed options *Differential = speed of ROTODIFF*	Complicated, indirect measurement of scroll speed; calculated from bowl and pinion speed, gearbox ratio and control error *Differential = (bowl speed – pinion speed) / gearbox ratio*	Precise Measurement and Control
6	One set of V-belts	Multiple sets and types of belts	Precise Measurement and Control Lower Maintenance Cost
7	Lower overhung weight reduces load on main bearings; reduces machine vibration; *Less weight means less horsepower needed to operate*	Heavy overhung gear increases load and heat on main bearings, causing reduced bearing life *More weight means more horsepower needed to operate*	Lower Maintenance
8	Versatile design for multiple applications	Limited design requires different units for each application	Lower Maintenance, Energy Efficient, Versatile
9	Low energy consumption; power is not lost or wasted. Scroll drive operates independently from the main drive motor	Increased energy cost; gearbox design steals energy from the main drive.	Versatile, Energy Efficient, Lower Operating Cost
10	State-of-the-art technology CERS (Centrifuge Energy Recovery System) allows the hydraulic scroll drive to recover energy at shut down	All energy is lost at shut-down; no power recovered	Energy Efficient
11	100% torque at all speeds, including standstill	Limited torque at maximum differential speed and standstill	More Powerful at All Speeds
12	Full range of differential speeds at all bowl speeds, including zero RPM, startup, shutdown and standstill	Limited range of differential speeds at lower bowl speeds and standstill	More Powerful at All Speeds
13	Low maintenance; continuous cleaning and cooling in a closed, 100% filtered system (filtered to 10 microns)	Unfiltered, uncooled closed system; retains all wear debris possibly shortening the gearbox life	Lower Maintenance, More Reliable
14	Pressure relief valves prevent high shock load, protecting the hydraulic system AND centrifuge; system does not transfer impact force to the shafting	Claims to have high shock load capability, but repeated high shock loads will damage and destroy in-line components and cause premature failure	Lower Maintenance, More Reliable
15	Standard on a Centrisys centrifuge	Standard on competitors' machines; if higher torque is required, hydraulic technology is offered as an upgrade	Lower Cost, Energy Efficient
16	No drag or parasitic loss on the main drive; uses only the energy required to convey solids	Robs energy from main drive; torque adds braking horsepower; increases drag on main drive motor	Efficient Operation
17	Capacity to run leading or lagging (optimized performance)	Limited to a one-direction process	Lower Maintenance, More Powerful and Efficient
18	No overheating of the hydraulic motor due to automatic, continuous heat dissipation through the oil conditioning system	External cooling often required; overheating is a common problem	Lower Maintenance, Longer Life

The **Truth** About Hydraulic Scroll Drives

The Centrisys-Viscotherm hydraulic scroll drive system with ROTODIFF technology is the best in the industry. Check the facts below to clear up any misconceptions about our system.

Misconception: Hydraulic drives are not efficient.
Fact: With ROTODIFF technology our hydraulic system is the most capable in the industry. Fewer (slow-moving) parts create less friction, and energy loss is minimized. Precise control of the scroll at any speed increases centrifuge capabilities and efficiency, even when loading conditions fluctuate. Hydraulics do not put a drag or load on the main motor and use only the power needed to turn the scroll.

Misconception: A hydraulic system is not effective in messy, dirty or hazardous environments.
Fact: Hydraulic technology is commonly used in rugged environments with high levels of shock, vibration, dust, water, corrosive chemicals and other potential hazards. Industries using hydraulic technology include construction, agriculture, marine, military, mining, paper production, drilling and tunneling. Hydraulic systems are used in mines, chemical plants, near explosives and in paint applications, because they are inherently spark-free and can tolerate high temperatures. Hydraulics have the strength and reliability for jobs requiring the best, most durable heavy equipment.

Misconception: Hydraulic systems are noisy.
Fact: Our hydraulic scroll drive is quieter than a gearbox. It has been shown to reduce ambient noise by 15 dB over the older electric scroll drives.

Misconception: Hydraulic systems are messy and leak.
Fact: Because fluids are enclosed in a contained system, there is virtually no leakage in modern hydraulics. Advanced sealing techniques and materials and state-of-the-art electronics are so efficient that today's manufacturers can raise the operating pressures of their pumps. It is not unusual to find hydraulic systems operating without leakage at pressures 2,000-3,000 psi higher than just a few years ago.

Misconception: A hydraulic drive is difficult to repair, requiring specialized technicians with hydraulic experience.
Fact: With fewer slow-moving parts and a less complicated design, hydraulic drives are easier to repair than a standard gearbox. Maintenance technicians with the skills to fix gearbox drives are more than capable of repair and maintenance with hydraulics.

Misconception: Hydraulic systems are more maintenance-intense than a typical gearbox.
Fact: On average, hydraulics need only simple oil and filter preventive maintenance, just like a car.

Misconception: Parts for the hydraulic drive are difficult to source.
Fact: Centrisys has distribution centers across the United States and around the world for all hydraulic components. In fact, many parts can be shipped express overnight delivery.

Misconception: Hydraulic technology is old and abandoned by other centrifuge manufacturers.
Fact: Hydraulic technology remains a dominant system in modern industrial manufacturing. No other system is as efficient and effective in transferring energy through small tubes or hoses and other hard-to-reach parts. Hydraulic innovation is progressing at an astonishing rate – so quickly that some experts cite more progress in the last ten years than in the 50 preceding years combined. Competitive centrifuge suppliers have not abandoned a hydraulic scroll drive, since most will offer it as an upgrade to the gearbox.

The Choice is Clear

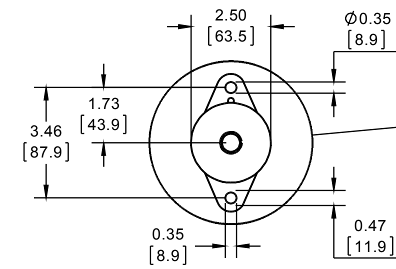
When you compare the Centrisys hydraulic scroll drive to a gearbox drive, the better choice is the Centrisys system. Centrisys is the only USA repair facility (besides Viscotherm affiliates) authorized by Viscotherm AG to repair, service, and perform warranty work on Viscotherm hydraulic components in North America. Contact Centrisys for more information on products, hydraulic scroll drive, service, parts or any other questions

9586 58th Place | Kenosha, WI 53144 USA | +1 (262) 654-6006 | info@centrisys-cnp.com
North America | South America | Europe | Middle East | China

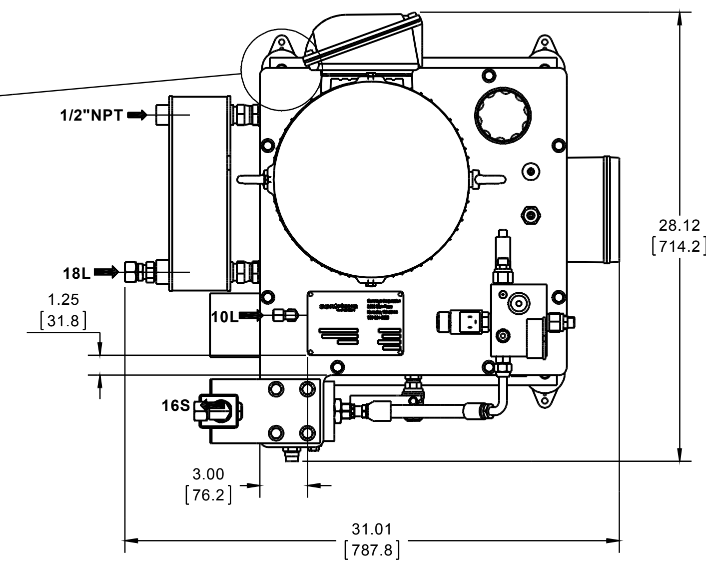
ISO 9001:2015

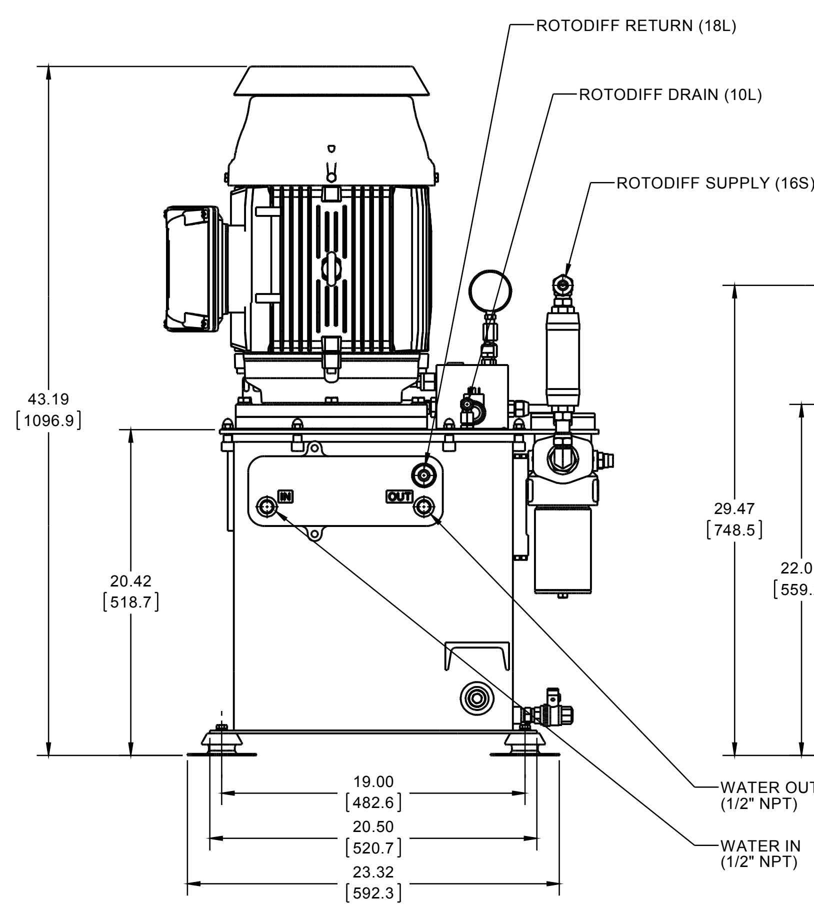
CENTRISYS MODEL # CS11-22-Z-TW-21 / PART # G1700103-HPU

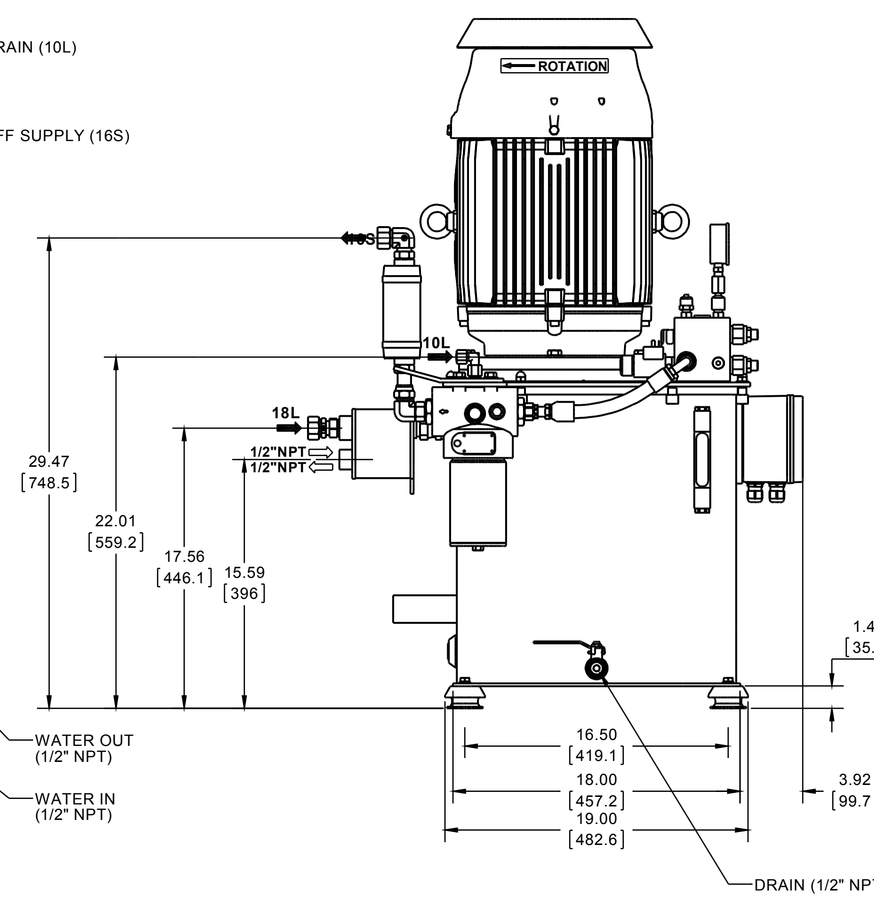
Tank:	Capacity:	20 gal [76 l]
	Medium:	ISO VG 68 anti-wear hydraulic oil
	Weight (dry):	450 lb [204 kg]
	Weight (filled):	625 lb [284 kg]
Electric Motor:	Size:	15 HP [11 kW]
	Frame:	NEMA 254TC with drip cover
	Manufacturer:	WEG 01518ET3ER254TC-W22-T-STAT
	Elec. Protection:	IP55
	Voltage:	230/460VAC / 3PH / 60HZ
	Thermostats	1 per phase @ 155°C
	Full Load Amps:	36 / 18
	RPM:	1765
Pump:	Type:	External Gear
	Displacement:	0.86 ci/rev [14.1 cc/rev]
	Max Flow:	5.8 gpm [22 lpm] @ 4000 psi [276 bar]
Regulation:	Analog:	Pressure and flow
Oil-Water Heat Exchanger:	Type:	Brazed Plate
	Water requirement:	80 gph [303 lph] min. flow / 68° F [20° C] max. temp
	Water connections:	1/2" NPT female
Control Block:	Type:	CS3 / CS5.5 / CS7.5 / CS11
		Proportional throttle valve
		Pressure transducer 4-20mA
		3-way bypass valve
		Pressure gauge w/ shut-off 0-5000 psi [0-350 bar]
		Safety relief valve 4300 psi [296 bar]
		Needle valve (base speed valve)
Level/Temp Switch:	Level switching contact opens 3.13 in [80 mm] under max. level	
	Temp switching contact opens 158° F [70° C] high temp	
Flow Meter:	Type:	Visual 0.5-5 gpm [2-19 lpm]
Oil Level Indicator:	Type:	Visual sight glass 20 gal [76 l] to top of sight glass
Hydraulic Connections:	Pressure:	EO bite type (16S)
	Return:	EO bite type (18L)
	Drain:	EO bite type (10L)
Power Unit Mounting	Type:	2-bolt captive vibration isolators (qty 4)
Finish Protection:	Type:	Sherwin Williams polyester powder coat
		ANSI 70 Gray (PAS8-C0003)
Hoses:	Pressure hose 1/2" ID, 4000 psi [276 bar], 16S female swivel x 16S female swivel x 120 in [3050 mm]	
	Return hose 5/8" ID, 3000 psi [207 bar], 18L female swivel x 18L female swivel x 120 in [3050 mm]	
Optional Accesories:	G1300075-WM1	Water modulating valve kit (includes bulb well)
	G1300075-MR20	Mounting rail kit
	G1300075-DB	Desecant breather kit
	G1300075-TS	Temp switch Kit (Air cooler)
	G1300075-FS	Electrical filter switch



VIBRATION ISOLATORS - 4 EACH
USE 8MM ANCHORS - 2 PER ISOLATOR
65MM MIN. EMBEDMENT







DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive
DJ	08/01/2017	Muskego, Wisconsin 53150

GRIMSTAD

CERTIFIED DRAWING

This is an as-built drawing. Manual revisions are prohibited. Revisions are noted on sheet 1.

Signed By: John Porter Date: 08/07/2017

REV	ECN	DATE	INITIALS	REVISION NOTES
0	N/A	08/01/2017	JP	INITIAL RELEASE

REVISE ON CAD ONLY

CENTRIFUGE SYSTEMS
9586 58TH PLACE
KENOSHA, WI 53144
TEL: (262) 654-6006
FAX: (262) 654-6063

Designed by: -	Date: -	
Drawn by: A.A.	Date: -	GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply
Chk'd by: -	Date: -	3rd Angle Projection
Approved by: -	Date: -	Material(s):
		Estimated weight (lbs):

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

Part #:	Drawing #: G1700103-HPU	
Sht: 1 OF 7	Scale: 1:6	0

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	RES00213-PCG	RESERVOIR, JM GRIMSTAD, 76L (20GAL) VERTICAL RESERVOIR
2	1	G1620-05-A-1	SIGHT LEVEL GAUGE, LDI, 5" W/THERMOMETER
3	1	RCP00065-PCG	RESERVOIR COVER, JM GRIMSTAD, ATHALON 76L (20GAL)
4	1	5201	FILLER BREATHER, LDI, 40uM
5	1	01518ET3ER254TC-W22-T-STAT	ELEC MOTOR, WEG, 11Kw (15HP), 1750RPM, 230-460VAC/3PH/60HZ, 254TC, W/DRIP COVER
6	1	GHP2A-D-20	GEAR PUMP, MARZOCCHI, 0.97CIPR (15.9CCPR), RHR, SAE-A, 3915PSI (270BAR) CONTINOUIS
7	1	032810-APA2	ADAPTER RING, JM GRIMSTAD, 184-256TC ADAPTER TO "D" STYLE MOTOR ADAPTER
8	1	3364	ADAPTER, LDI, 184-256TC MOTOR TO SAE-A PUMP, FACE-TO-FACE OF 5.44"
9	1	032810-01-GSK2	GASKET, JM GRIMSTAD, PUMP ADAPTER RING
10	1	032810-MPA2	MOTOR RING, JM GRIMSATD, 184-256TC "C" FLANGE TO "D" FLANGE STYLE MOUNT
11	1	BA020383071503	COUPLING HUB (PUMP), KTR, ROTEX 38 SERIES, 5/8" BORE X 5/32" KEYWAY
12	1	BA020383174100	COUPLING HUB (MOTOR), KTR, ROTEX 38 SERIES, 1-5/8" BORE X 3/8" KEYWAY
13	1	020381000042	COUPLING INSERT, KTR, ROTEX 38 SERIES, 98A DUROMETER, PURPLE
15	1	G1300075-MA3	MANIFOLD ASSEMBLY, JM GRIMSTAD, EXPLOSION PROOF
16	1	032810-01-GSK1	GASKET, JM GRIMSTAD, MANIFOLD
17	1	SS10RV3	SUCTION STRAINER, LDI, 100 MESH 1"NPT 13GPM 2.5 PSI BYPASS
18	1	10301-504-25	CHECK VALVE, VONBERG, 1/2"NPT MALE / 1/2" FEMALE, INLINE, 25 PSI CRACKING
19	1	UH210A1604ZGH	FILTER HOUSING, PALL, 16SAE PORTS, 65PSI BYPASS, FOR 4" ATHALON ELEMENT
20	1	UE210AS04Z	FILTER ELEMENT, PALL, 12uM, VITON
21	1	RCA219DZ091Z	DIFFERENTIAL INDICATOR, PALL, VISUAL, 50 PSI
22	1	H600A-005	FLOW METER, HEDLAND, 0.5-5.0 GPM ,ALUMINUM, -10SAE PORTS, 3500 PSI
23	1	MB00161	MOUNTING PLATE, JM GRIMSTAD, HEADLAND FLOW METER, 304SS
24	1	569510036001	HEAT EXCHANGER, ITT, BRAZED PLATE, OIL-TO-WATER
26	1	G1300075-JBOX8	ELECTRICAL JUNCTION BOX ASSEMBLY, JM GRIMSTAD
27	1	5406-HHP-12	FITTING, AIR-WAY, 3/4"NPT HOLLOW HEAD PLUG
28	1	171N-12-NPT	BALL VALVE, PCI, BRASS, 1/2"NPT, 600 PSI
29	1	NT EL-K40T700-210-M20X1.5	TEMP/LEVEL SWITCH, BUHLER, 160MM MIN HEIGHT, 70C NC SWITCHES
30	1	CENTRISYS-ENGRAVED-NAMEPLATE	NAMEPLATE, CENTRISYS, ENGRAVED WITH INFORMATION FROM CUSTOMER PO
31	1	G1300075-ISO2	ISOLATION MOUNTING KIT, GRIMSTASD, STABLE-FLEX 3/8-16, NEOPRENE (INCLUDES ITEM 31.1 - 31.3)
31.1	4	52045-10A	ISOLATION MOUNT, TECH PRODUCTS, STABLE FLEX 3/8-16, NEOPRENE
31.2	4	HHCS037C0870GR5ZP	HHCS, AMB, 0.38-16 X 1.00", GR5, ZINC PLATED (FASTENS ISO MOUNT TO RESERVOIR)
31.3	4	WMSL037-WASGR2ZP	LOCK WASHER, AMB, 0.38" MEDIUM, GR2, ZINC PLATED (FOR HEX HEAD CAP SCREWS ITEM 31.2)
32	1	VSTI1/2EDCF	FITTING, PARKER, 1/2BSPP HOLLOW HEX PLUG
33	1	HCH-08-16S-16S-120	HOSE ASSY, PARKER, 1/2" ID, 4000 PSI, ISO 18752, 16S FEM STR SWIVEL BOTH ENDS, 120" LONG
34	1	LCH-10-18L-18L-120	HOSE ASSY, PARKER, 5/8" ID, 3000 PSI, ISO 18752, 18L FEM STR SWIVEL BOTH ENDS, 120" LONG

NOTES:

1. TEST UNIT PER G1700103-HPU TEST PROCEDURE.
2. LABEL HEAT EXCHANGER PORTS "IN" & "OUT" PER SHEET 4 OF 7.
3. CONFIRM ELECTRIC MOTOR BOX ORIENTATION.

ITEM	QTY	PART NUMBER	DESCRIPTION
200	4	HHCS050C112GR5ZP	HHCS, AMB, 0.50-13 X 1.12", GR5, ZINC PLATED (FASTENS PUMP ADAPTER RING TO COVER)
201	4	HHCS050C150GR5ZP	HHCS, AMB, 0.50-13 X 1.50", GR5, ZINC PLATED (FASTENS MOTOR RING TO PUMP ADAPTER RING)
202	4	HHCS050C125GR5ZP	HHCS, AMB, 0.50-13 X 1.25", GR5, ZINC PLATED (FASTENS PUMP ADAPTER TO PUMP ADAPTER RING)
203	12	WMSL050WASGR2ZP	LOCK WASHER, AMB, 0.50" MEDIUM, GR 2, ZINC PLATED (FOR HEX HEAD CAP SCREWS ITEM 200 - 202)
204	4	SCLH050C125ZP	SCLH, AMB, 0.50-13 X 1.25", LOW HEAD, ZINC PLATED (FASTENS MOTOR RING TO MOTOR)
205	4	WHCL050WASGR2ZP	LOCK WASHER, AMB, 0.50" HI-COLLAR, GR2, ZINC PLATED (FOR SOCKET HEAD CAP SCREWS ITEM 204)
206	2	HHCS037C100GR5ZP	HHCS, AMB, 0.38-16 X 1.00", GR5, ZINC PLATED (FASTENS PUMP TO PUMP/MOTOR ADAPTER)
207	2	WMSL037WASGR2ZP	LOCK WASHER, AMB, 0.38" MEDIUM, GR2, ZINC PLATED (FOR HEX HEAD CAP SCREWS ITEM 206)
208	8	NACR037CNUTGR2ZP	HEX NUT, AMB, 0.38-16 ACORN STYLE, GR2, ZINC PLATED (FASTENS RESERVOIR COVER TO THE TANK)
209	8	WSAE037WASGR2ZP	WASHER, AMB, 0.38" SAE, GR2, ZINC PLATED (FOR ACORN NUTS ITEM 208)
210	4	HHFB031C075GR5ZPWL	FLANGE HEAD, AMB, 0.31-18 X 0.75", GR5, ZINC PLATED (FASTENS MANIFOLD TO RESERVOIR COVER)
211	4	HHFB043C100GR5ZPWL	FLANGE HEAD, AMB, 0.44-14 X 1.00", GR5, ZINC PLATED (FASTENS BRACKET AND FILTER TO RES COVER)
214	4	DRIV006C018ZP	DRIVE SCREW, AMB, #6 X .19", TYPE U, ZINC PLATED (FASTENS CENTRISYS NAMEPLATE)
300	1	5605-8-8-8	FITTING, AIR-WAY, 1/2"NPT FEMALE / (2) 1/2"NPT FEMALE TEE (MANIFOLD T-PORT)
301	1	2501-8-12	FITTING, AIR-WAY, 3/4"NPT MALE / 08JIC MALE ELBOW (HE INLET PORT INSIDE TANK)
302	2	6900-12-12	FITTING, AIR-WAY, 12SAE MALE / 3/4"NPT SWIVEL (HE IN&OUT PORTS)
305	1	5502-16-16	FITTING, AIR-WAY, 1"NPT MALE / 1"NPT FEMALE ELBOW (STRAINER PORT)
306	1	6805-16-16-NWO	FITTING, AIR-WAY, 16SAE MALE / 1"NPT FEMALE ELBOW (PUMP INLET PORT)
307	1	2501-8-8	FITTING, AIR-WAY, 08NPT MALE TO 08JIC MALE ELBOW (MANIFOLD T-PORT)
308	1	5406-12-8	FITTING, AIR-WAY, 3/4"NPT MALE / 1/2"NPT FEMALE REDUCER (HE CUST CONNECTION)
309	1	318-12	FITTING, AIR-WAY, 12JIC TUBE NUT (HE RETURN LINE INSIDE TANK)
310	1	319-12	FITTING, AIR-WAY, 12JIC TUBE SLEEVE (HE RETURN LINE INSIDE TANK)
311	1	5406-HHP-8	FITTING, AIR-WAY, 1/2"NPT MALE HEX HEAD PLUG (SHUT-OFF VALVE DRAIN PORT)
312	1	25011212-MOD	FITTING, AIRWAY, 3/4"NPT MALE / 12JIC MALE ELBOW, 1/8" ANTI-SIPHON HOLE (HE RETURN LINE IN-TANK)
313	1	A10RLWD	FITTING, HATEC, 10-L X 1/4" MALE BSPP SOFT SEAL STUD COUPLING
314	1	VBDKO10L	FITTING, HATEC, 90 DEG SWIVEL ELBOW W/O-RING
315	1	10-L	FITTING, HATEC, CAP (STO) W/TUBE NUT
319	1	FF6400-8-16-O	FITTING, AIR-WAY, 16SAE MALE / 08ORFS MALE STR CONNECTOR (PSI FILTER INLET PORT)
320	2	FF6400-8-8-O	FITTING, PARKER, 08SAE MALE / 08ORFS MALE STR CONNECTOR (MANIFOLD P-PORTS)
321	1	FF6801-10-10-NWO	FITTING, AIR-WAY, 10SAE MALE TO 10ORFS FEMALE ELBOW (FILTER OUTLET PORT)
322	1	FF6402-10-10-O	FITTING, AIR-WAY, 10ORFS FEMALE SWVL / 10SAE MALE STR CONNECTOR (FLOW METER INLET PORT)
323	1	FF6801-8-10-NWO	FITTING, AIR-WAY, 10SAE MALE TO 08ORFS MALE ELBOW (PUMP OUTLET PORT)
324	1	WEE16S7/8UNF	FITTING, PARKER, 10SAE MALE / 16MM TUBE ELBOW (FLOW METER OUTLET PORT)
325	1	GE18L1/2NPTCF	FITTING, PARKER, 18L METRIC 1/2"-14 NPT MALE CONNECTOR (HE CUST CONNECTION)
329	1	6410-12-16-O	FITTING, AIR-WAY, 12SAE MALE / 16SAE FEMALE EXPANDER (PUMP INLET PORT)
330	1	16-10F5OG5-S	FITTING, PARKER, 16SAE MALE / 10SAE FEMALE EXPANDER (FILTER OUTLET PORT)
400	1	F487TC-JS-J9-08-08-08-19	HOSE ASM, PARKER, 1/2" ID, 4000 PSI, ISO 18752, 08ORFS STR / 08ORFS ELBOW
401	1	F487TC-JS-J1-08-08-08-9	HOSE ASM, PARKER, 1/2" ID, 4000 PSI, ISO 18752, 08ORFS STR / 08ORFS LG ELBOW
402	1	F487TC-06-39-08-08-08-32	HOSE ASM, PARKER, 1/2" ID, 4000 PSI, ISO 18752, 08JIC STR / 08JIC ELBOW
403	2	5404-8-8	FITTING, AIR-WAY, 1/2"NPT X 1/2"NPT X CLOSE NIPPLE (RESERVOIR DRAIN PORT & MANIFOLD T-PORT)
404	1	1/2X6-S80-SMLS-BD-NIPPLE	NIPPLE, PIPE, 1/2"NPT SCH80 X 6" (BY-PASS CHECK VALVE OUTLET PORT)
405	1	1X7-S80-SMLS-BD-NIPPLE	NIPPLE, PIPE, 1"NPT SCH80 X 7" (PUMP INLET PORT FOR)
406	1	032810-TUBE-20	TUBE, JM GRIMSTAD, 3/4" OD X .035" WALL, SAE J525 HYDRAULIC SEAMLESS STEEL

DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive
DJ	08/01/2017	Muskego, Wisconsin 53150

GRIMSTAD

CERTIFIED DRAWING

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Signed By: John Porter

Date: 08/07/2017

REVISE ON CAD ONLY

centrisys
CENTRIFUGE SYSTEMS
9586 58TH PLACE
KENOSHA, WI 53144
TEL: (262) 654-6006
FAX: (262) 654-6063

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF CENTRISYS.

Designed by:	Date:
-	-
Drawn by: A.A.	Date: -
Chk'd by: -	Date: -
Approved by: -	Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

Material(s):

Estimated weight (lbs):

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

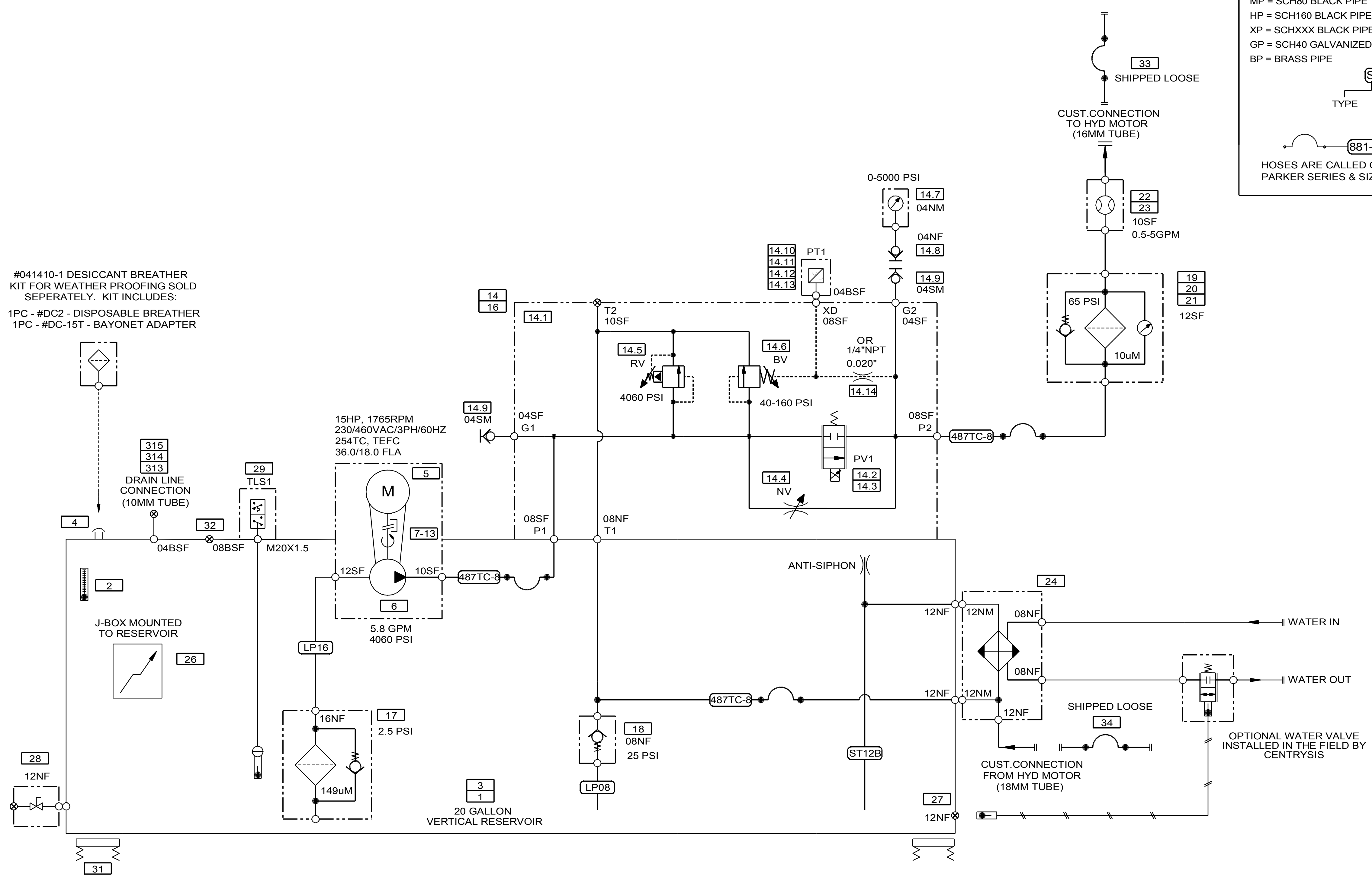
Part #:

Drawing #: G1700103-HPU

Sht: 2 OF 7

Scale: 1:12

0



PLUMBING LINE SIZE CHART			PORT CODE CHART	
TYPE	SIZE	WALL THICKNESS	SIZE	TYPE
ST = CARBON STEEL TUBE	02 = 1/8"	A = 0.028"	02 = 1/8"	SF = SAE FEMALE
SST1 = STAINLESS STEEL TUBE (304)	03 = 3/16"	B = 0.035"	03 = 3/16"	SM = SAE MALE
SST2 = STAINLESS STEEL TUBE (316L)	04 = 1/4"	C = 0.049"	04 = 1/4"	NF = NPT FEMALE
CT = COPPER TUBE	05 = 5/16"	D = 0.065"	05 = 5/16"	NM = NPT MALE
LP = SCH40 BLACK PIPE	06 = 3/8"	E = 0.083"	06 = 3/8"	C61 = SAE FLANGE CODE 61
MP = SCH80 BLACK PIPE	08 = 1/2"	F = 0.095"	08 = 1/2"	C62 = SAE FLANGE CODE62
HP = SCH160 BLACK PIPE	10 = 5/8"	G = 0.109"	10 = 5/8"	JF = 37DEG JIC FEMALE
XP = SCHXXX BLACK PIPE	12 = 3/4"	H = 0.120"	12 = 3/4"	JM = 37DEG JIC MALE
GP = SCH40 GALVANIZED PIPE	14 = 7/8"	I = 0.134"	14 = 7/8"	BSF = BSPP FEMALE
BP = BRASS PIPE	16 = 1"		16 = 1"	BSM = BSPP MALE
ST20D	20 = 1-1/4"		20 = 1-1/4"	BPF = BSPT MALE
	24 = 1-1/2"		24 = 1-1/2"	BPM = BSPT MALE
TYPE SIZE WALL	32 = 2"		32 = 2"	** = OTHER SPEC SEE NOTES
	40 = 2-1/2"		40 = 2-1/2"	
881-12	48 = 3"		48 = 3"	
	64 = 4"		64 = 4"	
HOSES ARE CALLED OUT USING PARKER SERIES & SIZE REFERENCE.				

DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive Muskego, Wisconsin 53150
DJ	08/01/2017	

GRIMSTAD

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Signed By: John Porter Date: 08/07/2017

REVISE ON CAD ONLY

centrisys CENTRIFUGE SYSTEMS

9586 58th Place Kenosha, WI 53144

Tel: (262) 654-6006 Fax: (262) 654-6063

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF CENTRISYS.

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

Designed by: - Date: -

Drawn by: A.A. Date: -

Chk'd by: - Date: -

Approved by: - Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

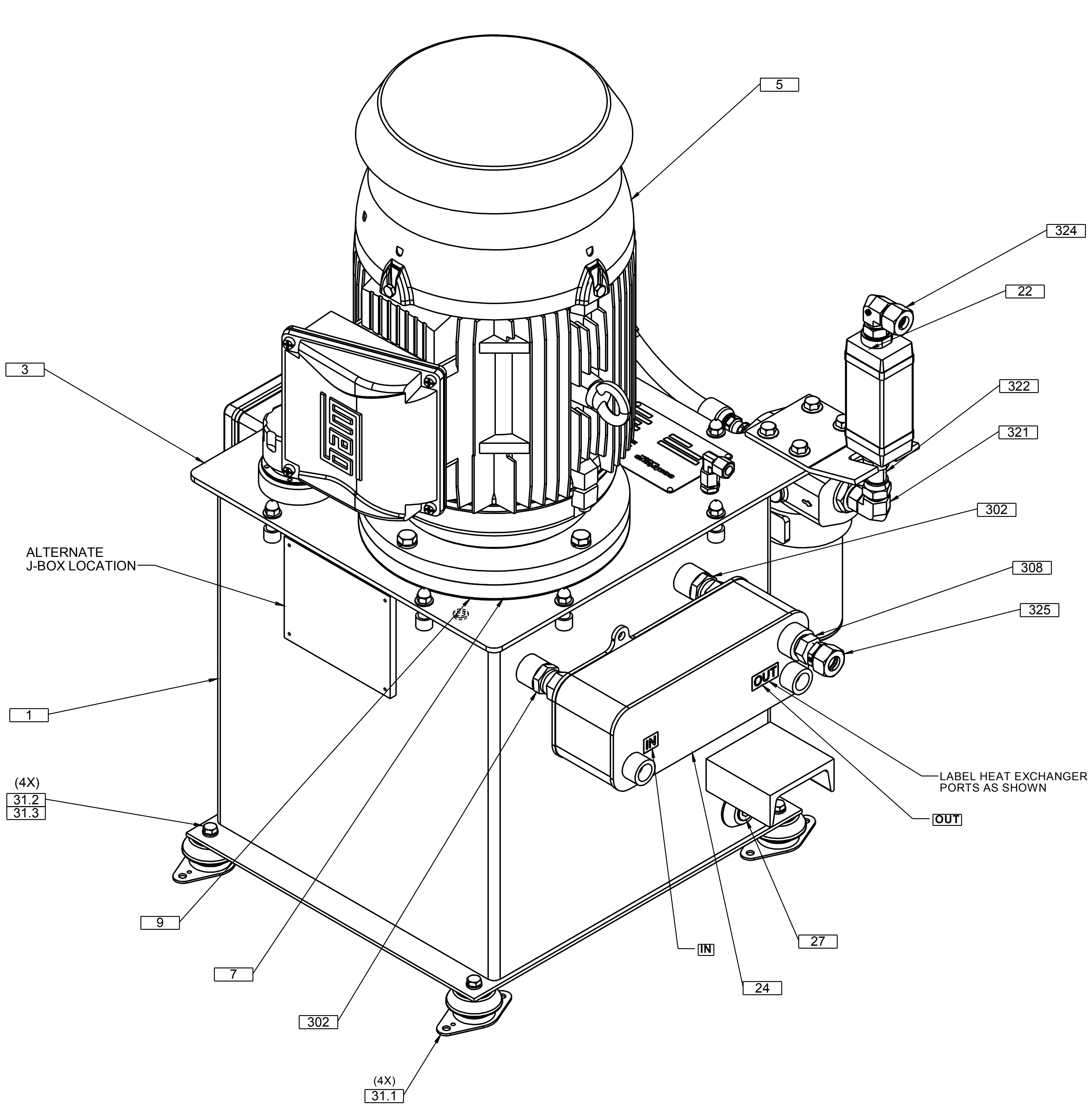
Material(s):

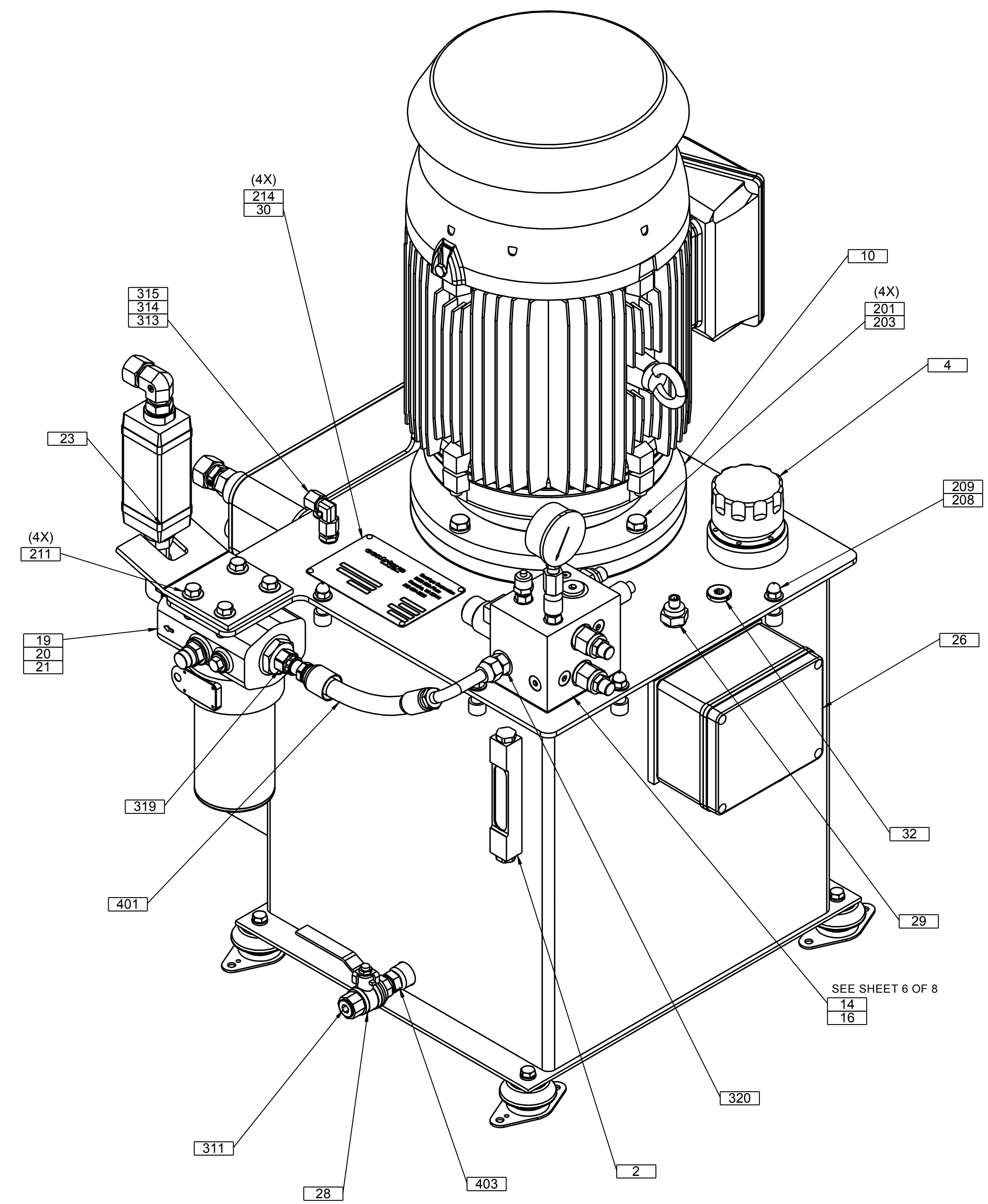
Estimated weight (lbs):

Part #:

Drawing #: G1700103-HPU

Sht: 3 OF 7 Scale: 1:12 0





DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive Muskego, Wisconsin 53150
DJ	08/01/2017	

GRIMSTAD

CERTIFIED DRAWING

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REVISE ON CAD ONLY

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Designed by: -	Date: -
Drawn by: A.A.	Date: -
Chk'd by: -	Date: -
Approved by: -	Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

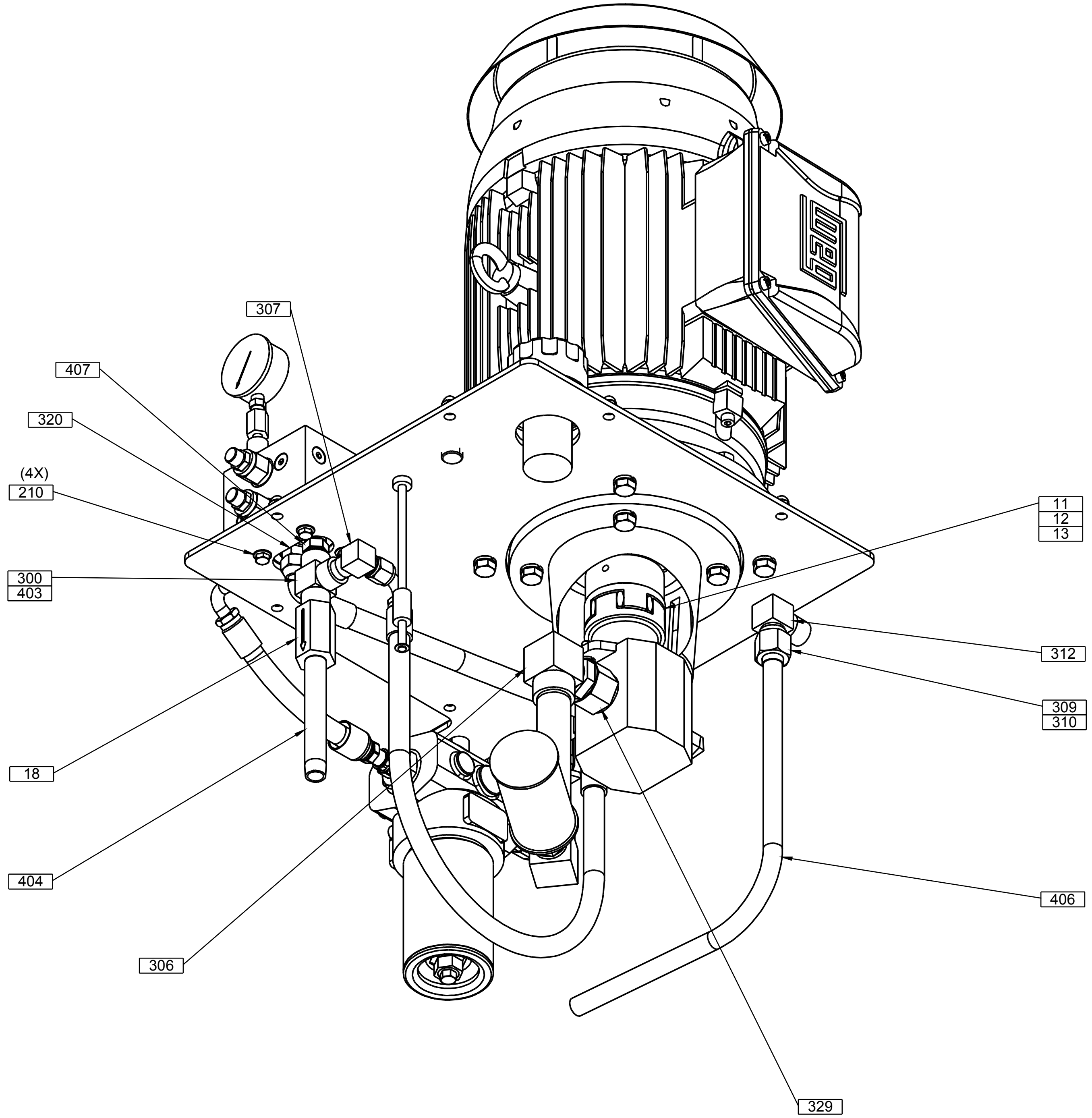
Material(s):

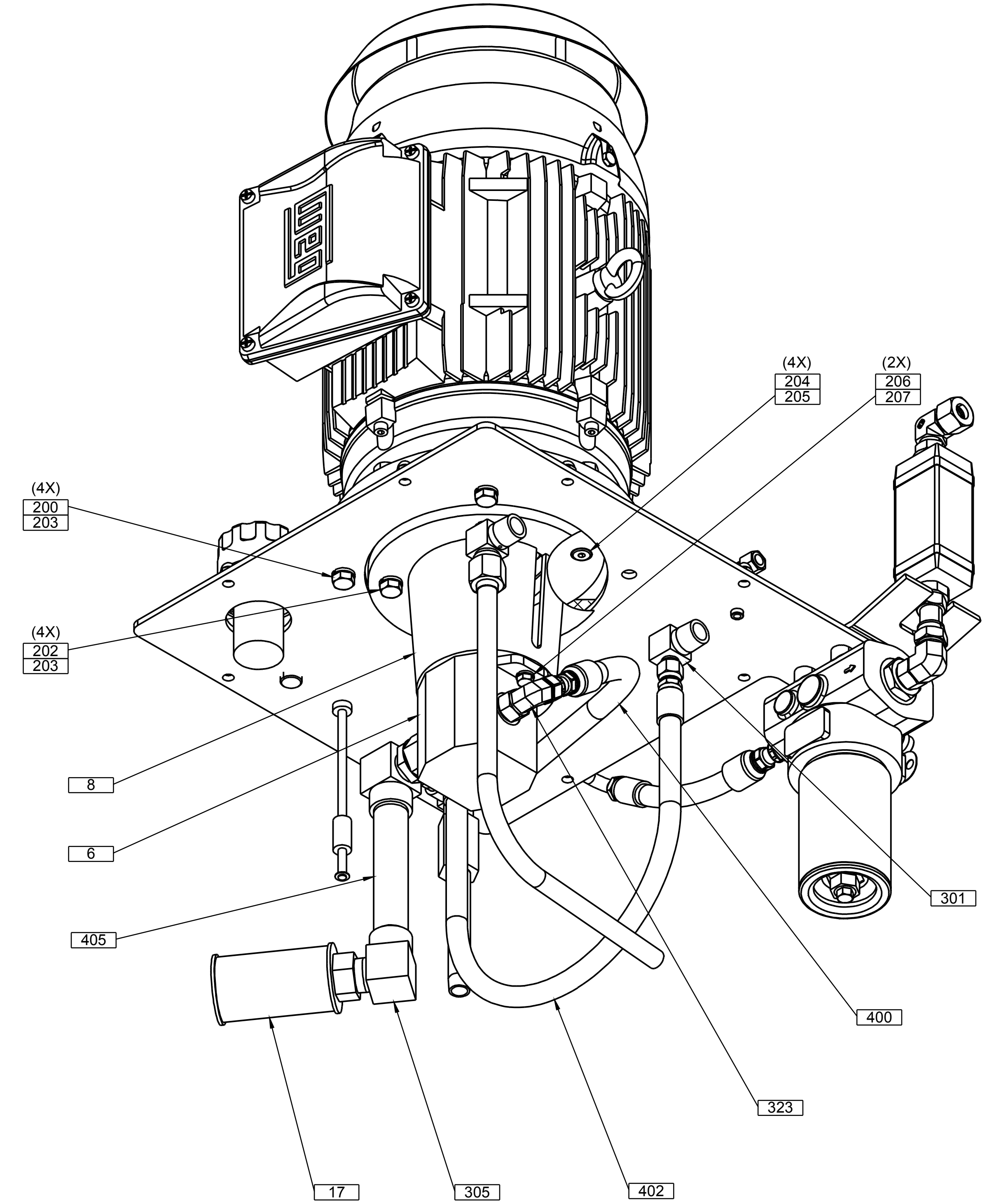
Estimated weight (lbs):

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

Part #:	Drawing #: G1700103-HPU	
Sht: 4 OF 7	Scale: 1:3	0





DRAWN BY	DRAWN DATE	PROJECT NUMBER	
JP	08/01/2017	G1700103	GRIMSTAD
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive	
DJ	08/01/2017	Muskego, Wisconsin 53150	

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Designed by:	Date:
Drawn by: A.A.	Date: -
Chk'd by: -	Date: -
Approved by: -	Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

Material(s):

Estimated weight (lbs):

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

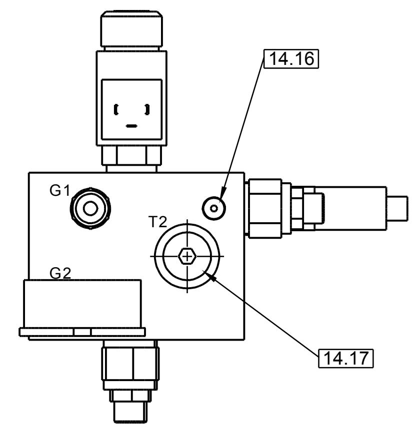
Project:

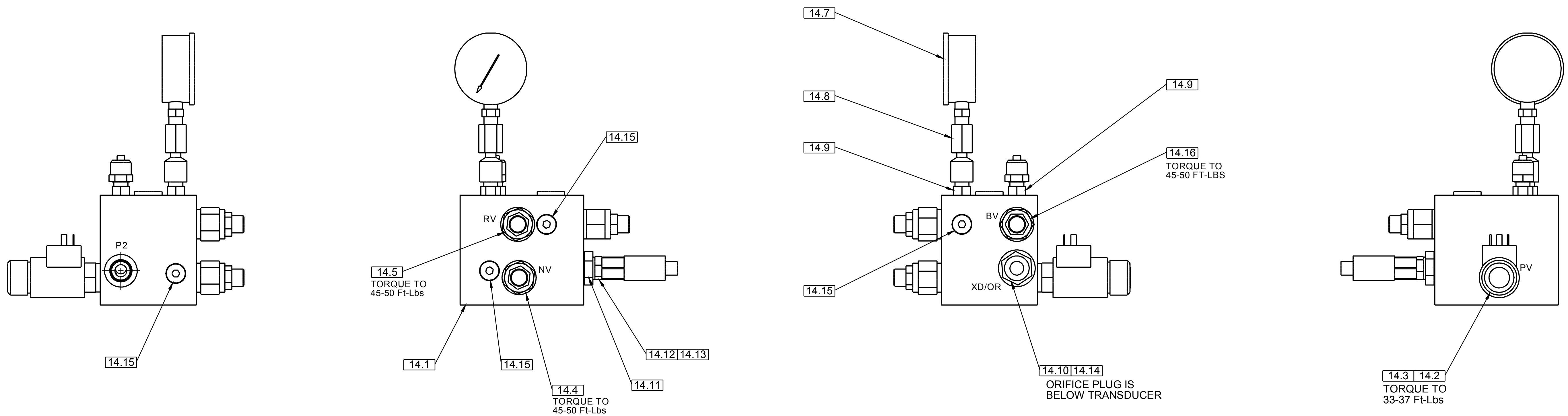
Part #:

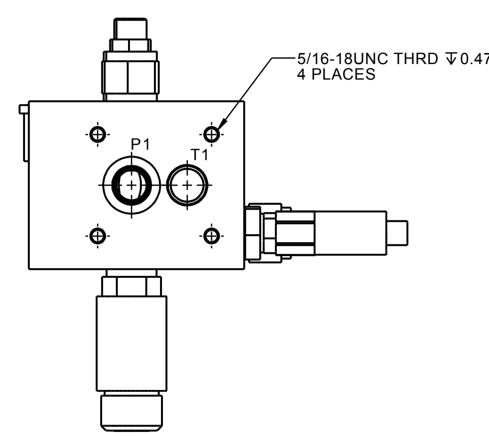
Drawing #: GI700I03-HPU

Sht: 5 OF 7 Scale: 1:3 0

ITEM	QTY	PART NUMBER	DESCRIPTION
14	1	G1300075-MA1	CENTRISYS MANIFOLD ASSM, FIXED PUMP UNITS
14.1	1	BLK00202A-CC	BLOCK FOR CENTRISYS W/ORIFICE (WAS 020907-1-1BLK W/O ORIF)
14.2	1	850254119	VALVE, COMATROL, PROP 2-WAY CARTRIDGE (PSV10-NC-40-00-00-B-0)
14.3	1	M19P-24D-0.9A-DN	COIL, COMATROL, 24VDC HIRSCHMAN CONNECTION
14.4	1	FCVL-10-N-S-0-NV	VALVE, BUCHER, FLOW CONTROL CARTRIDGE, LOCKABLE
14.5	1	RVPS-10-N-S-0-50	VALVE, BUCHER, P.O. RELIEF CARTRIDGE, SPOOL, 50-5000 PSI
14.6	1	LCEF-10-N-A-S-0-160	VALVE, BUCHER, LOGIC CONTROL ELEMENT, PILOT TO CLOSE, 40-160 PSI
14.7	1	CF-1P-350-A	GAUGE, PCI, 0-5000 PSI [0-350 BAR], 1/4"NPT MALE BOTTOM MTD, 2.50" DIAL
14.8	1	H900-86	FITTING, PCI, DIRECT GAGE CONNECTOR M16X2 / 1/4 NPT FEMALE, 5800 PSI
14.9	2	H900-11	FITTING, PCI, TEST POINT M16X2 / 04SAE MALE, BUNA-N, 9100 PSI
14.10	1	PT250R-11-LI3-H1131	TRANSDUCER, TURCK, 0-250 BAR, 4-20 MA, 1/4 BSPP FEMALE
14.11	1	RI1/2EDX1/4CF	FITTING, PARKER, 1/2" BSPP MALE TO 1/4" BSPP FEMALE ADAPTER
14.12	1	9500-04	SEAL WASHER, ADAPATALL, 1/4 BSPP MALE THREAD
14.13	1	9000-04-04	FITTING, ADAPTALL, 1/4 BSPP MALE TO 1/4 BSPP MALE ADAPTER
14.14	1	EH-20-SS	ORIFICE PLUG, OKEEFE CONTROLS, 1/4"NPT PLUG X .020" ORIFICE
14.15	4	22S-S06	PLUG, EPCO, 06SAE STR THRD, INTERNAL HEX, BUNA-N
14.16	1	22S-S02	PLUG, EPCO, 02SAE STR THRD, INTERNAL HEX, BUNA-N
14.17	1	22S-S10	PLUG, EPCO, 10SAE STR THRD, INTERNAL HEX, BUNA-N







P1, P2	8 SAE
T2	10 SAE
T1	1/2" NPT
XD	1/2" BSP
G1, G2	4 SAE

DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive
DJ	08/01/2017	Muskego, Wisconsin 53150

GRIMSTAD

CERTIFIED DRAWING

This is an as-built drawing. Manual revisions are prohibited. Revisions are noted on sheet 1.

Signed By: John Porter

Date: 08/07/2017

REVISE ON CAD ONLY

centrisys
CENTRIFUGE SYSTEMS

9586 58TH PLACE
KENOSHA, WI 53144

TEL: (262) 654-6006
FAX: (262) 654-6063

Designed by:	Date:
-	-
Drawn by: A.A.	Date: -
Chk'd by: -	Date: -
Approved by: -	Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

Material(s):

Estimated weight (lbs):

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

Part #:

Drawing #: GI700I03-HPU

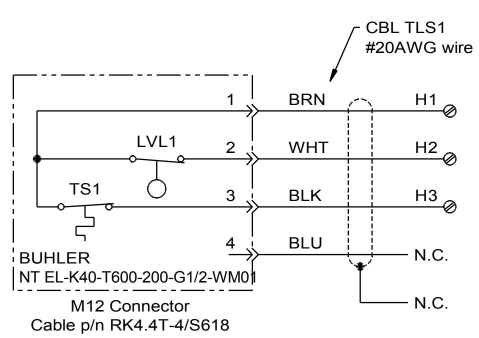
Sht: 6 OF 7

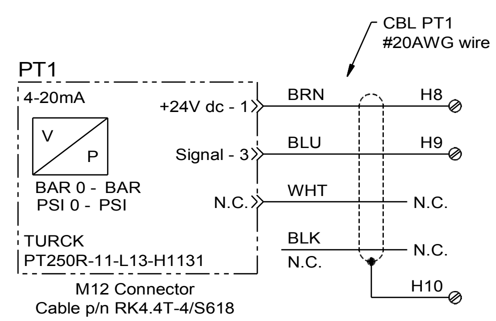
Scale: I:2

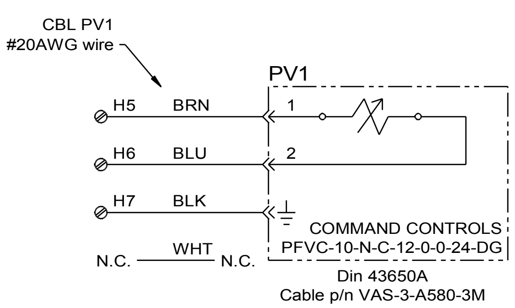
0

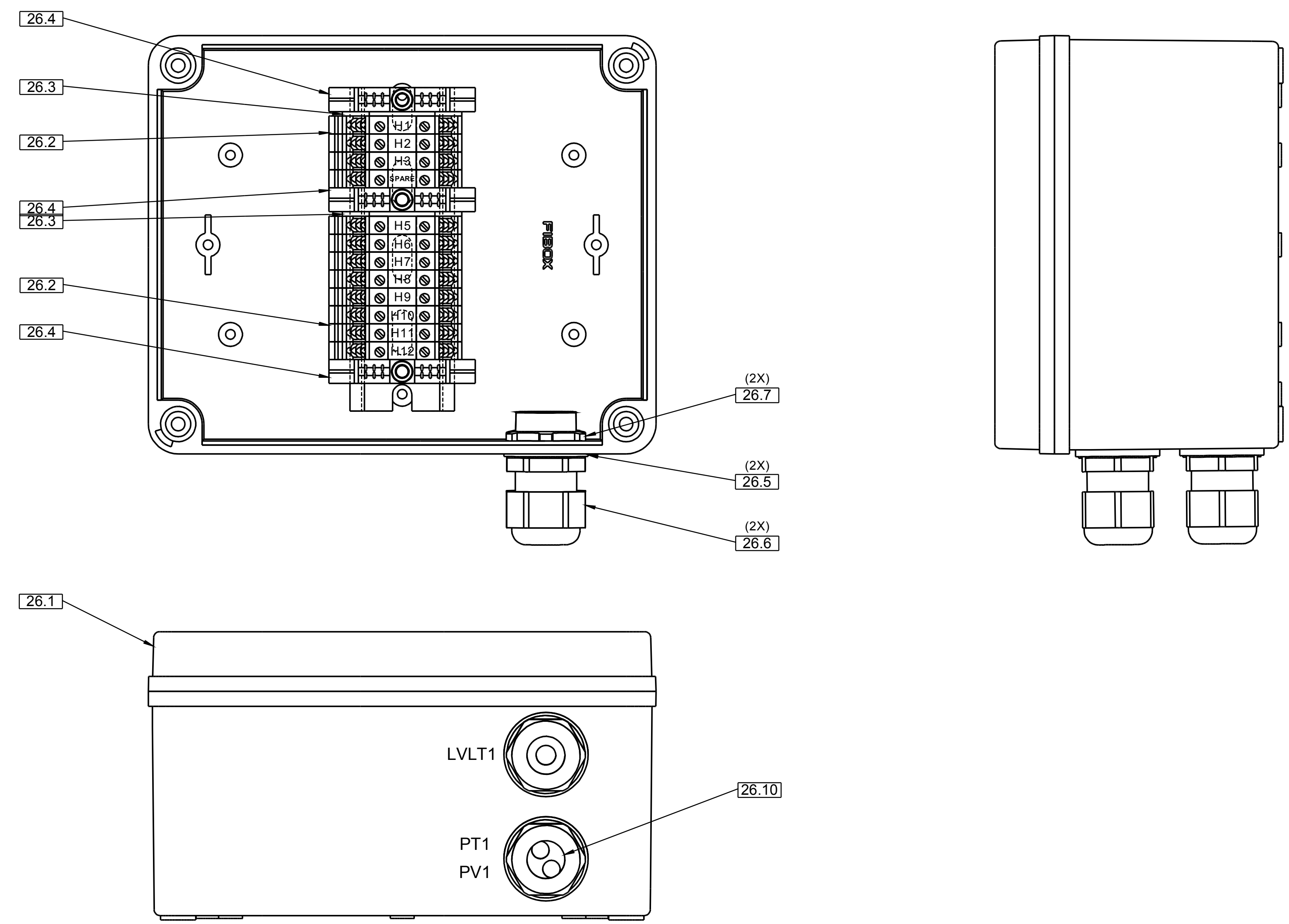
ITEM	QTY	PART NO.	DESCRIPTION
26	1	G1300075-JBOX8	ELECTRICAL J-BOX ASM, JM GRIMSTAD
26.1	1	PCH95G	POLYCARBONATE ENCLOSURE FIBOX, NEMA4, 6.7LX5.5WX3.7H
26.2	14	57.504.0055.0	TERMINAL BLOCK, WIELAND, 6MM
26.3	2	07.311.0155	END BARRIER, WIELAND, FOR 6MM TERMINAL BLOCK
26.4	4	Z5.522.8553	END ANCHOR, WIELAND
26.5	3	SG1	SEAL RING, CROUSE HINES, 1/2" PVC GASKET
26.6	2	PCG-1/2X	CORD GRIP, MENCOM, .197-.354", 1/2" NPT, GRAY PLASTIC
26.7	2	LN101SC	LOCK-NUT, T&B, 1/2"NPT
26.8	2	RK4.4T-4/S618	3 PIN CONNECTOR, TURCK, 4 METERS SHIELDED CABLE
26.9	9	110075/8	FERRULE, MIROMAR, INSULATED 8MM WHITE FOR #20GA WIRE
26.10	1	PG16-2X6	CORD GRIP GLAND, MENCOM, 2 HOLE
26.11	1	VAS 3-A580-3M	CABLE, TURCK, N.O. DIN 43650 3+ GRD, 3 METERS, PVC JACKET

CABLE LENGTHS DETERMINED AFTER THE
JBOX IS MOUNTED TO THE POWER UNIT.









DRAWN BY	DRAWN DATE	PROJECT NUMBER
JP	08/01/2017	G1700103
CHECKED BY	CHECKED DATE	S86W18498 Enterprise Drive
DJ	08/01/2017	Muskego, Wisconsin 53150

GRIMSTAD

CERTIFIED DRAWING

This is an as-built drawing. Manual revisions are prohibited. Revisions are noted on sheet 1.

Signed By: John Porter

Date: 08/07/2017

REVISE ON CAD ONLY

CENTRISYS
CENTRIFUGE SYSTEMS
9586 58th Place
Kenosha, WI 53144
Tel: (262) 654-6006
Fax: (262) 654-6063

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF CENTRISYS.

Title: CENTRISYS WEG HPU 11kW 22LPM CS11-22-Z-TW-21 WTR HE T-STATS

Project:

Designed by: - Date: -
Drawn by: A.A. Date: -
Chk'd by: - Date: -
Approved by: - Date: -

GD&T ASME Y14.5M1994+ Tolerancing Std. & Rules apply

3rd Angle Projection

Material(s):

Estimated weight (lbs):

Part #:

Drawing #: GI700I03-HPU

Sht: 7 OF 7

Scale: 1:1

0

End User Account Name	Ref Contact	Email (Ref Contact) (Contact)	Business Phone (Ref Contact)	Mobile Phone (Ref Contact)	City	State	Category Type	Industry Type	Industry Subtype	Mfr Model Type
El Mirage, AZ	Kevin Voight	kvoigt@elmirageaz.gov	(480) 825-0411		El Mirage	AZ	Capital - Municipal	Municipal Wastewater		CS10-4
City of Prescott, AZ	Ben Metzler	benjiman.metzler@prescott-az.gov	(928) 777-1641		Prescott	AZ	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS14-4
City of Kingman, AZ - WWTP					Kingman	AZ	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS14-4
City of Goodyear, AZ - Rainbow Plant	Rob Koontz	rob.koontz@goodyearaz.gov	(623) 882-7615	623-693-2488	Goodyear	AZ	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS18-4
City of Goodyear, AZ - 157th Ave Plant	Rob Koontz	rob.koontz@goodyearaz.gov	(623) 882-7615	623-693-2488	Goodyear	AZ	Capital - Municipal	Municipal Water & Wastewater	Waste Activated Sludge, and Water Plant Sludge	CS18-4
City of Goodyear, AZ - 157th Ave Plant	Rob Koontz	rob.koontz@goodyearaz.gov	(623) 882-7615	623-693-2488	Goodyear	AZ	Capital - Municipal	Municipal Water & Wastewater	Waste Activated Sludge, and Water Plant Sludge	CS18-4
Baker Commodities, Inc. - AZ	Manuel Camargo	mcamargo@bakercommodities.com	(602) 989-3171		Phoenix	AZ	Capital - Industrial	Animal Protein & By-products	Animal Rendering Wastewater	CS21-4HC
Liberty Water Palm Valley WRF	Terry Gilbertson	terry.gilbertson@libertywater.com	623-935-3005	623-293-6277	Goodyear	AZ	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS21-4HC
City of Goodyear, AZ - 157th Ave Plant	Rob Koontz	rob.koontz@goodyearaz.gov	(623) 882-7615	623-693-2488	Goodyear	AZ	Capital - Municipal	Municipal Water & Wastewater	Waste Activated Sludge, and Water Plant Sludge	CS26-4
Tenaya Lodge/DNC Parks & Resorts	Mike Morrise	mmorrise@delawarenorth.com	559-683-6555		Fish Camp	CA	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS10-4
Steen Research	Steve Temple			814-931-7036	Hayward	CA	Capital - Industrial	Food & Beverage	Other	CS14-4
Modesto WholeSoy Company Tan Industries	Closed				Modesto	CA	Capital - Industrial	Food & Beverage	Soy	CS14-4
Chukchansi Gold Resort & Casino	Daniel Burns		1	559-692-5375	CoarseGold	CA	Capital - Municipal	Municipal Wastewater	Dewatering	CS14-4
Camp Pendleton	Kevin Ham	kevin.ham@usmc.mil	(760) 725-4018		Oceanside	CA	Capital - Municipal	Municipal Wastewater	Dewatering	CS14-4
Lake of the Pines WWTP	Chad McBride	chad.mcbride@co.nevada.ca.us	(530) 265-7121		Auburn	CA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS14-4
Foster Farms Corporate - Livingston	Mike Norton		+1 (360) 575-4911	1	Porterville	CA	Capital - Industrial	Animal Protein & By-products	Poultry By-Products	CS14-4
Petroleum Solids Control	Manuel Tollini	manuel@petroleumsolids.com	+1(562) 424-0254	+1 (562) 254-6341	Signal Hil	CA	Capital - Industrial	PetroChemical	Drilling Mud	CS18-3
Petroleum Solids Control	Manuel Tollini	manuel@petroleumsolids.com	+1(562) 424-0254	+1 (562) 254-6341	Signal Hill	CA	Capital - Industrial	PetroChemical	Drilling Mud	CS18-3
Petroleum Solids Control	Manuel Tollini	manuel@petroleumsolids.com	+1(562) 424-0254	+1 (562) 254-6341	Signal Hill	CA	Capital - Industrial	PetroChemical	Drilling Mud	CS18-3
Petroleum Solids Control	Manuel Tollini	manuel@petroleumsolids.com	+1(562) 424-0254	+1 (562) 254-6341	Signal Hill	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS18-3
Lake Wildwood WWTP, County of	Brad Torres	brad.torres@co.nevada.ca.us	(530) 265-1555		Penn Valley	CA	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS18-4
Tahoe Truckee Sanitation Agency	Richard Pallante	rpallante@ttsa.net	530-587-2527		Truckee	CA	Capital - Municipal	Municipal Wastewater	Thickening	CS18-4
Fallbrook Municipal Water District	Craig Brown	craigb@fpud.com	(760)728-1125		Fallbrook	CA	Capital - Municipal	Municipal Wastewater		CS18-4
Placer County Water Agency	Rick Bauer	RBauer@pcwa.net	530-823-4924		Auburn	CA	Capital - Municipal	Municipal Water	Alum	CS18-4
Sunsweet Growers, Inc.	Matt Kelly		1	+1 (530) 682-7885	Yuba City	CA	Capital - Industrial	Food & Beverage	Juice	CS18-4
Valley Center Municipal Water District	Rick Beath	rbeath@valleycenterwater.org	760-765-4547		Escondido	CA	Capital - Municipal	Municipal Water	TBD - To Be Determined	CS18-4
City of Pacifica, CA - Calera Creek WWTP	Maria Aquilar	aguilarm@ci.pacifica.ca.us	1	650-738-4662	Pacifica	CA	Capital - Municipal	Municipal Wastewater		CS18-4
Foster Farms Corporate - Livingston	Ron Curiel	ron.curiel@fosterfarms.com	209-394-5251	209-226-3641	Livingston	CA	Capital - Industrial	Animal Protein & By-products	Poultry	CS21-4
Foster Farms Corporate - Livingston	Ron Curiel	ron.curiel@fosterfarms.com	209-394-5252	209-226-3642	Livingston	CA	Capital - Industrial	Animal Protein & By-products	Poultry By-Products	CS21-4
Sierra Process System, Inc.	Stan Ellis	sellis@bak.rr.com	1	+1 (661) 201-1000	Bakersfield	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS21-4
Summit Environmental					Huntington Beach	CA				CS21-4
Synagro - CT - New Haven	Henry Glasser			415-820-5600	Modesto	CA	Capital - Industrial	Food & Beverage	Soy	CS21-4
RL Environmental Services, INC	Randy Jackson	rjackson@rleinc.us	(661) 706-5200		Bakersfield	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS21-4
Tahoe Truckee Sanitation Agency	Richard Pallante	rpallante@ttsa.net	530-587-2525		Truckee	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4
Tahoe Truckee Sanitation Agency	Richard Pallante	rpallante@ttsa.net	530-587-2526		Truckee	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4
Kappa Products Corporation	Mike Vignovich	vignovich@petroleumsolids.com	+1 (562) 424-0254	+1 (562) 254-4924	Morris	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS21-4
Sierra Process System, Inc.	Stan Ellis	sellis@bak.rr.com	1	+1 (661) 201-1000	Houston	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS21-4
Susanville Sanitary Community/Sanitary District	Steve Stump	steve@susanvillesanitarydistrict.com	(530) 257-5665		Susanville	CA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS21-4
City of Manteca, CA - Dept. of Public Works	Andrew Barrious	abarrious@ci.manteca.ca.us	209-456-8470	1	Manteca	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4
Sierra Process System, Inc.	Stan Ellis	sellis@bak.rr.com	1	+1 (661) 201-1000	Bakersfield	CA	Capital - Industrial	PetroChemical	Oil Refinery	CS21-4
City of Riverside, CA	Victor Corrales	vcorrales@riversideca.gov	951-351-6205	951-288-8554	Riverside	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4HC
City of Delano, CA	Daniel Ulloa	dulloa@cityofdelano.org	(661) 721-3352		Delano	CA	Capital - Municipal	Municipal Wastewater	Primary & WAS Blend	CS21-4HC
Baker Commodities, Inc. - Los Angeles, CA	Jesse Hernandez		+1 (323) 353-6918	+1 (323) 353-6918	Los Angeles	CA	Capital - Industrial	Animal Protein & By-products	Animal Rendering Wastewater	CS21-4HC
City of Patterson, CA	Victorio Tostado	vtostado@ci.patterson.ca.us		1	Patterson	CA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS21-4HC
EMWD Moreno Valley	Van tang	tangv@emwd.org	(951) 928-3777		Moreno Valley	CA	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS26-4
EMWD Perris Eastern Municipal Water District	James Rhodes	rhodesj@emwd.org	(951) 928-3777		Perris Valley	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS26-4
EMWD San Jacinto Eastern Municipal Water District	Mike Brem	brehmm@emwd.org	(951) 928-3777		San Jacinto	CA	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS26-4
EMWD Temecula Eastern Municipal Water District	Brian Cohen	CohenB@emwd.org	951-928-3777		Temecula	CA	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS26-4
Inland Empire	Robert Delgado	rdelgado@ieua.org	(909)993-1679		Ontario	CA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS30-4
Lyons CO	Wayne Ramey	wayner@recinc.net	303-833-5505		Lyons	CO	Capital - Municipal	Municipal Wastewater		CS10-4
City of Delta, CO	Andy Mitchell	andy@cityofdelta.net	970-874-7566	970-261-7916	Delta	CO	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS14-4
Upper Thompson Sanitation District	Henery Newhouse	henery@utsd.org	970-586-5389	970-646-5994	Estes Park	CO	Capital - Municipal	Municipal Wastewater	Dewatering	CS18-4
City of Montrose, CO - WWTP	Hyrum Webb	hwebb@cityofmontrose.org	970-240-1452	970-901-0134	Montrose	CO	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS18-4HC
City of Montrose, CO - WWTP	Hyrum Webb	hwebb@cityofmontrose.org	970-240-1452	970-901-0134	Montrose	CO	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS18-4HC
Silverthorne - Blue River WWTP	Jason Kruckerberg	JKruckeberg@silverthorne.org	+1 (970) 468-6152		Silverthorne	CO	Capital - Municipal	Municipal Wastewater	Dewatering	CS21-4
JBS Swift & Company - Greeley CO	Fernando Meza	Fernando.meza@jbssa.com	970-371-8589	970-371-8589	Greeley	CO	Capital - Industrial	Animal Protein & By-products	Animal Rendering Wastewater	CS21-4HC
JBS Swift & Company - Greeley CO	Fernando Meza	Fernando.meza@jbssa.com	970-371-8589	970-371-8589	Greeley	CO	Capital - Industrial	Animal Protein & By-products	Three Phase (Fat Recovery)	CS21-4HC
JBS Swift & Company - NE Grand Island	Corbin Utley	corbin.utley@jbssa.com	308-395-9437	308-258-1025	Grand Island	CO	Capital - Industrial	Animal Protein & By-products	Three Phase (Fat Recovery)	CS21-4HC
Longmont CO	Matt Brunning	matt.brunning@longmontcolorado.gov	(303) 651-8748		Longmont	CO	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS24-4EV
Dairy Specialists LLC	Randy Sorensen	randy@dairyspecialists.com	970-330-1870	+1 (970) 590-3838	Hillrose	CO	Capital - Industrial	Animal Protein & By-products	Other	CS26-4
Dairy Specialists LLC	Dave McGinley	dmcginley@dairyspecialists.com	(970) 330-1870	(970) 590-3230	Pierce	CO	Capital - Industrial	Industrial Wastewater	Primary Sludge	CS26-4
Denver Metro Wastewater Reclamation District - (NTP)	Paul Gaetano	PGaetano@mwrd.dst.co.us	(303) 286-3147		Denver	CO	Capital - Municipal	Municipal Wastewater	ATAD	CS26-4
Fort Collins - Drake WRF	Nick Russle	nrussell@fcgov.com	970.217.9588		Fort Collins	CO	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS26-4
Denver Metro Wastewater Reclamation District	Daniel Stillwell	dstillwell@mwrd.dst.co.us	+1 (303) 286-3301		Denver	CO	Capital - Municipal	Municipal Wastewater	Primary & WAS Blend	CS26-4
Kauai County - Waimea WWTP	Peter Honjo	waimeaww@kauai.gov	(808) 212-9928		Waimea	HI	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	Cs14-4
Kauai County - Lihue STP					Lihue	HI	Capital - Municipal	Municipal Wastewater		CS21-4
Kauai County - Wailua STP	John Nakashima	jnakashima@kauai.gov	(808) 241-4082		Wailua	HI	Capital - Municipal	Municipal Wastewater		CS10-4
Kailua WWTP	Fil Quibilan		1 (808) 254-4063	808-254-1954	Kailua	HI	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4HC
City of Blackfoot, ID	Eric Hadley	ehadley@cityofblackfoot.org	208-785-8616		Blackfoot	ID	Capital - Municipal	Municipal Wastewater	Dewatering	CS21-4
Douglas County Sewer District	Bob Edmonds		+1 (775) 356-8004	+1 (775) 772-0976	Zephyr Cove	NV	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS21-4
Pipe Maintenance Service, Inc.	John Martin			+1 (702) 373-5234	North Las Vegas	NV	Capital - Industrial	Animal Protein & By-products	Three Phase (Fat Recovery)	CS21-4HC
Hubbard Public Works	Melinda Olinger	molinger@cityofhubbard.org	503-982-9429		Hubbard	OR	Capital - Municipal	Municipal Wastewater	Waste Activated Sludge	CS10-4
Pacific Coast Seafoods Bio Oregon AKA Pacific Surimi Joint Venture	B. Bigelow		1	+1 (503) 338-2029	Warrenton	OR	Capital - Industrial	Food & Beverage	Fish	CS21-4
Crystal Ocean Seafood					Astoria	OR	Capital - Industrial	Food & Beverage		CS21-4F
Peshastin/PUD No. 1 Chelan Cty	Dale Pipkin	dale.pipkin@chelanpud.org	(509) 663-8121		Peshastin	WA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS10-4
City of North Bend, WA	Don Deberg	ddeberg@northbendwa.gov	(425) 888-7652		North Bend	WA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS14-4
Ault Field Naval Air Station - Whidbey Island					Oak Harbor	WA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS14-4
Snoqualmie	Brian Gasper	bgasper@snoqualmiewa.gov	425-888-1555		Snoqualmie	WA	Capital - Municipal	Municipal Wastewater		CS14-4

City of Selah, WA - WWTP	Ben Arnold	ben.arnold.electric@gmail.com	(509) 698-7321		Selah	WA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS18-4
Southwest Suburban Sewer District	Brett Wittman	brett.wittman@swssd.com	206 243 7770		Burien	WA	Capital - Municipal	Municipal Wastewater	Aerobically Digested Sludge	CS18-4
Leavenworth WA WWTP	Antinio Muro	antoniom@cityofleavenworth.com	509-548-5994		Leavenworth	WA	Capital - Municipal	Municipal Wastewater	Unfermented WAS	CS18-4
Alaska Ocean Seafood, Inc.					Acortes	WA	Capital - Industrial	Food & Beverage	Fish	CS21-4
Lamb-Weston ConAgra aka Twin City Foods - Prosser, WA					Prosser	WA	Capital - Industrial	Food & Beverage	Corn	CS21-4
Environmental Management Corp. Quincy (formerly Earth Tech)	Travis Kirk		1	+1 (509) 797-3008	Quincy	WA	Capital - Industrial	Industrial Wastewater	Secondary Sludge	CS21-4
City of Bremerton, WA	Travis Olsen	travis.olson@ci.bremerton.wa.us	(360) 473-5450		Bremerton	WA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4
J. Lieb Foods, Inc.	Daniel Critzer		1	+1 (509) 930-6061	Kennewick	WA	Capital - Industrial	Food & Beverage	Juice	CS21-4HC
Central Kitsap WA Treatment Plant	Dennis Graham	dgraham@co.kitsap.wa.us	(360) 337-5765		Central Kitsap	WA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS21-4HC
Vancouver City	Matt McCallum	matt.mccallum@jacobs.com	(360) 608-3447		Vancouver	WA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS26-4
King County WA	Sekhar Palepu	sekhar.palepu@kingcounty.gov	(206) 263-3900		Seattle	WA	Capital - Municipal	Municipal Wastewater	Anaerobically Digested Sludge	CS26-4

Attachment C: Velodyne Polymer System

QTY. **OPTION #2 DESCRIPTION**

1 **<u>VeloBlend Model VM-5P-1200-D-0-A-1 Liquid Polymer Blending System</u>**

Polymer Flow Range: 0.25 to 5 GPH
Dilution Water Flow: 120 to 1200 GPH

<u>Each unit shall include the following unless otherwise indicated:</u>

1 Polymer Mixing Chamber:
- A. Series: VeloBlend VM
- B. Type: Staged Hydro-Mechanical
- C. Mixer Motor: ½ HP, 90 VDC, 1750 RPM, wash-down duty
- D. Mixer Shaft Seal: Mechanical with seal flushing assembly
- E. VeloCheck™ Neat Polymer Check Valve with Quick Release Pin
- F. Construction:
  1. Body: Stainless steel
  2. Impeller: Stainless steel
  3. Mechanical Seal: Ceramic, Carbon, Stainless steel, Viton
  4. Cover: Clear polycarbonate with stainless steel reinforced flange & discharge
- G. Pressure Rating: 100 psi
- H. Pressure Relief Valve: Brass

1 Neat Polymer Metering Pump Assembly:
- A. PVC FNPT union style polymer inlet
- B. Type: Progressive Cavity type
- C. Motor: ½ HP, 1750 RPM, 90 VDC, Wash-down duty motor with gear reducer
- D. Loss of polymer flow sensor
- E. Metering pump calibration assembly with isolation valves: 500 ml
- F. Plumbing: SCH. 80 PVC

1 Dilution Water Inlet Assembly shall be provided, including the following:
- A. Stainless steel FNPT water inlet connection
- B. Dilution water ON/OFF solenoid valve
- C. Control Valve: Manual rate control valve
- D. Primary dilution water flow meter type: Rotameter
- E. Low differential pressure alarm switch
- F. 0-160 psi inlet water pressure gauge (stainless steel, liquid filled)
- G. Plumbing: SCH. 80 PVC

1 Solution Discharge Assembly:
- A. Stainless steel FNPT solution discharge connection
- B. 0-160 psi solution discharge pressure gauge (stainless steel, liquid filled)
- C. Plumbing: SCH. 80 PVC

1 Control Panel:
- A. Enclosure: NEMA 4X FRP
- B. Power:
  1. Required: 120 VAC, 60 Hz., 1 Ph
  2. Disconnect: 10' power cord with 120 VAC plug
- C. Motor controllers:
  1. Mixing Chamber
  2. Neat polymer metering pump
- D. Miscellaneous:
  1. Control circuit protection
  2. Control relays
  3. Power supplies
  4. Grounding blocks
  5. Numbers terminal blocks
  6. Wire labels, shrink-tube type

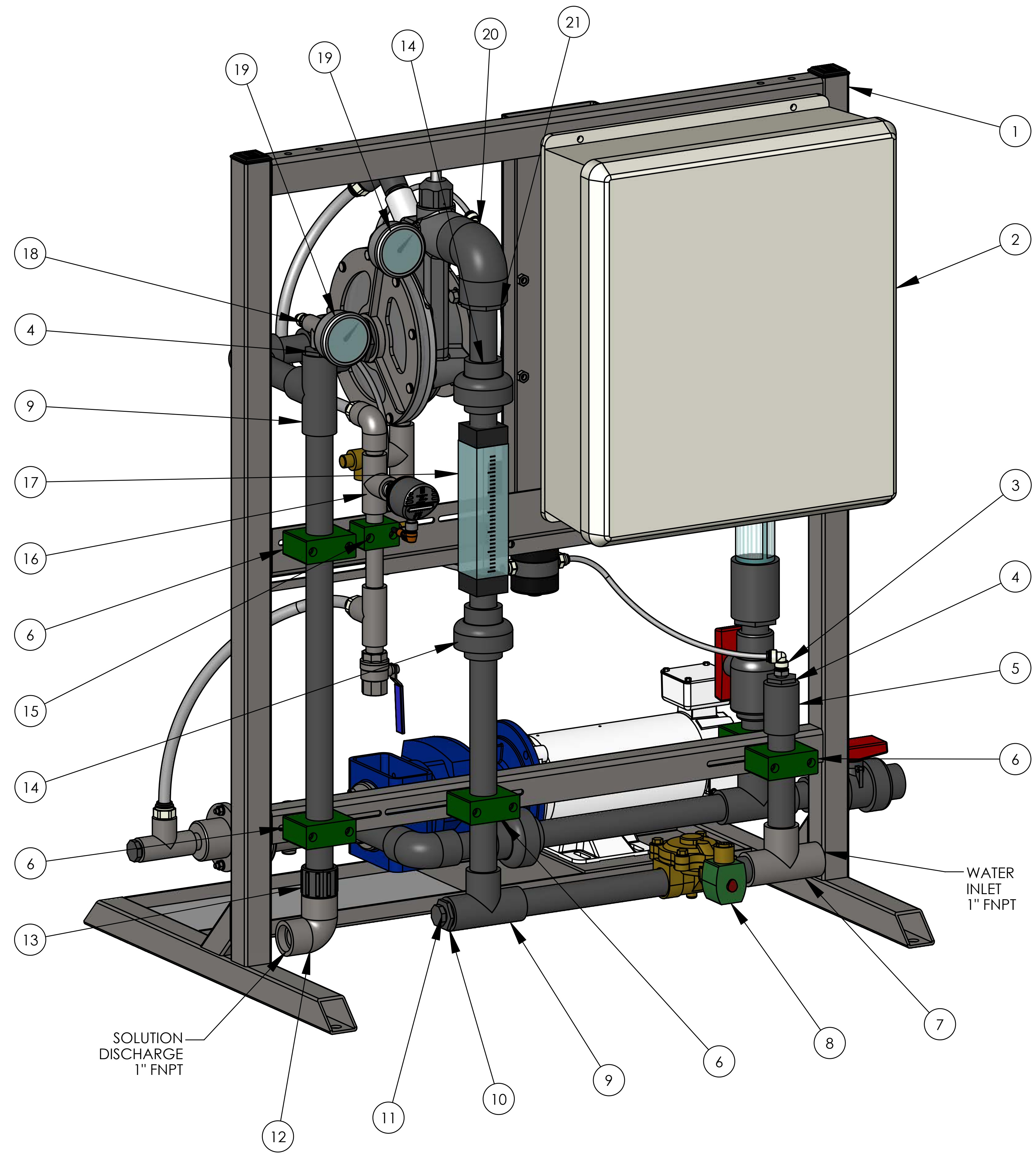
E. Operator Interface – Discrete Selector Switch
    1. System ON / OFF (reset) / REMOTE
    2. Ten-Turn Potentiometer – Metering Pump Control
    3. One-Turn Potentiometer – Mixer Speed Control
F. Status / Alarm Indicators:
    1. System Running Indication
    2. Main Power ON Indication
    3. LED Display Metering Pump Rate
    4. Low Water Differential Pressure Alarm
    5. Low Polymer Flow Alarm
G. Inputs (signals by others):
    1. Remote Start / Stop (discrete dry contact)
    2. Pacing Signal Based on Process Flow (4-20mA)
H. Outputs:
    1. System Running (discrete dry contact)
    2. System Remote Mode (discrete dry contact)
    3. Common Alarm (discrete dry contact)

1 System Skid:

A. Frame: 304 stainless steel, open frame design for access to all components
B. Fasteners: 304 SS
C. Designed for bolt-down

REVISIONS

REV	ECO	DESCRIPTION	DATE	APPROVED
A	SO 5249	INITIAL RELEASE	5/7/19	B HEALY



NOTE: DRAWINGS ARE FOR GENERAL LAYOUT USE ONLY. SEE PROPOSAL FOR DETAILS OF THE PROPOSED SCOPE OF SUPPLY.

NOTES -

1) APPROXIMATE DRY WEIGHT 250 LBS

2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT

3) FRAME MATERIAL IS 304 SS AND HARDWARE IS 18-8 SS UNLESS OTHERWISE NOTED

ITEM #	NUMBER	DESCRIPTION	QTY
1	158-1353	FRAME, VELOBLEND, COMPACT, 3 SPAN, 18X16	1
2	970-4000	CONTROL PANEL ASSY, VM-P-D-0-A, STD	1
3	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	2
4	194-2012	REDUCER, BUSHING, 1" X 1/4", SXT, SR, SCH 80, PVC	2
5	194-0445	COUPLING, 1", SXS, PVC	1
6	194-0027	CLAMP, PIPE, 1", STAUFF	5
7	194-0442	TEE, 1", FPT, 304 SS	1
8	248-0160	VALVE, SOLENOID, 1" FNPT, BRASS/NBR, 120 VAC, ASCO	1
9	194-0314	TEE, 1" SOC, SCH 80, PVC	3
10	194-0690	REDUCER, BUSHING, 1" X 1/2", SXT, SCH 80, PVC	1
11	194-0407	PLUG, 1/2" , T, SCH 80, PVC	3
12	194-0496	ELBOW, 90, 1" NPT, 304	1
13	194-0618	ADAPTER, MALE, 1", SCH 80, PVC, S X MPT	1
14	194-0642	UNION, 1", SXS, PVC/VITON	4
15	194-0029	CLAMP, PIPE, 1/2", STAUFF	1
16	182-0462	SENSOR ASSY, FLOW, THERMAL, SI5006, AC, 1/2"	1
17	182-0088	FLOW METER, ROTAMETER, 20 GPM, 1" FNPT	1
18	194-0587	TEE, 1/4", T X T X T, 304	1
19	182-0002	GAUGE, PRESSURE, 2.5", 160 PSI, SS/BRASS, 1/4" MNPT, BACK MNT, GLYCERINE FILL	2
20	194-0137	ELBOW, 90 DEG, 1 1/2" SOC, PVC	1
21	194-0687	REDUCER, BUSHING, 1.5" X 1", SXS, SCH 80, PVC	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS .XX = ±.015 .XXX = ±.005
ANGLES ± 1°
63 √ MINIMUM
FILLET RADII TO BE .005 MAXIMUM
BREAK ALL EDGES .005/.010
MATERIAL
FILENAME 300-1108
DO NOT SCALE DRAWING

CAD GENERATED DRAWING, INTERPRET DRAWING PER ASME Y14.5M - 2009

APPROVALS		DATE
MODELED	B HEALY	5/7/2019
DRAWN	B HEALY	5/7/2019
PROJECT MGR	C HEUSEL	5/7/2019
PURCHASING MGR		
QUAL ENG		

VELODYNE

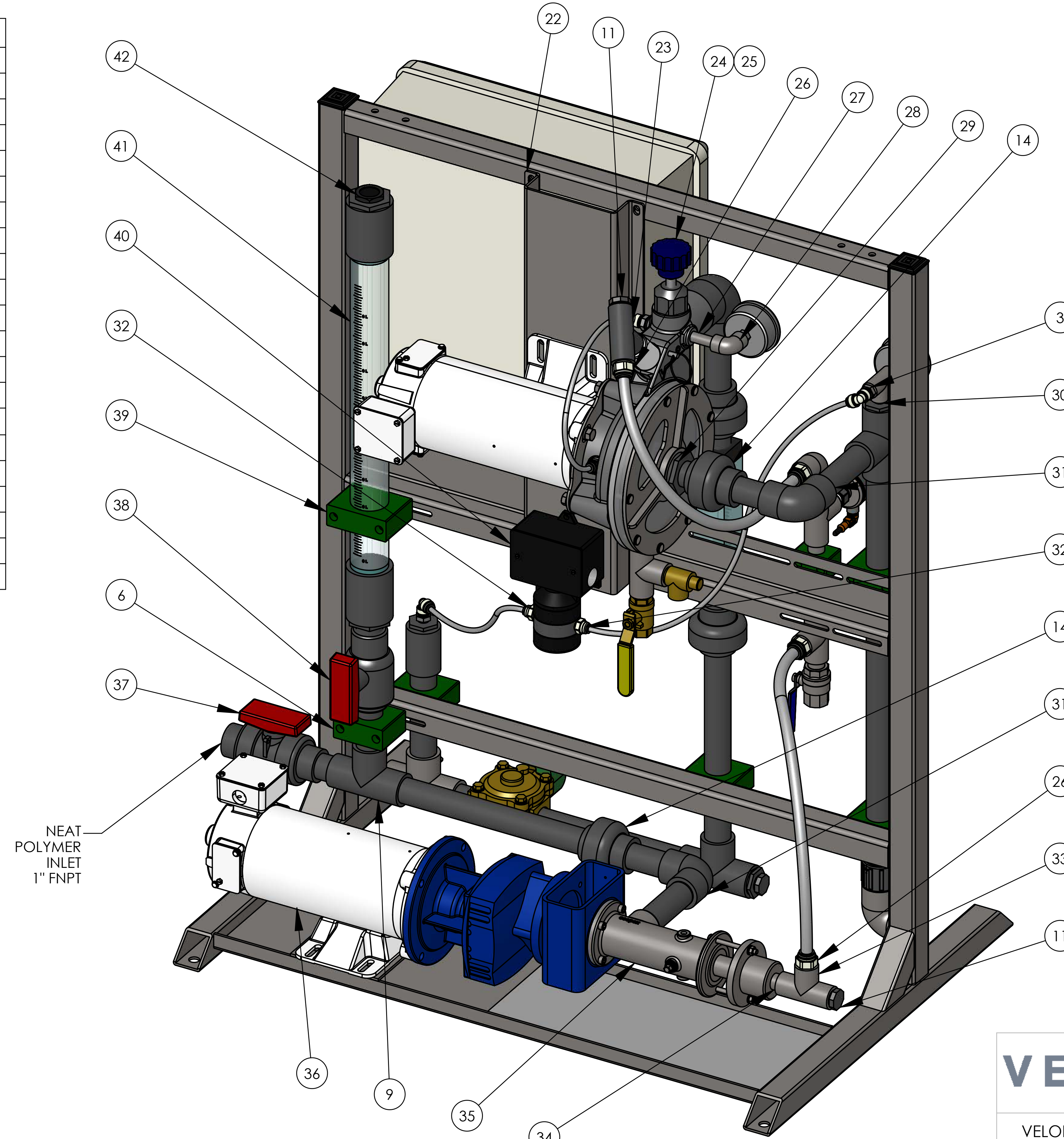
VELOBLEND, VM-5P-1200-D-0-A-1

SIZE B DWG. NO. 300-1108 REV. A

SCALE 1:6 CAD FILE: SHEET 1 OF 3

ITEM #	NUMBER	DESCRIPTION	QTY
22	158-0426	BRACKET, MIXER MOUNT, VELOBLEND, UNIVERSAL	1
23	194-0304	TEE, 1/2", T X T X T, SCH 80, PVC	1
24	200-0399	VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90VDC	1
25	200-0045	ORIFICE, THROTTLE VALVE, .385", 20 GPM, 6" BLENDER	1
26	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
27	194-0634	NIPPLE, 1/4" X 2.00 L, 304	1
28	194-0055	ELBOW, 90, 1/4", TXT, 304	1
29	194-0688	REDUCER, BUSHING, 1.5" X 1", TXT, SCH 80, PVC	1
30	194-0023	NIPPLE, 1/4" X CLOSE, 304	1
31	194-0621	ELBOW, 90, 1", S X S, SCH 80, PVC	2
32	194-0641	ADAPTER, 1/4" TUBE - 1/4 MNPT, ACETAL	2
33	194-0021	TEE, 1/2" FNPT, 304	1
34	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
35	215-0087	PUMP, PROG CAV, .25 - 5 GPH, 3.15:1, SS/VITON	1
36	191-0001	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56 C, WASH DOWN	1
37	248-0004	VALVE, BALL, 1" SOC - 1" FNPT, TRUE UNION, PVC/VITON	1
38	248-0012	VALVE, BALL, 1" SOC, COMPACT, PVC/VITON	1
39	194-0026	CLAMP, PIPE, 1.5", STAUFF	1
40	182-0272	SWITCH, PRESSURE DIFF, ASHCROFT, D4-24-B-60PSI	1
41	110-0003	CALIBRATION COLUMN, 500 ML, 1" FNPT	1
42	194-1976	VENT, BREATHER, POLYPROPYLENE, 1" MNPT	1

NOTE: DRAWINGS ARE FOR GENERAL LAYOUT USE ONLY. SEE PROPOSAL FOR DETAILS OF THE PROPOSED SCOPE OF SUPPLY.

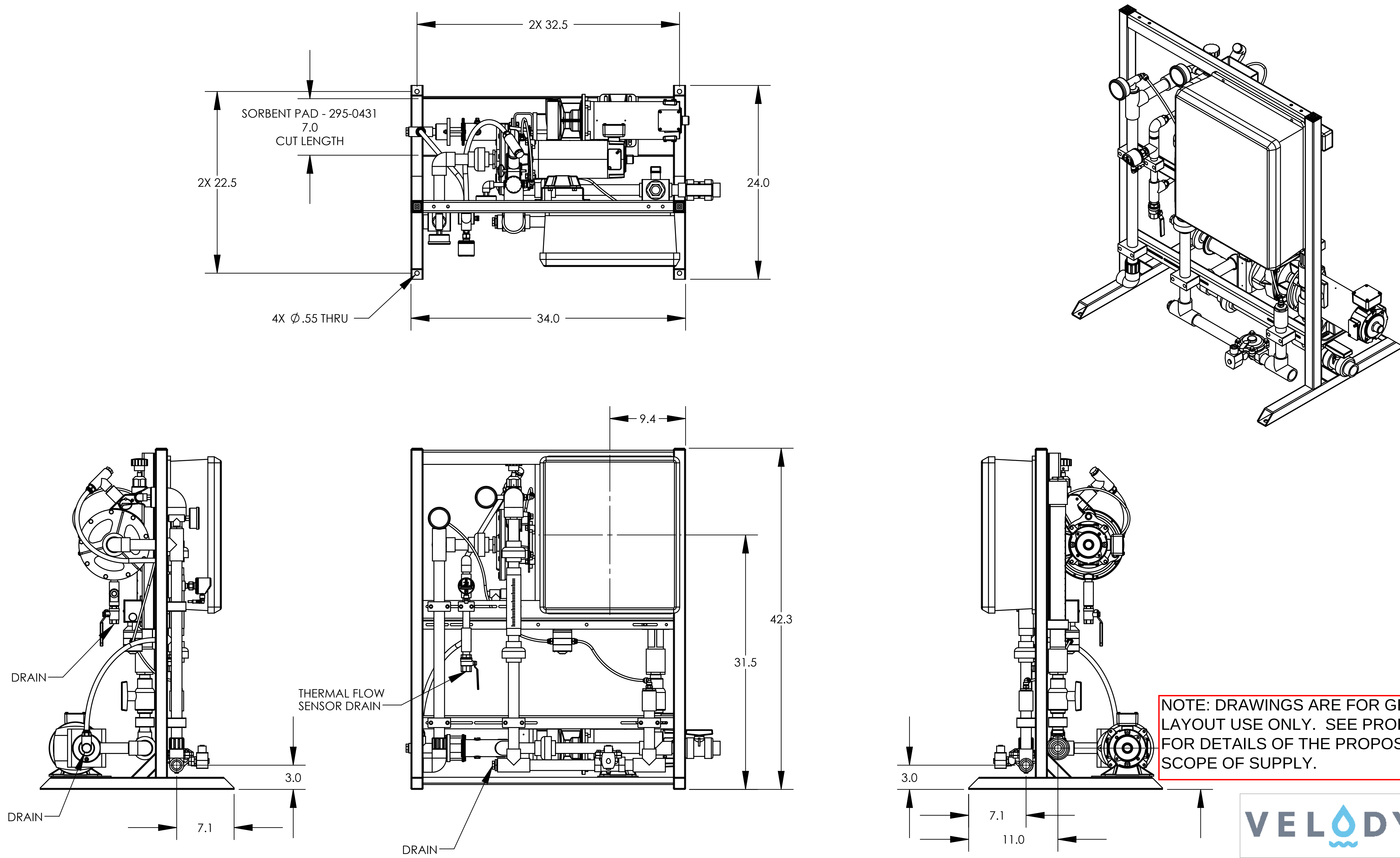


VELODYNE

VELOBLEND, VM-5P-1200-D-0-A-1

SIZE B | DWG. NO. 300-1108 | REV. A

SCALE 1:6 | DO NOT SCALE DRAWING | SHEET 2 OF 3



NOTE: DRAWINGS ARE FOR GENERAL LAYOUT USE ONLY. SEE PROPOSAL FOR DETAILS OF THE PROPOSED SCOPE OF SUPPLY.

VELODYNE

VELOBLEND, VM-5P-1200-D-0-A-1

SIZE	DWG. NO.	REV.
B	300-1108	A
SCALE 1:12	DO NOT SCALE DRAWING	SHEET 3 OF 3

Attachment D: Cost Estimate

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 1 - Andritz

Building:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No.: 2276008*00

Estimate Type:

- ■ **Conceptual**
- □ **Preliminary (w/o plans)**
- □ **Design Development @ __% Complete**
- □ **Construction**
- □ **Change Order**

Current at ENR 13,167.84
Escalated to ENR
Mos. to Midpoint 18

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
1	Demo		0	22,000	0	22,000
2	Temporary Dewatering Skid		0	66,000	19,800	85,800
3	Concrete		5,000	3,500	0	8,500
4	Metals		0	0	0	0
5	High Performance Coatings		15,000	3,750	0	18,750
6	Signage		500	500	0	1,000
7	Centrifuges, Polymer		640,000	160,000	240,000	1,040,000
9	Conveyors		86,400	21,600	32,400	140,400
10	Spare Parts		20,000	0	0	20,000
11	Piping		220,000	55,000	0	275,000
12	Flow Meters		14,112	3,528	5,292	22,932
	Subtotals		1,001,012	335,878	297,492	1,634,382
	Contractor Indirects	12%	120,121	40,305	35,699	196,126
	Subtotals		1,121,133	376,183	333,191	1,830,508
	Contractor OH&P @	15%	168,170	56,428	49,979	274,576
	Subtotals		1,289,303	432,611	383,170	2,105,084
	Estimate Contingency @	25%				526,271
	Subtotal					2,631,355
	Escalation to Mid-Pt of Construction	6.5%				256,557
	Estimated Bid Price					2,887,912
	Market Conditions Contingency	10.0%				288,791
	Estimated Bid Price					3,176,703
	Engineering, Administrative, Permits, Legal	38%				1,207,147
	Total Estimate					**$4,400,000**

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$6,160,000	**$4,400,000**	**$3,520,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 1 - Andritz

Building, Area:

Prepared By:	BIB
Date Prepared:	8.22.2022
K/J Proj. No.	2276008*00
Current at ENR	13,167.84
Escalated to ENR	
Months to Midpoint of Construct	18

Estimate Type: ■ **Conceptual** ☐ **Preliminary (w/o plans)** ☐ **Design Development @** ☐ **Construction** ☐ **Change Order** **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 1						0.00		0.00		0.00	0.00
DIVISION 2 - SITE WORK											
	Demo										
		Remove centrifuges, conveyors, polymer system, controls	1	LS			20,000.00	20,000.00			20,000.00
		Haul	1	LS			1,000.00	1,000.00			1,000.00
		Disposal	1	LS			1,000.00	1,000.00			1,000.00
	Temporary										
		Dewatering Skid and Temp connections	6	Mo.	0.00	0.00	0.00	0.00	11,000.00	66,000.00	66,000.00
SUBTOTAL - DIVISION 2						0.00		22,000.00		66,000.00	88,000.00
DIVISION 3 - CONCRETE											
Equipment Bases											
		Concrete Base Slab on Grade	10	CY	300.00	3,000.00	300.00	3,000.00	0.00	0.00	6,000.00
		Grout at Equipment Bases	1	LS	2,000.00	2,000.00	500.00	500.00	0.00	0.00	2,500.00
SUBTOTAL - DIVISION 3						5,000.00		3,500.00		0.00	8,500.00
DIVISION 4 - MASONRY						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 4						0.00		0.00		0.00	0.00
DIVISION 5 - METALS						0.00		0.00		0.00	0.00
Centrifuges											
		Dewatering Belt Modifications	0	LS	50,000.00	0.00	12,500.00	0.00	0.00	0.00	0.00
SUBTOTAL - DIVISION 5						0.00		0.00		0.00	0.00
DIVISION 6 - WOOD AND PLASTICS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 6						0.00		0.00		0.00	0.00
DIVISION 7 - THERMAL AND MOISTURE PROTECTION						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 7						0.00		0.00		0.00	0.00
DIVISION 8 - DOORS AND WINDOWS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 8						0.00		0.00		0.00	0.00
DIVISION 9 - FINISHES						0.00		0.00		0.00	0.00
		Concrete Finishes	1	LS	5,000.00	5,000.00	1,250.00	1,250.00	0.00	0.00	6,250.00
		Piping Coatings	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 9						15,000.00		3,750.00		0.00	18,750.00
DIVISION 10 - SPECIALTIES						0.00		0.00		0.00	0.00
		Misc. signage	1	LS	500.00	500.00	500.00	500.00		0.00	1,000.00
SUBTOTAL - DIVISION 10						500.00		500.00		0.00	1,000.00
DIVISION 11 - EQUIPMENT						0.00		0.00		0.00	0.00
Centrifuge Replacement (Andritz)						0.00		0.00		0.00	0.00
		Centrifuges, includes:	1	LS	640,000.00	640,000.00	160,000.00	160,000.00	0.00	0.00	800,000.00
		Stands									
		Polymer System									
		Conveyors	1	LS	86,400.00	86,400.00	21,600.00	21,600.00	0.00	0.00	108,000.00
		Spare Parts	1	LS	20,000.00	20,000.00	0.00	0.00	0.00	0.00	20,000.00
SUBTOTAL - DIVISION 11						746,400.00		181,600.00		0.00	928,000.00
DIVISION 12 - FURNISHINGS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 12						0.00		0.00		0.00	0.00
DIVISION 13 - SPECIAL CONSTRUCTIONS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 13						0.00		0.00		0.00	0.00
DIVISION 14 - CONVEYING SYSTEMS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 14						0.00		0.00		0.00	0.00
DIVISION 15 -MECHANICAL						0.00		0.00		0.00	0.00
Process Piping											
		Feed Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		3W Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
		Centrate Piping	1	LS	100,000.00	100,000.00	25,000.00	25,000.00	0.00	0.00	125,000.00
		Vent Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		Polymer Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 15						220,000.00		55,000.00		0.00	275,000.00
DIVISION 16 - ELECTRICAL		Note: Electrical costs are estimated to be 30% of the construction subtotal amount.				0.00		0.00		0.00	0.00
		Electrical Materials, Installation and Subcontractor	1	LS	0.00	0.00	0.00	0.00	297,492.00	297,492.00	297,492.00
SUBTOTAL - DIVISION 16						0.00		0.00		297,492.00	297,492.00
DIVISION 17 - INSTRUMENTATION											
	Centrifuges										
		Flowmeters	2	EA	7,056.00	14,112.00	1,764.00	3,528.00	0.00	0.00	17,640.00
SUBTOTAL - DIVISION 17						14,112.00		3,528.00		0.00	17,640.00
AREA TOTAL						1,001,012.00		335,878.00		297,492.00	1,634,382.00

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 1 - Centrisys

Building:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No.: 2276008*00

Estimate Type:

- [x] **Conceptual**
- [ ] **Construction**
- [ ] **Preliminary (w/o plans)**
- [ ] **Change Order**
- [ ] **Design Development @ __% Complete**

Current at ENR 13,167.84
Escalated to ENR
Mos. to Midpoint 18

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
1	Demo		0	22,000	0	22,000
2	Temporary Dewatering Skid		0	66,000	19,800	85,800
3	Concrete		5,000	3,500	0	8,500
4	Metals		0	0	0	0
5	High Performance Coatings		15,000	3,750	0	18,750
6	Signage		500	500	0	1,000
7	Centrifuges, Polymer		777,340	194,335	291,503	1,263,178
9	Conveyors		63,560	15,890	23,835	103,285
10	Spare Parts		20,000	0	0	20,000
11	Piping		220,000	55,000	0	275,000
12	Flow Meters		14,112	3,528	5,292	22,932
	Subtotals		1,115,512	364,503	340,430	1,820,445
	Contractor Indirects	12%	133,861	43,740	40,852	218,453
	Subtotals		1,249,373	408,243	381,281	2,038,898
	Contractor OH&P @	15%	187,406	61,237	57,192	305,835
	Subtotals		1,436,779	469,480	438,473	2,344,733
	Estimate Contingency @	25%				586,183
	Subtotal					2,930,916
	Escalation to Mid-Pt of Construction	6.5%				285,764
	Estimated Bid Price					3,216,680
	Market Conditions Contingency	10.0%				321,668
	Estimated Bid Price					3,538,348
	Engineering, Administrative, Permits, Legal	38%				1,344,572
	Total Estimate					**$4,900,000**

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$6,860,000	**$4,900,000**	**$3,920,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 1 - Centrisys

Building, Area:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No. 2276008*00

Current at ENR 13,167.84
Escalated to ENR
Months to Midpoint of Construct 18

Estimate Type: ■ **Conceptual** ☐ **Preliminary (w/o plans)** ☐ **Design Development @** ☐ **Construction** ☐ **Change Order** **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 1						0.00		0.00		0.00	0.00
DIVISION 2 - SITE WORK											
	Demo										
		Remove centrifuges, conveyors, polymer system, controls	1	LS			20,000.00	20,000.00			20,000.00
		Haul	1	LS			1,000.00	1,000.00			1,000.00
		Disposal	1	LS			1,000.00	1,000.00			1,000.00
	Temporary										
		Dewatering Skid and Temp connections	6	Mo.	0.00	0.00	0.00	0.00	11,000.00	66,000.00	66,000.00
SUBTOTAL - DIVISION 2						0.00		22,000.00		66,000.00	88,000.00
DIVISION 3 - CONCRETE											
Equipment Bases											
		Concrete Base Slab on Grade	10	CY	300.00	3,000.00	300.00	3,000.00	0.00	0.00	6,000.00
		Grout at Equipment Bases	1	LS	2,000.00	2,000.00	500.00	500.00	0.00	0.00	2,500.00
SUBTOTAL - DIVISION 3						5,000.00		3,500.00		0.00	8,500.00
DIVISION 4 - MASONRY						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 4						0.00		0.00		0.00	0.00
DIVISION 5 - METALS						0.00		0.00		0.00	0.00
Centrifuges											
		Dewatering Belt Modifications	0	LS	50,000.00	0.00	12,500.00	0.00	0.00	0.00	0.00
SUBTOTAL - DIVISION 5						0.00		0.00		0.00	0.00
DIVISION 6 - WOOD AND PLASTICS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 6						0.00		0.00		0.00	0.00
DIVISION 7 - THERMAL AND MOISTURE PROTECTION						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 7						0.00		0.00		0.00	0.00
DIVISION 8 - DOORS AND WINDOWS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 8						0.00		0.00		0.00	0.00
DIVISION 9 - FINISHES						0.00		0.00		0.00	0.00
		Concrete Finishes	1	LS	5,000.00	5,000.00	1,250.00	1,250.00	0.00	0.00	6,250.00
		Piping Coatings	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 9						15,000.00		3,750.00		0.00	18,750.00
DIVISION 10 - SPECIALTIES						0.00		0.00		0.00	0.00
		Misc. signage	1	LS	500.00	500.00	500.00	500.00		0.00	1,000.00
SUBTOTAL - DIVISION 10						500.00		500.00		0.00	1,000.00
DIVISION 11 - EQUIPMENT						0.00		0.00		0.00	0.00
Centrifuge Replacement (Centrisys)						0.00		0.00		0.00	0.00
		Centrifuges, includes:	1	LS	777,340.00	777,340.00	194,335.00	194,335.00	0.00	0.00	971,675.00
		Stands									
		Polymer System									
		Conveyors	1	LS	63,560.00	63,560.00	15,890.00	15,890.00	0.00	0.00	79,450.00
		Spare Parts	1	LS	20,000.00	20,000.00	0.00	0.00	0.00	0.00	20,000.00
SUBTOTAL - DIVISION 11						860,900.00		210,225.00		0.00	1,071,125.00
DIVISION 12 - FURNISHINGS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 12						0.00		0.00		0.00	0.00
DIVISION 13 - SPECIAL CONSTRUCTIONS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 13						0.00		0.00		0.00	0.00
DIVISION 14 - CONVEYING SYSTEMS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 14						0.00		0.00		0.00	0.00
DIVISION 15 -MECHANICAL						0.00		0.00		0.00	0.00
Process Piping											
		Feed Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		3W Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
		Centrate Piping	1	LS	100,000.00	100,000.00	25,000.00	25,000.00	0.00	0.00	125,000.00
		Vent Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		Polymer Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 15						220,000.00		55,000.00		0.00	275,000.00
DIVISION 16 - ELECTRICAL		Note: Electrical costs are estimated to be 30% of the construction subtotal amount.				0.00		0.00		0.00	0.00
		Electrical Materials, Installation and Subcontractor	1	LS	0.00	0.00	0.00	0.00	340,429.50	340,429.50	340,429.50
SUBTOTAL - DIVISION 16						0.00		0.00		340,429.50	340,429.50
DIVISION 17 - INSTRUMENTATION											
	Centrifuges										
		Flowmeters	2	EA	7,056.00	14,112.00	1,764.00	3,528.00	0.00	0.00	17,640.00
SUBTOTAL - DIVISION 17						14,112.00		3,528.00		0.00	17,640.00
AREA TOTAL						1,115,512.00		364,503.00		340,429.50	1,820,444.50

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 2 - Andritz

Building:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No.: 2276008*00

Estimate Type:

- [x] **Conceptual**
- [ ] **Construction**
- [ ] **Preliminary (w/o plans)**
- [ ] **Change Order**
- [ ] **Design Development @ __% Complete**

Current at ENR 13,167.84
Escalated to ENR
Mos. to Midpoint 18

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
1	Demo		0	22,000	0	22,000
2	Temporary Dewatering Skid		0	66,000	19,800	85,800
3	Concrete		5,000	3,500	0	8,500
4	Metals		50,000	12,500	0	62,500
5	High Performance Coatings		15,000	3,750	0	18,750
6	Signage		500	500	0	1,000
7	Centrifuges, Polymer, Conveyors		946,400	236,600	354,900	1,537,900
10	Spare Parts		20,000	0	0	20,000
11	Piping		220,000	55,000	0	275,000
12	Flow Meters		14,112	3,528	5,292	22,932
	Subtotals		1,271,012	403,378	379,992	2,054,382
	Contractor Indirects	12%	152,521	48,405	45,599	246,526
	Subtotals		1,423,533	451,783	425,591	2,300,908
	Contractor OH&P @	15%	213,530	67,768	63,839	345,136
	Subtotals		1,637,063	519,551	489,430	2,646,044
	Estimate Contingency @	25%				661,511
	Subtotal					3,307,555
	Escalation to Mid-Pt of Construction	6.5%				322,487
	Estimated Bid Price					3,630,042
	Market Conditions Contingency	10.0%				363,004
	Estimated Bid Price					3,993,046
	Engineering, Administrative, Permits, Legal	38%				1,517,357
	Total Estimate					**$5,600,000**

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$7,840,000	**$5,600,000**	**$4,480,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 2 - Andritz

Building, Area:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No. 2276008*00

Current at ENR 13,167.84
Escalated to ENR
Months to Midpoint of Construct 18

Estimate Type: ■ **Conceptual** ☐ **Preliminary (w/o plans)** ☐ **Design Development @** ☐ **Construction** ☐ **Change Order** **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 1						0.00		0.00		0.00	0.00
DIVISION 2 - SITE WORK											
	Demo										
		Remove centrifuges, conveyors, polymer system, controls	1	LS			20,000.00	20,000.00			20,000.00
		Haul	1	LS			1,000.00	1,000.00			1,000.00
		Disposal	1	LS			1,000.00	1,000.00			1,000.00
	Temporary										
		Dewatering Skid and Temp connections	6	Mo.	0.00	0.00	0.00	0.00	11,000.00	66,000.00	66,000.00
SUBTOTAL - DIVISION 2						0.00		22,000.00		66,000.00	88,000.00
DIVISION 3 - CONCRETE											
Equipment Bases											
		Concrete Base Slab on Grade	10	CY	300.00	3,000.00	300.00	3,000.00	0.00	0.00	6,000.00
		Grout at Equipment Bases	1	LS	2,000.00	2,000.00	500.00	500.00	0.00	0.00	2,500.00
SUBTOTAL - DIVISION 3						5,000.00		3,500.00		0.00	8,500.00
DIVISION 4 - MASONRY						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 4						0.00		0.00		0.00	0.00
DIVISION 5 - METALS						0.00		0.00		0.00	0.00
	Centrifuges										
		Dewatering Belt Modifications	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
SUBTOTAL - DIVISION 5						50,000.00		12,500.00		0.00	62,500.00
DIVISION 6 - WOOD AND PLASTICS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 6						0.00		0.00		0.00	0.00
DIVISION 7 - THERMAL AND MOISTURE PROTECTION						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 7						0.00		0.00		0.00	0.00
DIVISION 8 - DOORS AND WINDOWS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 8						0.00		0.00		0.00	0.00
DIVISION 9 - FINISHES						0.00		0.00		0.00	0.00
		Concrete Finishes	1	LS	5,000.00	5,000.00	1,250.00	1,250.00	0.00	0.00	6,250.00
		Piping Coatings	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 9						15,000.00		3,750.00		0.00	18,750.00
DIVISION 10 - SPECIALTIES						0.00		0.00		0.00	0.00
		Misc. signage	1	LS	500.00	500.00	500.00	500.00		0.00	1,000.00
SUBTOTAL - DIVISION 10						500.00		500.00		0.00	1,000.00
DIVISION 11 - EQUIPMENT						0.00		0.00		0.00	0.00
Centrifuge Replacement (Andritz)						0.00		0.00		0.00	0.00
		Centrifuges, includes:	1	LS	946,400.00	946,400.00	236,600.00	236,600.00	0.00	0.00	1,183,000.00
		Stands									
		Polymer System									
		Conveyors									
		Spare Parts	1	LS	20,000.00	20,000.00	0.00	0.00	0.00	0.00	20,000.00
SUBTOTAL - DIVISION 11						966,400.00		236,600.00		0.00	1,203,000.00
DIVISION 12 - FURNISHINGS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 12						0.00		0.00		0.00	0.00
DIVISION 13 - SPECIAL CONSTRUCTIONS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 13						0.00		0.00		0.00	0.00
DIVISION 14 - CONVEYING SYSTEMS						0.00		0.00		0.00	0.00
						0.00		0.00		0.00	0.00
SUBTOTAL - DIVISION 14						0.00		0.00		0.00	0.00
DIVISION 15 -MECHANICAL						0.00		0.00		0.00	0.00
	Process Piping										
		Feed Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		3W Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
		Centrate Piping	1	LS	100,000.00	100,000.00	25,000.00	25,000.00	0.00	0.00	125,000.00
		Vent Piping	1	LS	50,000.00	50,000.00	12,500.00	12,500.00	0.00	0.00	62,500.00
		Polymer Piping	1	LS	10,000.00	10,000.00	2,500.00	2,500.00	0.00	0.00	12,500.00
SUBTOTAL - DIVISION 15						220,000.00		55,000.00		0.00	275,000.00
DIVISION 16 - ELECTRICAL		Note: Electrical costs are estimated to be 30% of the construction subtotal amount.				0.00		0.00		0.00	0.00
		Electrical Materials, Installation and Subcontractor	1	LS	0.00	0.00	0.00	0.00	379,992.00	379,992.00	379,992.00
SUBTOTAL - DIVISION 16						0.00		0.00		379,992.00	379,992.00
DIVISION 17 - INSTRUMENTATION											
	Centrifuges										
		Flowmeters	2	EA	7,056.00	14,112.00	1,764.00	3,528.00	0.00	0.00	17,640.00
SUBTOTAL - DIVISION 17						14,112.00		3,528.00		0.00	17,640.00
AREA TOTAL						1,271,012.00		403,378.00		379,992.00	2,054,382.00

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 2 - Centrisys

Building:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No.: 2276008*00

Estimate Type:

- ■ **Conceptual**
- ☐ **Construction**
- ☐ **Preliminary (w/o plans)**
- ☐ **Change Order**
- ☐ **Design Development @ __% Complete**

Current at ENR 13,167.84
Escalated to ENR
Mos. to Midpoint 18

SUMMARY BY DIVISION

Item No.	ITEM DESCRIPTION		MATERIALS	INSTALLATION	SUB-CONTRACTOR (E&I/C)	TOTAL
1	Demo		0	22,000	0	22,000
2	Temporary Dewatering Skid		0	66,000	19,800	85,800
3	Concrete		5,000	3,500	0	8,500
4	Metals		50,000	12,500	0	62,500
5	High Performance Coatings		15,000	3,750	0	18,750
6	Signage		500	500	0	1,000
7	Centrifuges		1,028,620	257,155	369,563	1,655,338
8	Polymer System		21,756	5,439	8,159	35,354
9	Conveyors		66,500	16,625	24,938	108,063
10	Spare Parts		20,000	0	0	20,000
11	Piping		220,000	55,000	0	275,000
12	Flow Meters		14,112	3,528	5,292	22,932
	Subtotals		1,441,488	445,997	427,751	2,315,236
	Contractor Indirects	12%	172,979	53,520	51,330	277,828
	Subtotals		1,614,467	499,517	479,081	2,593,064
	Contractor OH&P @	15%	242,170	74,928	71,862	388,960
	Subtotals		1,856,637	574,444	550,943	2,982,023
	Estimate Contingency @	25%				745,506
	Subtotal					3,727,529
	Escalation to Mid-Pt of Construction	6.5%				363,434
	Estimated Bid Price					4,090,963
	Market Conditions Contingency	10.0%				409,096
	Estimated Bid Price					4,500,060
	Engineering, Administrative, Permits, Legal	38%				1,710,023
	Total Estimate					**$6,300,000**

Estimate Accuracy	
+40%	-20%

Estimated Range of Probable Cost		
+40%	Total Est.	-20%
$8,820,000	**$6,300,000**	**$5,040,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS**

Project: Newport Centrifuge Replacement - Scenario 2 - Centrisys

Building, Area:

Prepared By: BIB
Date Prepared: 8.22.2022
K/J Proj. No. 2276008*00

Current at ENR 13,167.84
Escalated to ENR
Months to Midpoint of Construct 18

Estimate Type: ■ **Conceptual** ☐ **Preliminary (w/o plans)** ☐ **Design Development @** ☐ **Construction** ☐ **Change Order** **% Complete**

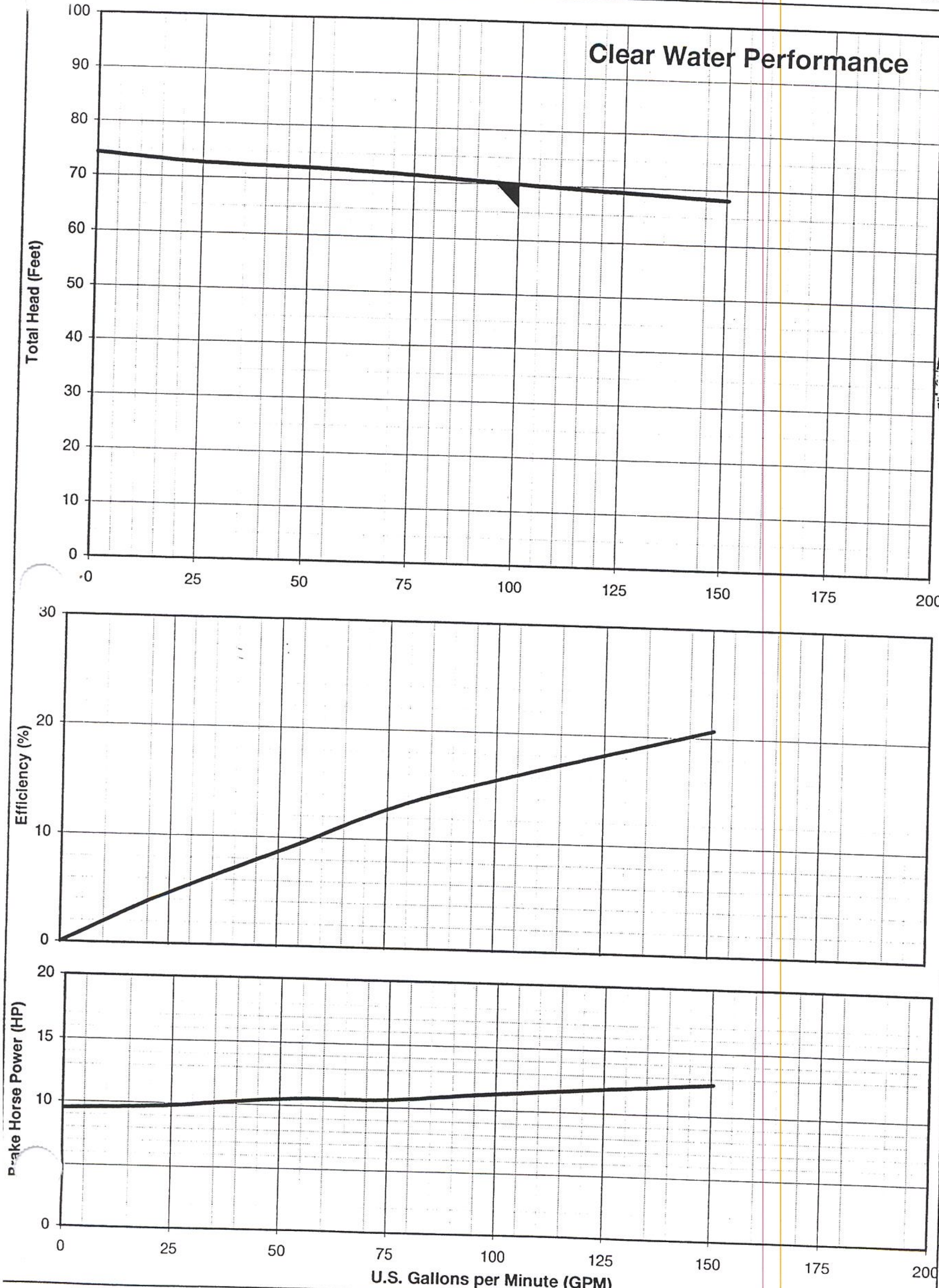
Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0		0		0	0
SUBTOTAL - DIVISION 1						0		0		0	0
DIVISION 2 - SITE WORK											
	Demo										
		Remove centrifuges, conveyors, polymer system, controls	1	LS			20,000.00	20,000			20,000
		Haul	1	LS			1,000.00	1,000			1,000
		Disposal	1	LS			1,000.00	1,000			1,000
	Temporary										
		Dewatering Skid and Temp connections	6	Mo.	0.00	0	0.00	0	11,000	66,000	66,000
SUBTOTAL - DIVISION 2						0		22,000		66,000	88,000
DIVISION 3 - CONCRETE											
	Equipment Bases										
		Concrete Base Slab on Grade	10	CY	300.00	3,000	300.00	3,000	0	0	6,000
		Grout at Equipment Bases	1	LS	2,000.00	2,000	500.00	500	0	0	2,500
SUBTOTAL - DIVISION 3						5,000		3,500		0	8,500
DIVISION 4 - MASONRY						0		0		0	0
SUBTOTAL - DIVISION 4						0		0		0	0
DIVISION 5 - METALS						0		0		0	0
	Centrifuges										
		Dewatering Belt Modifications	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
SUBTOTAL - DIVISION 5						50,000		12,500		0	62,500
DIVISION 6 - WOOD AND PLASTICS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 6						0		0		0	0
DIVISION 7 - THERMAL AND MOISTURE PROTECTION						0		0		0	0
SUBTOTAL - DIVISION 7						0		0		0	0
DIVISION 8 - DOORS AND WINDOWS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 8						0		0		0	0
DIVISION 9 - FINISHES						0		0		0	0
		Concrete Finishes	1	LS	5,000.00	5,000	1,250.00	1,250	0	0	6,250
		Piping Coatings	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
SUBTOTAL - DIVISION 9						15,000		3,750		0	18,750
DIVISION 10 - SPECIALTIES						0		0		0	0
		Misc. signage	1	LS	500.00	500	500.00	500		0	1,000
SUBTOTAL - DIVISION 10						500		500		0	1,000
DIVISION 11 - EQUIPMENT						0		0		0	0
Centrifuge Replacement (Centrisys)						0		0		0	0
		Centrifuges, includes:	1	LS	985,500	985,500	246,375	246,375	0	0	1,231,875
		Power run-through option									
		Remote monitoring									
		Extended 15-year scroll warranty									
		Hydraulic Containment Pans									
		Stands	2	EA	21,560	43,120	5,390	10,780	0	0	53,900
		Polymer System	1	EA	21,756.00	21,756	5,439	5,439	0	0	27,195
		Conveyors	1	LS	66,500.00	66,500	16,625	16,625	0	0	83,125
		Spare Parts	1	LS	20,000.00	20,000	0	0	0	0	20,000
SUBTOTAL - DIVISION 11						1,136,876		279,219		0	1,416,095
DIVISION 12 - FURNISHINGS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 12						0		0		0	0
DIVISION 13 - SPECIAL CONSTRUCTIONS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 13						0		0		0	0
DIVISION 14 - CONVEYING SYSTEMS						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 14						0		0		0	0
DIVISION 15 -MECHANICAL						0		0		0	0
	Process Piping										
		Feed Piping	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
		3W Piping	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
		Centrate Piping	1	LS	100,000.00	100,000	25,000.00	25,000	0	0	125,000
		Vent Piping	1	LS	50,000.00	50,000	12,500.00	12,500	0	0	62,500
		Polymer Piping	1	LS	10,000.00	10,000	2,500.00	2,500	0	0	12,500
SUBTOTAL - DIVISION 15						220,000		55,000		0	275,000
DIVISION 16 - ELECTRICAL		Note: Electrical costs are estimated to be 30% of the construction subtotal amount.				0		0		0	0
		Electrical Materials, Installation and Subcontractor	1	LS	$0.00	$0	$0.00	$0	$427,751	$427,750.50	$427,751
SUBTOTAL - DIVISION 16						0		0		427,751	427,751
DIVISION 17 - INSTRUMENTATION											
	Centrifuges										
		Flowmeters	2	EA	$7,056.00	14,112	$1,764.00	3,528	$0.00	0	17,640
SUBTOTAL - DIVISION 17						14,112		3,528		0	17,640
AREA TOTAL						1,441,488		445,997		427,751	2,315,236

Attachment E: Dewatering Feed Pump Curve

WEMCO PUMP 3 x 3 Model C

WEIR SPECIALTY PUMPS

440 W. 800 S. Salt Lake City, Utah 84110
Phone: (801) 359-8731 Fax: (801) 355-9303



SALES ORDER NO: DW03292

RPM: 1309

Exp 12/31/03

Customer: Slayden Construction, Inc.

Customer PO. 221-11314

Pump ID

Certified

BASED ON: TEST

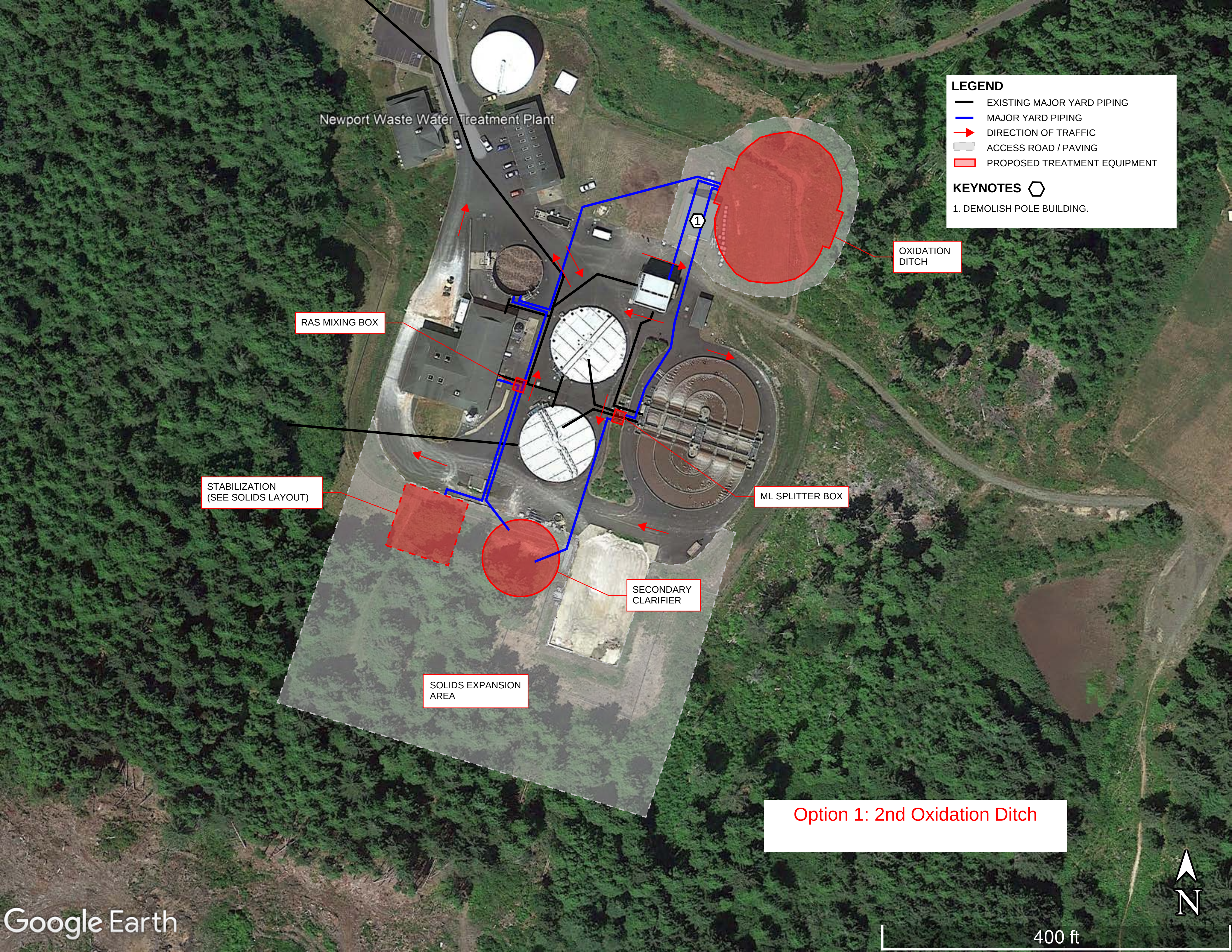
DATE: 9/20/01

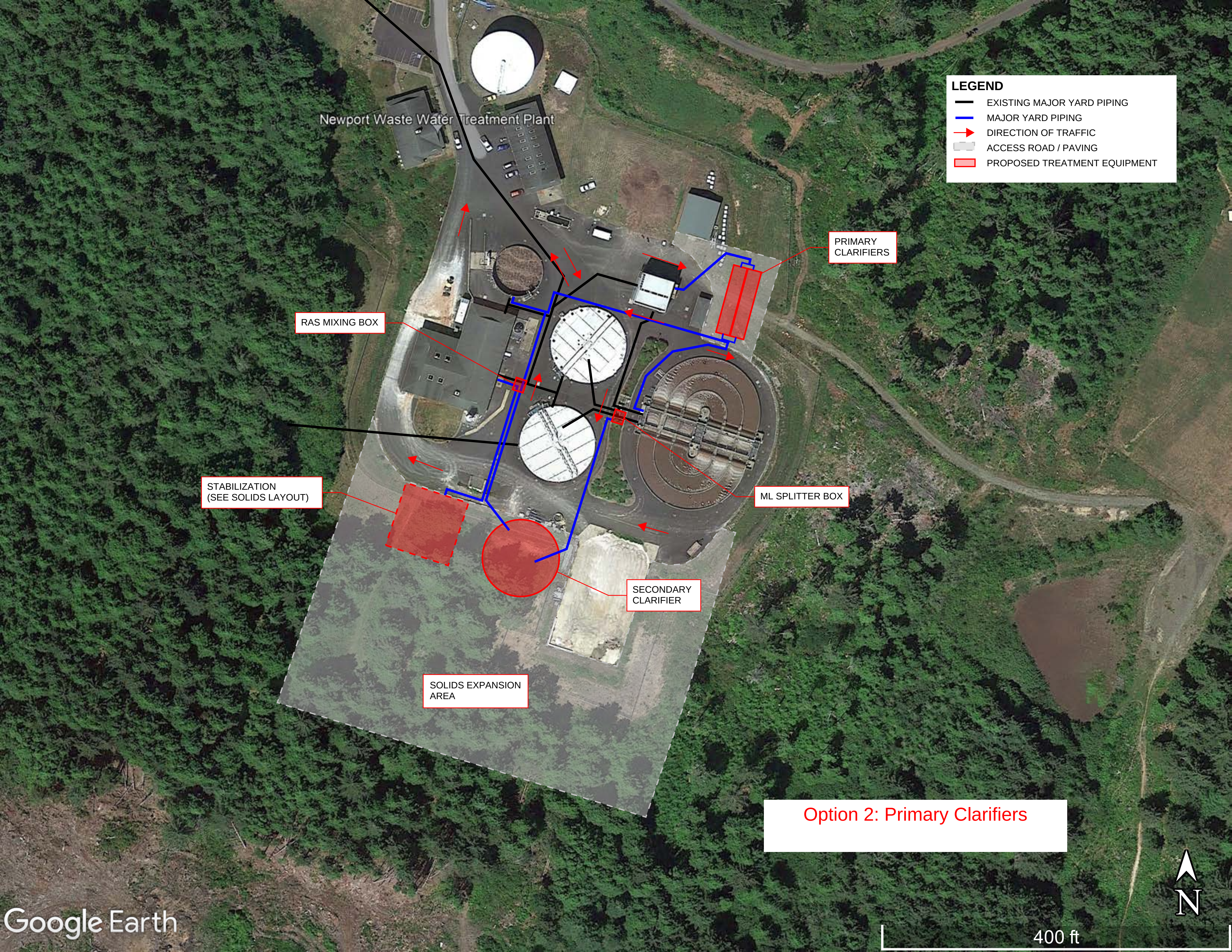
SERIAL NO.: 01DW03292-01

TEST NO.: 12214-1-0

Impeller Size: Full

Appendix F Alternative Site Plans


Newport Waste Water Treatment Plant
LEGEND
EXISTING MAJOR YARD PIPING
MAJOR YARD PIPING
DIRECTION OF TRAFFIC
ACCESS ROAD / PAVING
PROPOSED TREATMENT EQUIPMENT
KEYNOTES
1. DEMOLISH POLE BUILDING.
1
OXIDATION DITCH
RAS MIXING BOX
STABILIZATION (SEE SOLIDS LAYOUT)
ML SPLITTER BOX
SECONDARY CLARIFIER
SOLIDS EXPANSION AREA
Option 1: 2nd Oxidation Ditch
Google Earth
N
400 ft



LEGEND
EXISTING MAJOR YARD PIPING
MAJOR YARD PIPING
DIRECTION OF TRAFFIC
ACCESS ROAD / PAVING
PROPOSED TREATMENT EQUIPMENT
Newport Waste Water Treatment Plant
PRIMARY CLARIFIERS
RAS MIXING BOX
STABILIZATION (SEE SOLIDS LAYOUT)
ML SPLITTER BOX
SECONDARY CLARIFIER
SOLIDS EXPANSION AREA
Option 2: Primary Clarifiers
Google Earth
N
400 ft

Appendix G Alternatives Workshop Meeting Minutes

Meeting Minutes

Brown AND Caldwell

Street Address
City, ST Zip

T: 503.244.7005
F: 503.244.9095

Prepared for: City of Newport
Project Title: WWTP Master Plan
Project No.: 158211 / Task Order 26

Purpose of Meeting: Alternatives Evaluation Workshop | **Date:** April 25, 2023
Meeting Location: Vance Avery WWTP | **Time:** 10:00 a.m. – 2:00 p.m.
Minutes Prepared by: Jennifer Kersh, BC

Attendees:
David Powell, Newport
Aaron Collett, Newport
A. Grant, Newport
Clare Paul, Newport
Mark Strahota, BC
Josh Johnson, BC
Greg Humm, BC
Jennifer Kersh, BC
Holly Tichenor, BC
Adam Klein, BC
Mark Cullington, KJ
Ben Bosse, KJ

The notes below summarize key discussions with City of Newport staff:

<u>General/Schedule</u>

1. Dave Powell will present to city council on June 5 to advocate for funding required for the WWTP improvements. Council is aware approximately $60 million is planned.
2. Dave has 5-10 minutes to present the latest information from the master planning effort.
3. BC offered to prepare a short presentation for the upcoming meeting.
4. Rates will be raised by about 12% at the end of June with potentially more increases into the future.
5. Clare recommended uploading a draft master plan report online for public comment when ready.

<u>Critical Success Factors</u>

1. Add communication of the need and urgency of upgrades as a CSF.
    a. Public outreach needed for rate increase.

<u>Flows and Loads</u>

1. Loading to the WWTP is expected to increase by about 12% by 2040.
2. As discussed previously, Newport is subject to a sharp increase in flows and loads during the summer months and holiday weekends due to increases in tourism.
3. Additional development is expected even in areas that appear “undevelopable” due to steep slopes (this is largely driven by a tight housing market).

4. Base flow forecasts are based on permanent residents, but peak flows are tourism driven – i.e. peak BOD load occurs on summer holiday weekends.
5. BC will include a discussion regarding major industry/tourism influences in the master plan.
6. Aaron recommended these concepts be distilled down to simple graphics for presentation to city council. Technical graphs are too detailed for this purpose.

WWTP Alternatives

1. Composing and drying:
    a. Composting can be odorous but can be controlled by covering the process and/or using room ventilation. Foul air control and leachate control are critical.
    b. Mark C. recommended the City visit facilities currently composting and drying for comparative purposes.
    c. Approximately one full-time equivalent (FTE) is recommended that is dedicated to the composting process.
    d. Composting is more dependent on biosolids land application than dryers due to quantity of solids. During the off-season, additional measures such as bagging/storage may be required.
        i. Some agencies are able to send compost to landscaping companies, where it is blended as a commercial product.
    e. Composting provides a "Class B offramp" for the timeframes a Class A product is not required.
    f. Per Grant, composting is labor intensive and logistically difficult.
    g. Drying is a mature technology that is more common on the east coast where land application is not as practical.
    h. A stabilization process is recommended upstream of the drying process. Otherwise the rewetted product is odorous.
    i. Drying requires a much smaller footprint than composting.
    j. Drying is recommended as a precursor for treatment of PFAS. Ceiling limits for land application are not anticipated to be incorporated into regulations in the near future.
    k. Grant has concerns with fire hazards associated with dryers.
    l. Aaron notes they still get complaints when biosolids trucks go by due primarily to lack of understanding / familiarity.
    m. Grant points out that composted biosolids meet Class A, as the plant currently does, but composted biosolids look more like a landscaping product with the added carbon material.
    n. Dave mentioned certain members of City Council strongly prefer greener and more environmentally friendly options. Composting may be more "publicly palatable" for this reason.
2. Aerobic versus anaerobic digestion:
    a. Gas produced from anaerobic digestion can potentially be reused for digestor heating and other processes such as drying.
    b. Grant noted that captured gas must be cleaned prior reuse. Flaring of the gas may be a simpler option.
    c. Clare prefers aerobic digestion as anaerobic digestion is more typical for larger treatment plants.
3. Primary clarifiers versus a second oxidation ditch:
    a. Grant suggested primary clarifiers could act as a stabilization tank to accommodate for slug loading to the plant.
    b. Adam suggested a selector could be added upstream of an oxidation ditch to potentially serve the same purpose.

   c. A bypass line could be routed around the primary clarifiers to provide additional process flexibility.
4. Odor control:
   a. Dave inquired whether odor control would be added to each process or a single odor control unit would service the entire plant. Due to costs associated with running ductwork around the entire plant, individual odor control units (carbon scrubbers) are recommended at each process with short runs of ductwork to the odorous areas.
   b. Grant mentioned winter and summer sludges are distinctly different, with different odors.
   c. Options with no stabilization are significantly more odorous and would require additional odor control measures.
5. Scoring:
   a. Greg suggested the scoring criteria adopted may be overly complex. Two categories may be simpler and more appropriate for the evaluation. "Community" and "operations" were recommended.
   b. "Community" could refer to the benefits associated with less odorous options, greener/environmentally friendly options, and options that create local jobs.

<u>Communication/Funding Support</u>

1. Dave is currently trying to gain support from the Council for $60 million for the recommended upgrades. To help cover the costs, a 12% rate increase has been approved and will be effective at the end of June, with more increases possible afterwards.
2. Dave suggested the Council may be leaning on the City Manager for approval to move forward on obtaining additional funding. There seems to be a lack of effective communication within the Council and limited understanding of the key issues. The Council tends to prioritize other issues over the WWTP, such as homelessness, parks, and dam improvements.
3. Holly presented a recent example from Vancouver, WA that demonstrated an effort to secure funding for critical upgrades. She stressed the importance of simple and effective graphics, with personal elements such as photos of operators and workers. She recommended having individual conversations with each Council member, which could be effective in swaying the decisions of the entire Council and securing the required funding.
4. Dave intends to keep the project phasing as is and suggested the column chart graphic with funding plan for council use.
5. Question about differences between master planning and facility planning based on funding questions. Facility Plan may require official DEQ submittal, but BC will confirm and follow up. Aaron notes that grants are available from Business Oregon for Facility Plan costs, which may apply to this project.

<u>WWTP Headworks</u>

1. Clare noted there is significant rusting on the underside of the headworks building, and Grant agreed.
2. For Alternative 2, Grant suggested the proposed layout of the new screens could be flipped to optimize access to the doors on the new screens. BC has no concerns with this re-arrangement.
3. The City agreed in concept to carbon adsorption as the preferred odor control option.
4. "Ragging" has been a significant issue with the existing auger screens.
5. It was noted the preliminary costs presented are construction only and do not include engineering and administrative costs.

Northside PS Alternatives

1. Greg presented a summary of the alternatives, associated costs, and phasing options for Northside PS. Four options have been developed – two are short term options that are designed to smooth out cash flow with WWTP costs and two are long term, buildout options.
2. The options had been discussed in previous meetings with David and Grant. The outcome of those meeting has been a consensus to proceed with Alternative 2 which will make improvements to the existing NSPS to replace aging equipment to improve reliability and upgrade other areas of the facility to allow it to operate for another 10+ years. During that 10 year +/- interval, the City will be making investments at the WWTP. At the end of the 10 year +/- interval, a new buildout pump station will need to be constructed and the existing NSPS decommissioned.
3. Estimated construction costs for the 4 alternatives have now been developed and these were presented as well.
4. The MP will describe each alternative and recommend implementation of Alternative 2. David, Clare, Grant, and Aaron were in agreement with this decision.

Conclusions and Next Steps

1. Additional discussion is required to confirm the requirements for the upcoming facilities plan that will follow the master plan report.
2. BC to recommend a single WWTP alternative as a part of the master plan, guided by discussions in the workshop.
3. BC to provide a finalized master plan report to the City at the end of June.

Appendix H Northside Pump Station Alternative TM

6500 SW Macadam Avenue, Suite 200
Portland, OR 97239

Phone: 503-244-7005
Fax: 503-244-9095

Technical Memorandum

Prepared for: City of Newport

Project Title: Wastewater Treatment Master Plan – Phase II

Project No.: 158211

Technical Memorandum

Subject: DRAFT Analysis of Northside Pump Station Upgrade Alternatives

Date: June 9, 2023

To: David Powell, P.E.

From: Mark Strahota, P.E.

Prepared by: ___________________________________
Gregory Humm, P.E.

Reviewed by: ___________________________________
Jennifer Kersh, P.E.

Limitations:

This is a draft memorandum and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final report.

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List of Abbreviations

AACE	Association for the Advancement of Cost Engineering
BC	Brown and Caldwell
City	City of Newport
CIP	Capital Improvement Plan
DEQ	(Oregon) Department of Environmental Quality
HI	Hydraulic Institute
MCC	Motor Control Center
mgd	million gallon(s) per day
NFPA	National Fire Protection Association
MH	manhole
NEC	National Electric Code
NPDES	National Pollutant Discharge Elimination System
NSPS	Northside Pump Station
OSHA	Occupational Health and Safety Administration
OSSC	Oregon Structural Specialty Code
PLC	Programmable Logic Controller
PS	Pump station
RUL	remaining useful life
VFD	variable frequency drive
Waterdude	Waterdude Solutions
WWTMP	Wastewater Treatment Master Plan
WWTP	Wastewater Treatment Plant

Section 1: Introduction and Facility Overview

1.1 Purpose

This memorandum is a component of the City of Newport's (City) Wastewater Treatment Master Plan (WWTMP). The purpose of the WWTMP is to evaluate the City's existing wastewater treatment infrastructure, operational procedures, and equipment performance and develop a 20-year Capital Improvement Plan (CIP) that will address treatment needs for the projected population growth, future flow and organic load conditions, and possible future regulations.

Development of the CIP involves identifying and comparing improvement alternatives based on criticality, estimated capital costs, estimated operation and maintenance costs, risks, and cash flow. An implementation schedule outlining the timing and phasing of improvements is a key element of the CIP.

This memorandum presents this information specifically for the Northside Pump Station (NSPS). Alternatives for improving and upgrading the facility are developed and evaluated. Based on the outcome of this evaluation, recommended upgrades are described and an overall plan for the facility and site has been formulated. The cost and timing for making the recommended upgrades has been integrated into the overall wastewater CIP.

1.2 Background

In 2002, the City constructed the Vance Avery Wastewater Treatment Plant (WWTP) in South Beach, Oregon. In doing so, the former WWTP located north of Yaquina Bay was decommissioned and transformed into a pumping facility that functions to pump wastewater to the new WWTP. The pump station is now known as the NSPS.

The pump station itself was constructed using one of the clarifier basins from the existing WWTP to form the screening channels, grit basin, wetwell, and pump room. As a result, the station is unique and the wetwell layout is unusual in terms of meeting industry-wide design standards. Even so, the facility has served its purpose very well since it was re-purposed as a pumping facility in 2002. On the other hand, the uniqueness of the station also creates performance and operational issues which will be presented in this memorandum.

Approximately 90-percent of the City's wastewater is generated through development north of Yaquina Bay. This significant portion of the overall wastewater flow is conveyed to the NSPS and then pumped to the WWTP through a force main that crosses the bay. Removal of rags, grit, sand, and other solid materials from the wastewater is critical to wastewater conveyance to the WWTP. Poor removal performance will result in an accumulation of material in the force main, eventually impacting hydraulic capacity or possibly blocking the pipe entirely. Cleaning the pipe is inherently difficult due to the length and installation on the bay bottom, so efficient removal of debris is vitally important.

The NSPS has been in service for over 20 years and its equipment is approaching the end of its service life. Maintenance costs are expected to increase, and the reliability of the facility will become increasingly more important as the facility continues to age. Additionally, several operator safety issues are evident and require correction. With these issues growing more significant over time, the City has requested an analysis of NSPS improvement options as part of the overall WWTMP that Brown and Caldwell (BC) is preparing.

Section 2: Current Conditions, Station Performance, and Previous Work

2.1 Facility Description

The NSPS utilizes two inclined screw-type mechanical screens to removed rags and other large debris from the influent wastewater. A grit removal basin is used to remove grit and other settleable debris from the influent wastewater to provide preliminary treatment. Accumulated grit is removed from the basin in a slurry, which is then dewatered. Material removed by the screens is bagged and manually transported in a wheelbarrow to a dumpster, which also receives dewatered grit from the grit removal process.

The wastewater enters the pump station through three channels where the three existing screening systems are located–the two outer channels contain the mechanical screens and the middle channel has a manual bar screen. Once the wastewater passes the screens, it moves to the grit chamber where further separation of sand, gravel, and other heavy solids takes place. Following the grit chamber is the wetwell where water collects before being pumped to the WWTP.

2.2 Site Development

As noted above, the NSPS site was formerly the City's original WWTP. Several abandoned and decommissioned wastewater structures still exist on the site. These include a trickling filter, clarifier basins, an anaerobic digestion facility, and chlorine contact basin. A network of buried piping and electrical ductbanks also exist below the ground surface, most notably the influent gravity sewer pipe and effluent pipeline which are still in use and are critical to continued operation.

Additionally, the site is used by other City departments including the fire department for training, police department for impounding vehicles, and a public works maintenance shop. Although these facilities and activities can co-exist with wastewater operations, it would be beneficial to eventually reduce or eliminate these additional activities being performed onsite altogether, so that the site is dedicated exclusively to wastewater operations. The City plans to begin this effort by relocating the vehicle impoundment activities by the police department to the WWTP.

A suggested site layout that accounts for a future new pump station is shown in Figure 1. The layout is based on demolition of decommissioned wastewater structures (i.e., trickling filter, digestion facility, and clarifiers), elimination of police activities, construction of a dechlorination facility and vehicle parking garage, and a future NSPS. Demolition of wastewater structures can happen over time as funds become available and as additional space is needed. The fire department training facility would remain, as there are no alternate locations for this type of facility within the City.

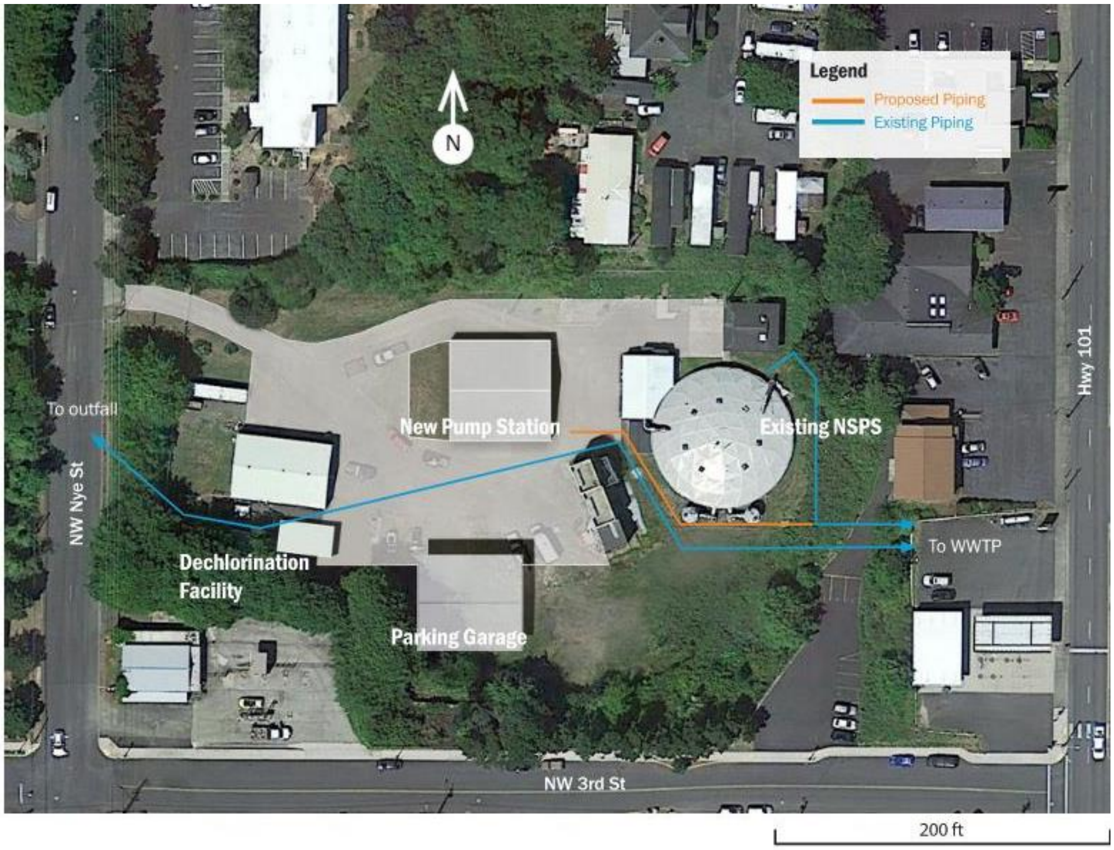


Figure 1. Site Development with new (future) pump station

2.3 Condition Assessments

Condition assessments were previously completed by Waterdude Solutions (Waterdude) and BC to identify conditions within the NSPS that require attention. These assessments are summarized in this section.

2.3.1 Waterdude 2018 Assessment

A condition assessment was completed by Waterdude for the WWTP and NSPS. Waterdude prepared an initial condition assessment report in January 2018 and an update to this report in 2021. Their *Wastewater Treatment Facilities Condition Assessment Update,* dated October 11, 2021, provides a criticality assessment which evaluates the overall condition rating of each system and identifies systems that pose the highest risk. The systems that are deemed most at risk are:

- NSPS
- Headworks
- Septage
- Solids Handling

Specifically, for the NSPS, the 2021 update report concludes that screening and grit removal systems and the pump station structure itself are in Fair to Poor condition. The condition of the station is a challenge to the ongoing operation and maintenance of the station. The screens were determined to be approaching their end of service life and the geodesic dome over the structure is leaking and in poor condition. Leaks are noted to cause humid conditions inside the structure which results in corrosion, slip hazards, and premature electrical equipment failure. Furthermore, odorous air treatment is not occurring because the odor control system is not in use.

2.3.2 Brown and Caldwell 2019 Assessments

In addition, BC also performed inspections of the facility to assess its condition and identify problem areas. An inspection performed in May 2019 identified the following issues:

- An electrical fault on the power cables feeding Raw Sewage Pump No. 1 required replacement of the cables using the spare conduit that was originally provided for (un-installed) Pump No. 4. Field tests determined that numerous existing power cables between the Electrical Building and pump station are in poor condition and should be replaced. Refer to Section 3.4.1 for additional detail.
- Grit system is in poor condition and lacks the redundancy that should be provided given the potential for blockage of the force main from an accumulation of solids that would pass through the station in the event the grit system is out-of-service. Failure of the grit piping in the lower pump room would cause flooding of the station. Overall, the grit system is considered high risk in terms of reliability; there are consequences of system failure. Refer to Section 3.2 for additional detail.
- The geodesic dome cover is leaking primarily where the structural supports anchor to the perimeter concrete wall. See photos in Figure 2 on the following page. These connections are complicated with structural shapes coming together at various angles with numerous bolts and gusset plates. Sealing these connections is difficult to accomplish properly, causing leakage to occur at these locations. The cover is also leaking at localized spots throughout the cover panels. These leaks are likely the result of deterioration of the seals at the edges of the individual triangular cover panels. Refer to Section 3.3 for additional details.

Figure 2. Examples of rainwater leakage through geodesic dome

2.3.3 Electrical Investigation

In 2012, an electrical fault occurred within the power cables feeding Raw Sewage Pump No. 1. The fault occurred on the load-side cables to the pump motor and was resolved by installing new conductors to the motor using the spare conduit to (un-installed) Pump No. 4. Although the exact cause of failure is unknown, it was suspected that the buried ductbank between the Electrical Building and the pump station had been damaged, possibly due to settlement. An investigation was conducted in May 2019 to test the other cables in the same ductbank to determine whether other existing circuits were also damaged or at risk of failure.

Based on the testing results and visual observations, the action items listed below were provided to the City in May 2019.

1. Replace the existing power cables for Raw Sewage Pumps No. 1, 2, and 3 with new variable frequency drive (VFD)-rated, multi-conductor cable with grounds.
2. Replace the existing conductor cables for Rotary Screen No. 1 with new conductors.
3. Existing spare conduits between the Electrical Building and the pump station are suitable for use provided each conduit is tested and cleaned prior to pulling new cables into place.
4. Install new conduits between the Electrical Building and the pump station for future equipment (Grit Pump No. 2, Raw Sewage Pump No. 4, Screenings Conveyor, plus any spare conduits). These can be installed in either an overhead configuration or buried. If buried, inspect the existing ductbank for damage when it is exposed for construction of the new conduits.

2.3.4 Remaining Useful Life Estimates

Results from the condition assessments and electrical investigation described above informed general estimates of the remaining useful life (RUL). Developing RUL estimates can be risk- and scientifically-based, highly detailed assessments that are generated through statistical analysis of operation and maintenance information. RUL estimates prepared for this planning level effort have not been made using these detailed analyses; rather, they are general estimates that have been developed to provide a framework for prioritizing and scheduling upgrades and improvements to the NSPS.

The generalized approach taken to develop RUL estimates consisted of estimating remaining life for individual components of the overall facility. These estimates are tabulated in Table 1 below.

Table 1. Estimated RUL for Station Components and Basis for Remaining Life Estimates

Station Component	Estimated RUL (years)	Basis for RUL Estimate
Screens	2-3	Poor condition, numerous known issues impacting remaining life.
Grit System	2-5	Condition of paddle in grit basin is unknown (not visible). An un-installed replacement grit pump is available. Classifier and washer are in poor condition. Grit piping and valves are likely near end of service life due to abrasive conditions.
Electrical Wiring to Pumps	2-4	Known deterioration of conductors between Electrical Building and pump station, likely remaining life of two to four years.
Ventilation System	3-5	Supply fan and foul air fans likely at end of life; odor treatment system is not functional; louvers have deteriorated and require replacement.
Geodesic Dome	10-15	Dome has localized leakage points and City employees report deterioration. Life may possibly be extended through on-going maintenance.
Electrical and Instrumentation Systems	5-10	Motor Control Center (MCC) needs a thorough assessment, approximately ten years of remaining service would be expected. Control panels within pump station are in poor condition although internal components may be operable for five to ten years
Wastewater Pumps	10-15	Pumps are in good condition; a spare, un-installed pump is available. Normal, on-going maintenance is necessary.
Wastewater Piping and Valves	20-30	Appears to be in good condition.
Concrete Structure	20-30	Structure is in good condition; minor, localized signs of degradation. Wetwell is not visible, an inspection is needed to determine actual condition.

The assessments from Table 1 above are shown graphically in Figure 3 on the following page.

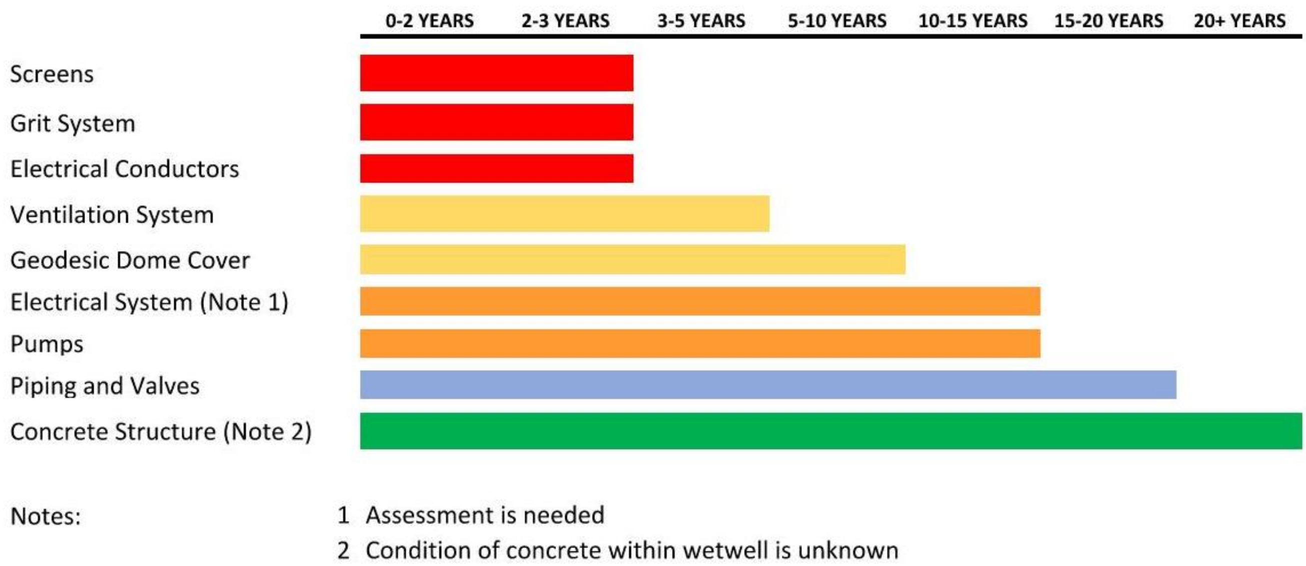


Figure 3. Summarized graphical representation of RUL estimates

Observations that can be made using the condition assessment information and general RUL estimates described above include:

- High priority improvements include replacing the screens and grit system components, electrical cables to the Raw Sewage Pumps, and ventilation fans.
- At least three components of the NSPS are of immediate concern and replacement to these components should be considered a high priority for continued moderately reliable operation until more extensive improvements, or a new pumping facility, can be constructed and placed into service.
- A pivot point of about ten years seems apparent. With completion of the high-priority improvements (i.e., screens, grit system, electrical cables, and fans), reliable operation of the facility for another ten years appears realistic. Reliability concerns will begin increasing towards the end of that time and beyond unless additional improvements are made. If those additional improvements are completed, the existing facility could have a realistic service life of twenty years or more (beyond the initial ten years).

These observations have allowed development of upgrade alternatives for the facility. These are presented in Section 4.1 and described in Table 2 on the following page.

Table 2. Upgrade Alternatives for NSPS Based on RUL		
Alternative	Name	Description
Alternative 1	"Bare Minimum" Alternative	Make immediate minor improvements to increase reliability and provide time for design and construction of a new buildout pump station, then abandon/decommission the existing NSPS.
Alternative 2	"10-Year Alternative"	Replace equipment to extend service life by ten years to allow the City to make investments at the WWTP, then construct a new pump station and abandon/decommission the existing NSPS.
Alternative 3	"New Dry Weather Facility"	Construct a new pumping facility with capacity for dry weather flows and upgrade the existing NSPS to serve as a wet weather pumping facility.
Alternative 4	"New Buildout Facility"	Construct a new pumping facility with capacity for buildout flows and abandon/decommission the existing NSPS.

2.4 Operational Performance of Screens

Screen performance has been historically problematic and tolerable operation has been diminishing over time. Screen performance issues include:

- Inefficiency at moving floating material from the channel–debris becomes trapped in the approach channel and must be manually removed.
- Overall poor debris removal performance causing blinding, reducing hydraulic capacity resulting in surcharging the influent sewer, ultimately resulting in overflows at the upstream manhole (MH).
- Debris accumulation in the compaction chamber at the top of the screen, causing jamming of the unit and requiring manual removal by operations staff.
- Corrosion and overall degradation of the equipment leading to a lack of cleanliness of the area around the screens and leakage.
- Handling of screened material and transporting bagged debris to the dumpster resulting in significant manual labor and negative impacts to operator safety.

Figure 4. Existing Auger Screens

2.5 Previous Upgrade Projects

In 2018, the City considered the replacement of a screen. In 2023, the design of a dechlorination facility was completed. The details of these projects are discussed in this section.

2.5.1 Screen Replacement Project

The City initiated a screen replacement project in 2018 but halted the project before the final design phase. The scope of the project included an analysis of feasible alternatives for replacing the existing screens with new screens and improvements to the screenings processing and management systems. The analysis considered available types of screens, screening washing/compacting systems, conveying systems, and alternatives for improving hydraulics in the existing channel. Reliability and redundancy considerations were identified and capital, operations, and maintenance costs for implementing the recommended improvements were developed. Refer to Section 3.1 for additional details.

2.5.2 Effluent Dechlorination Facility

Currently, effluent is chlorinated at the WWTP to comply with disinfection requirements stipulated in the National Pollutant Discharge Elimination System (NPDES) discharge permit. The chlorine dose is set such that residual chlorine is below the permitted concentration prior to discharge. The point of compliance is at the NSPS. However, without a means of controlling effluent residual chlorine dose through a dechlorination process, compliance with the permitted effluent chlorine concentration limit is difficult. The limit has been exceeded periodically in violation of the NPDES permit.

To improve control and better achieve compliance, the Oregon Department of Environmental Quality (DEQ) is requiring the City to dechlorinate the final effluent prior to discharge. A dechlorination facility that would meter sodium bisulfite into the effluent to reduce and control residual chlorine concentration will be needed at the NSPS. The City is currently working to establish funding for this facility. When funding is in place, design is scheduled to begin in Summer 2023 and construction of the facility will be completed in 2024.

In addition to constructing the new sodium bisulfite facility, two existing structures at the site are to be demolished to create space for parking, turn-around for chemical deliveries, a new vehicle garage (pre-engineered metal building), and a future replacement pump station. Specifically, the existing digester and clarifier structures at the NSPS site are to be demolished with a new vehicle storage garage constructed.

Section 3: Improvements to Existing NSPS

Four alternatives for improving the NSPS have been developed as summarized in Table 2 and described in detail in Section 4. In three of these alternatives, the existing NSPS would be upgraded and would remain in service–at least in the near term. Alternative 4 is the only alternative that involves immediately constructing a new pumping facility and decommissioning the existing station.

Thus, improvements to the existing NSPS that would be undertaken in Alternatives 1, 2, and 3 have been defined through the previous work described in the preceding sections. These are briefly described in the following sections with references to previous documents have can be referenced for additional detail.

3.1 Screening Process Improvements

Channel modifications to reduce surcharging the incoming sewer pipe during high-flow events were developed as part of the screen replacement project. The modifications are described in this section.

3.1.1 Overview

Wastewater flows from the influent sewer pipe into a head box at the upstream end of the three screen channels. After passing through the screens, the wastewater enters the grit chamber and then flows into the wetwell.

During high flow events, the headloss through the channels and screens causes water to back up into the head box and influent pipe. Plugging or "blinding" of the screens caused by poor screen performance further restricts flow from passing into the downstream grit chamber. In the past, the combination of high flows, screen blinding, and headlosses through the system has resulted in overtopping MH-1, which is at the entrance to the pump station.

3.1.2 Hydraulic Performance

A hydraulic analysis was completed to assess the hydraulic performance of the channels, establish the hydraulic capacities of each screen channel, and determine the allowable headloss through the channels.

A Visual Hydraulic model of the screen channel arrangement was developed and used to assess the flow split between the channels. With two channels in operation, an unequal flow distribution is apparent with about 5.4 million gallons per day (mgd) conveyed through the Screen 1 channel and 3.8 mgd through the Screen 2 channel. Unequal flow distribution will tend to overload Screen 1 with debris, increasing the risk of blinding–refer to Figure 5.

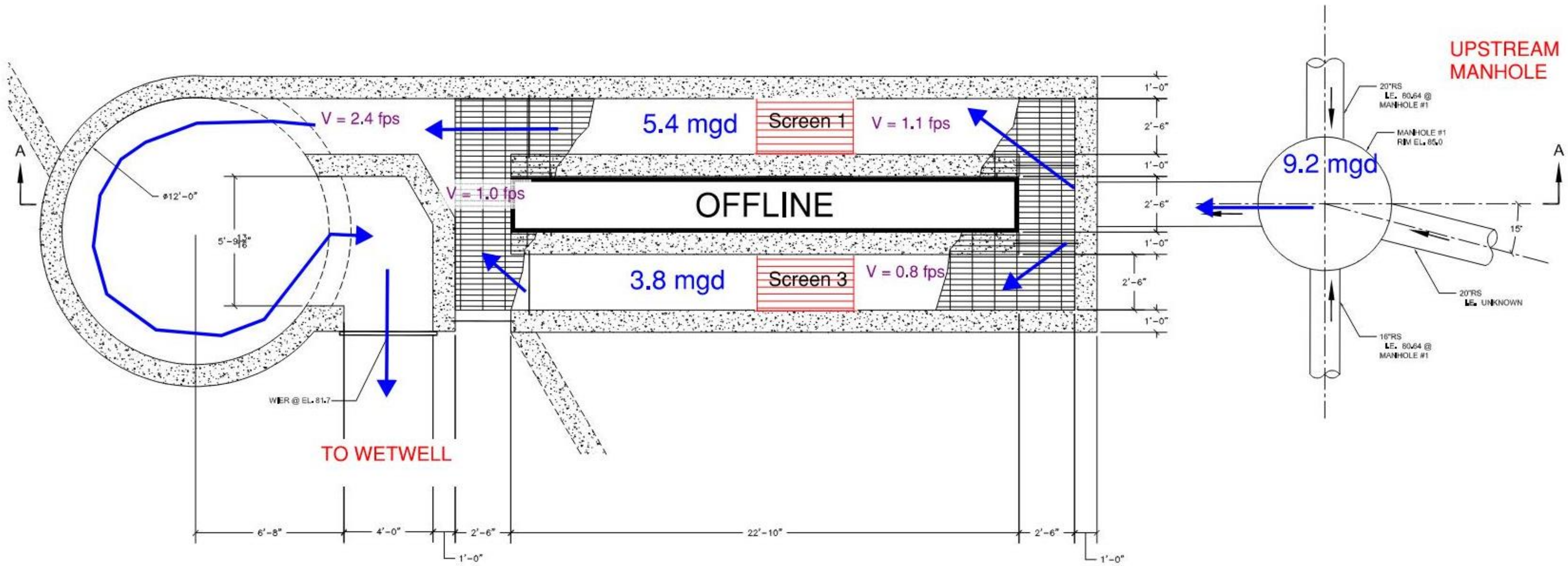


Figure 5. Flow Distribution Diagram – Existing Screen Channel

The Visual Hydraulics model was also used to assess the risk of overflowing MH-1. Assuming six inches of headloss through the screens and with unequal flow distribution through the channels, the peak flow rate of 9.2 mgd would surcharge the incoming sewer such that the water surface elevation in MH-1 will be only about 1.2 feet below the MH rim. Screen losses are dynamic and fluctuate according to the amount of debris that has accumulated on the screen. The screen loss increases as debris collects on the face of the screen and decreases after the screen is cleaned. As a result, the existing screens that are installed in the channels have blinded and caused overtopping of MH-1 in the past. Water surface elevations at peak flow are shown in Figure 6.

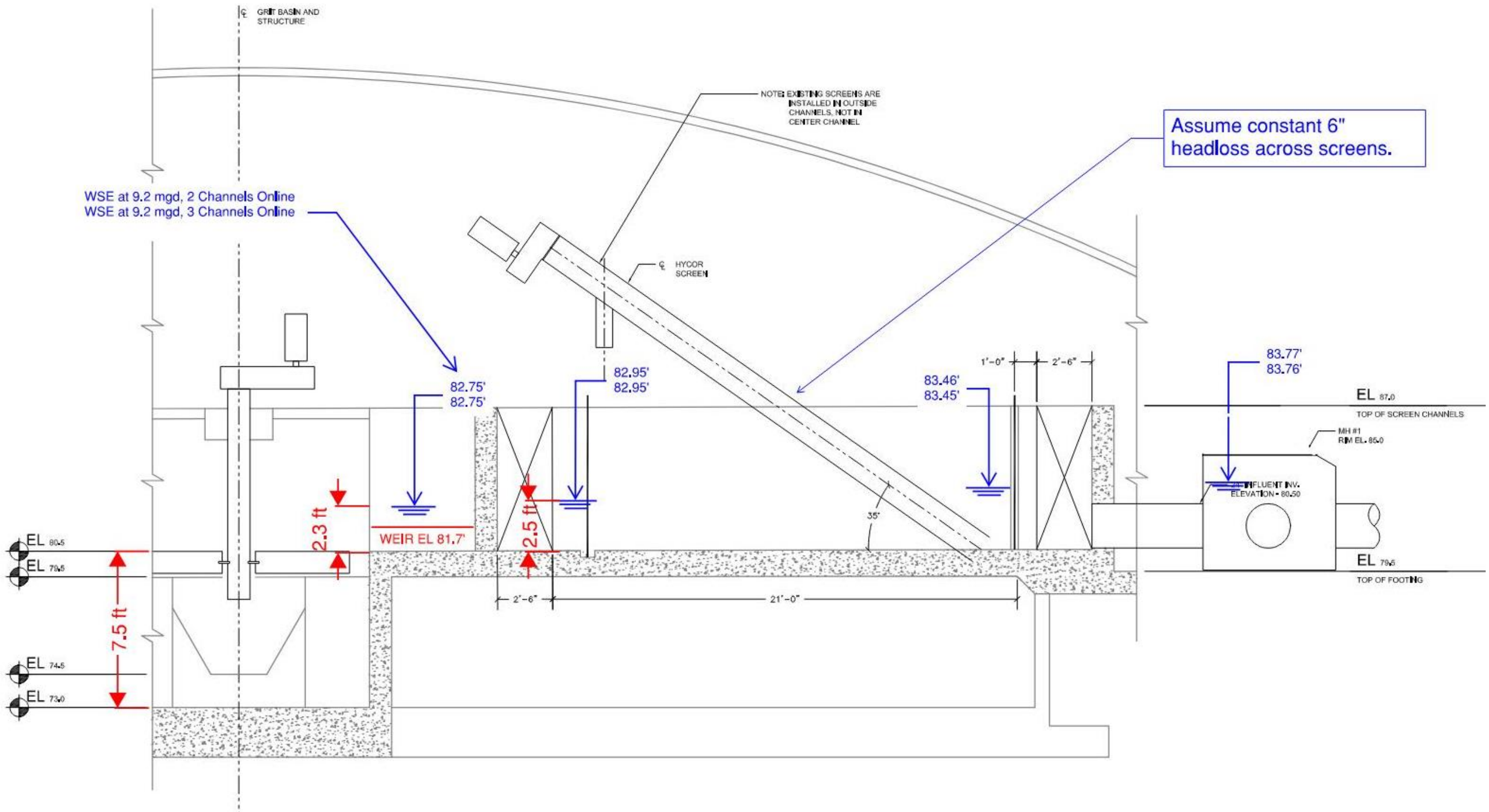


Figure 6. Water Surface Elevations at Screen Channel

3.1.3 Screen Channel Modifications for Improved Performance

Equalizing the distribution of flow between the three channels and reducing the risk of overflowing MH-1 can be accomplished through channel modifications. These modifications, shown in Figure 7, would be made in conjunction with installation of new screens in the channels. A screenings conveyor could also be installed as described in Section 3.1.5.

One of the three existing channels would be configured as an emergency bypass channel that would route flow around the screens, in the event they become blinded, and their combined capacity is less than the influent flow rate. The water level upstream of the screens would increase to a point where the level is above the elevation of the bypass weir. From which, water begins to enter the emergency channel flowing directly into the wetwell.

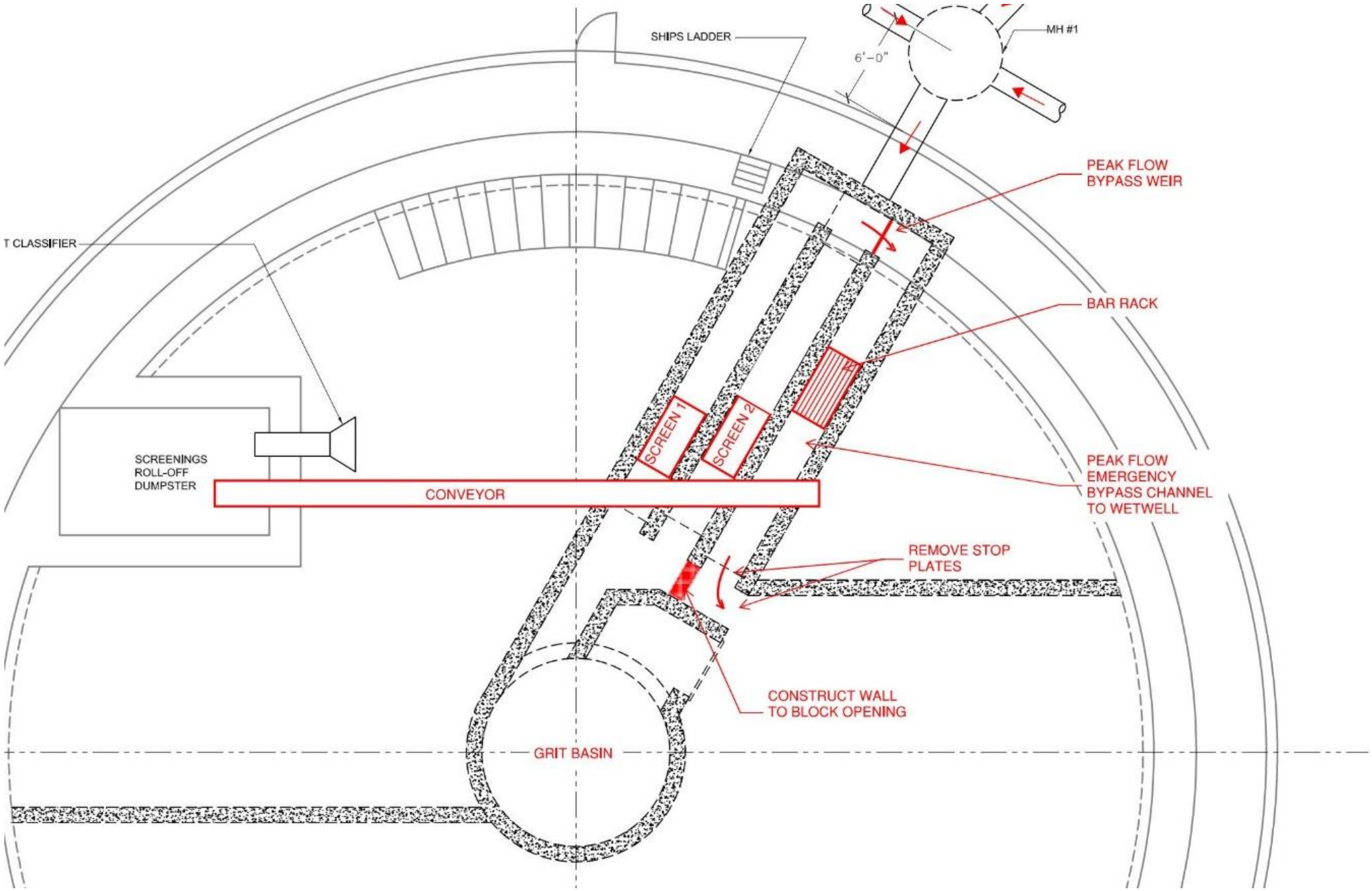


Figure 7. Recommended Channel Modifications

3.1.4 Screen Replacement

A wide variety of screening technologies and screen designs are offered by reputable manufacturers with extensive experience in the wastewater industry. Screen options are typically evaluated during a preliminary design phase, thus selecting a specific screen technology would be beyond the scope of a planning study.

For the purposes of this planning study, it is assumed that the new screens will match the type of screen that will be installed at the WWTP headworks. Table 3 below provides the recommended basis of design.

Table 3. Recommended Basis of Design for Replacement Screens at Existing NSPS

Design Parameter	Value
Number of Mechanical Screens (installed in outside channels)	2
Flow Capacity, each	5.4 mgd
Number of Channels and Screens in Operation	1 at flows up to 4.6 mgd 2 at flows above 4.6 mgd
Number of Bar Racks (installed in center channel)	1
WS Elevation in MH #1 at Peak Flow (assumes 6" loss across screens)	EL 83.8
Freeboard in MH #1	1.2 feet
Freeboard in Screen Channel	3.5 feet

3.1.5 Screening Conveyor

Material removed by the existing screens is compacted and discharged from the screen into a plastic bag. A wheelbarrow is placed below the discharge chute to hold the bag, so it does not break open. When the bag is full, the operators must maneuver the wheelbarrow over to the dumpster, lift the heavy bag into a pivoting trough device, and manually flip the trough so the bags fall into the dumpster. This procedure has caused back and hand injuries and is an on-going safety issue. A safer way to move the screened material into the dumpster is by conveyor.

As shown in Figure 7, the conveyor will be arranged adjacent to the screening discharge locations. The installation will be extended across the emergency channel in case the screens are rearranged, or a third screen is eventually installed in the emergency channel. Screened solids will be conveyed across the pump station to the dumpster continuously, erasing the need for frequent manual transportation of bagged waste. While the conveyor will require some degree of maintenance and additional power, the resulting process is far safer and less time-consuming for the operations team.

3.2 Grit System Improvements

The existing grit removal system consists of a grit basin, grit pump, grit classifier, and grit washer. The overall system is in poor condition with limited remaining service life. Therefore, upgrading this system is ranked as a high priority and should be a component of any facility upgrade alternative in which the existing NSPS would remain in operation (i.e., all alternatives except Alternative 4).

3.2.1 Grit Pump and Piping

The lack of redundancy within the existing grit pumping system is considered high risk for the NSPS from both a reliability and risk-of-failure perspective. The existing pump is nearing the end of its service life. The City has ordered a new pump (wet end only) to replace the existing pump. Depending upon the condition of the existing pump, the City may elect to rebuild the pump so that it would be a spare pump that could be (quickly) installed, if necessary.

The existing piping is also nearing the end of its service life, which is typically estimated to be 20 years based on the propensity for erosion of the interior pipe wall from the grit slurry moving through the piping. Ninety-degree elbows are especially susceptible to erosion. In the case of the NSPS, a failure of the piping could potentially flood the basement of the station, thus the consequences of failure are very high.

In addition to having a spare pump, a new grit pump could be installed to increase redundancy and improve reliability. The grit piping at the classifier area must be reconfigured to allow installation of the screenings belt conveyor, as such, all grit piping and valves should be replaced with new piping.

3.2.2 Grit Classifier and Washer

The grit classifier and washer, both deemed to be in very poor condition, should be replaced in their entirety, including the associated piping, valves, conduit and wire, and electrical equipment.

3.3 Geodesic Dome Replacement

City staff have reported rapid deterioration of the geodesic dome that covers the pump station. Deterioration has resulted in water leakage through the roof panels, roof panels blowing off during medium- to high-velocity wind gusts, and brittleness of the skylights which have resulted in failures.

The 2021 condition assessment undertaken by Waterdude noted rainwater leakage through the dome (refer to Section 2.3) and recommended full replacement of the dome. BC also noted this deterioration during a subsequent condition assessment inspection and evaluated replacement in more detail with structural assessments and cost estimates.

The structural assessment concluded that the perimeter concrete wall that the dome is anchored to would need to be strengthened to meet current building code requirements. While strengthening the wall could be done in a variety of ways, for the basis of the cost evaluation it was assumed that the wall would be reinforced with concrete buttresses around the exterior of the wall. This increased the estimated cost of the dome replacement to about $1.6 million (February 2021).

Initially (2021), a second driver for replacing the cover was to simplify pump removal, which–because of design deficiencies in the original design–is difficult to accomplish, labor intensive, and dangerous to personnel. Currently, pump removal is accomplished using a gantry crane/hoist, pallet mover, and forklift to move the pump area in the basement to a flatbed truck outside the building, which is cumbersome and time-consuming. On one occasion, a pump was damaged during the removal process. Replacing the cover offered an opportunity to mitigate damage by adding a dormer with a crane and hoist for safe, proper removal of the wastewater pumps.

However, the structural upgrades to the perimeter wall that would be necessary, combined with escalation due to pushing the project several years into the future, significantly increases the cost of dome replacement. Investing in a new cover for the facility–especially under upgrade alternatives in which the existing facility is ultimately abandoned (Alternatives 1, 2, and 4)–does little towards improving the facility operation. While acknowledging the cover is in poor condition, nonetheless, our recommendation is not to include replacement under any of the upgrade options except Alternative 3.

3.4 Ventilation System Upgrades

The ventilation system for the existing station includes supply and exhaust fans and an activated carbon scrubber. The supply air fans run continuously to maintain a fresh air environment within the station that is essential for personnel to enter the structure.

A condition assessment was completed in 2022 and the fans and fan motors were determined to be in poor condition. The activated carbon scrubber for the exhaust air is not functional and has been abandoned-in-place since 2017. Replacement of the entire system is necessary and included in Alternatives 1, 2, and 3.

3.5 Electrical Upgrades

Based on the testing results and visual observations described in Section 2.3.3, the action items listed below have been incorporated into the overall upgrade recommendations for NSPS.

1. Replace the existing power cables for Raw Sewage Pumps No. 1, 2, and 3 with new VFD-rated, multi-conductor cable with grounds.
2. Replace the existing conductor cables for Rotary Screen No. 1 with new conductors.
3. Existing spare conduits between the Electrical Building and the pump station are suitable for use provided each conduit is tested and cleaned prior to pulling new cables into place.
4. Install new conduits between the Electrical Building and the pump station for future equipment (i.e., Grit Pump No. 2, Raw Sewage Pump No. 4, Screenings Conveyor, plus any spare conduits). These can be installed in either an overhead configuration or buried. If buried, inspect the existing ductbank for damage when it is exposed for construction of the new conduits.

Programmable Logic Controller (PLC) Replacement: The existing PLC is reaching the end of its service life, as are other PLCs in the City's wastewater facilities. However, replacement parts are difficult to find and procure from vendors. The City has proactively instituted a PLC replacement plan wherein at least one PLC is replaced each year. PLC replacement at NSPS is assumed to fall under this program and therefore has not been included in the CIP for the NSPS.

Section 4: Analysis of Facility Upgrade Alternatives

Four alternatives for upgrading the NSPS have been developed and are described and analyzed in this section. In addition to estimated construction cost, the analysis considers the implementation schedule for each option, which is an important consideration from a cash flow perspective. In addition to investments at the NSPS, the City will also be making improvements to the WWTP and the schedule and cost for those improvements must be considered to match available funds.

The improvements described under these alternatives are in addition to construction of the dechlorination facility (required for NPDES permit compliance as mandated by DEQ) and the site improvements described in Section 2.5.2.

4.1 Upgrade Alternatives

Four alternatives considered for the NSPS upgrades are discussed in this section. The first three alternatives recommend minor to extensive modifications to the existing pump station. Alternative 4 proposes demolition of the pump station. The schedules and costs associated with these alternatives are in the respective sections following.

4.1.1 Alternative 1 – "Bare Minimum" Investment

The objective of this alternative is to minimize the capital investment in the existing facility by making minor improvements to extend the life of the facility (Phase I) until a new, buildout facility can be constructed and commissioned (Phase II). After the new facility is in service, the existing station will be decommissioned. Design of the improvements recommended under this alternative would need to begin immediately such that construction of the upgraded facility is completed by 2026.

Improvements to the existing NSPS under this alternative are the highest priority items and related to condition, performance, and operator safety. The improvements listed in Table 4 below are considered the minimum required to increase reliability and to extend service life until the new facility is operational. The new replacement pumping facility would need to be constructed and commissioned by 2031.

Table 4. Recommended Upgrades for Alternative 1 ("Bare Minimum" Alternative)

Component	Description	TM Cross Reference	Notes
Screens	Replace both screens	Section 3.1.4	Emergency bypass channel (Section 3.1.3) and screening conveyor (Section 3.1.5) not included in scope of alternative.
Ventilation	Replace supply and exhaust fans	Section 3.4	Carbon scrubber replacement not included in scope of alternative.
Electrical	Replace power conductors to pumps and screens Add new conduits for future	Section 3.5	PLC replacement part of City's overall program.

4.1.2 Alternative 2 – Improvements to Extend Service Life ("10-Year Alternative")

This alternative improves the existing NSPS by replacing and upgrading equipment to increase reliability and extend the service life by ten years. Similar to Alternative 1, a new station (either a dry weather flow facility or a buildout pump station) would need to be constructed at the end of this time frame, but the costs for the new station are pushed further into the future to allow the City to devote funds to WWTP improvements as a higher priority than making investments to the NSPS.

Improvements listed in Table 5 below would be made under this alternative.

Table 5. Recommended Upgrades for Alternative 2 ("10-Year Alternative")

Component	Description	TM Cross Reference	Notes
Screening System	Replace both screens	Section 3.1.4	
	Add screening conveyor	Section 3.1.5	
	Modify screen channels to add emergency bypass channel	Section 3.1.3	Includes replacing channel isolation plates with actuated slide gates.
Grit Removal System	Replace basin mechanism, grit pump and piping, grit cyclone, and grit washer	Section 3.2	
Ventilation	Replace supply and exhaust fans	Section 3.4	Carbon scrubber replacement not included in scope of alternative.
Electrical	Replace power conductors to pumps and screens Add new conduits for future	Section 3.5	PLC replacement part of City's overall program.

4.1.3 Alternative 3 – New Dry Weather Pump Station with Existing Facility

This alternative entails constructing a new pumping facility on the site but keeping the existing NSPS in operation as well. The new station would function as a "duty" station, operating daily and pumping all influent flow up to its full capacity. The existing station would serve as a wet weather pumping facility. A schematic of the concept is shown in Figure 8.

The capacity of the new duty station would be equivalent to the highest estimated diurnal peak flow that would occur during the dry weather. This sizing criterion would reduce the frequency of placing the second pump station (the existing NSPS) in operation during the dry weather season. The existing NSPS would be upgraded and re-purposed as a peak flow facility and would also be capable of serving as a standby facility that would be placed into operation whenever influent flows exceed the capacity of the duty station or in the event the duty station is out of service.

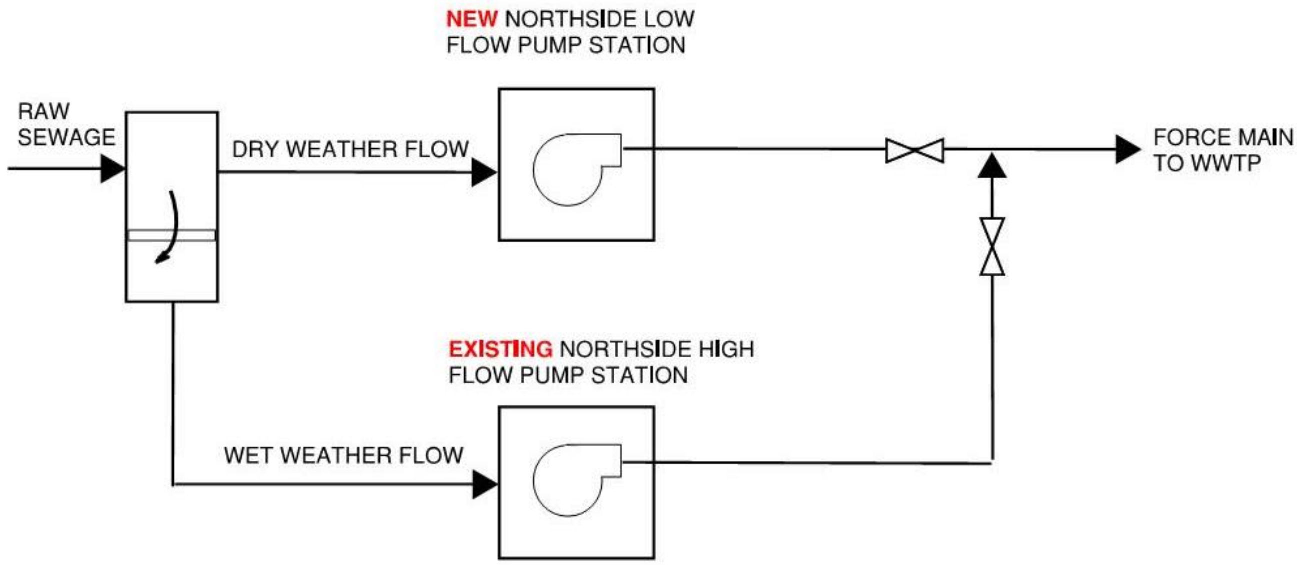


Figure 8. Flow Schematic for Separate Dry Weather and Wet Weather Pump Stations

Although this alternative was fully developed and evaluated, it was eliminated as a viable option based on total cost and the need to maintain two separate pumping facilities, whereas each of the other alternatives consists of a single pump station. In addition to this alternative having the highest estimated capital cost, operation and maintenance costs would also be higher than any of the other alternatives because there would be two stations to operate and maintain rather than just a single station.

4.1.4 Alternative 4 – Construct New Buildout Facility without Existing Facility

In this alternative, a new pumping facility would be constructed and the existing NSPS would be decommissioned. The new station would be designed as a state-of-the-art facility, meeting all current codes and standards of practice such as:

- Hydraulic Institute [HI] standards for pumping stations
- Building codes
- Structural codes (Oregon Structural Specialty Code [OSSC])
- Safety guidelines and requirements of the Occupational Health and Safety Administration (OHSA)
- Fire and life safety codes mandated by the National Fire Protection Association (NFPA)
- Electrical codes by the National Electric Code (NEC).

Under this alternative, the City would not make further investments in the existing NSPS. Instead, design of the buildout facility would begin immediately, and the new station would be constructed as quickly as possible to minimize the length of time the existing NSPS would remain in service in its current condition.

A schematic of the buildout facility is shown in Figure 9 and the components of the new facility are listed in Table 6.

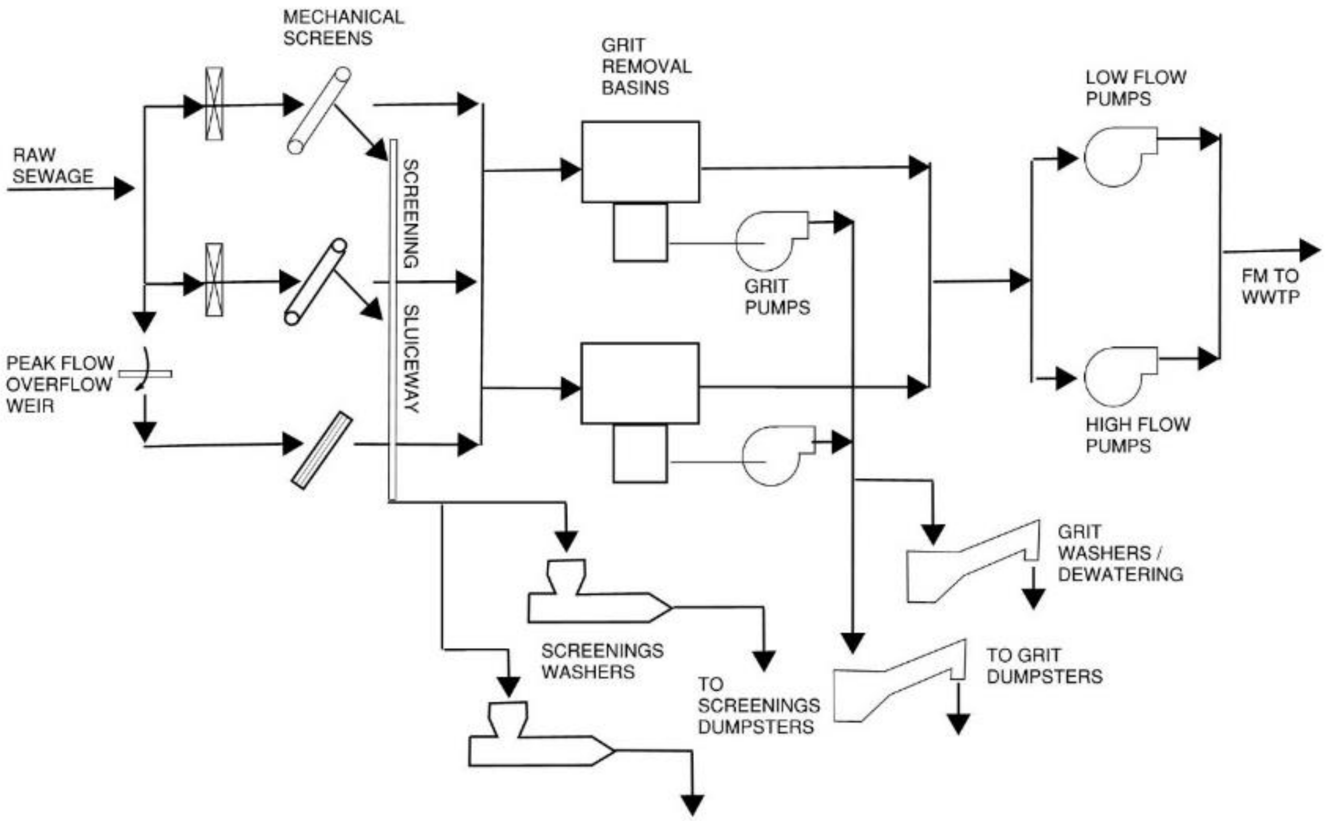


Figure 9. Process Flow Schematic for New Pump Station

Table 6. Planning Level Components of Buildout PS	
Process Components	**Number**
Mechanical Screens	2
Screen Conveyance	Belt conveyor or sluiceway
Screenings Washers	2
Grit Removal Basins	2
Grit Classifier/Washer	2
Low Flow Pumps	3
High Flow Pumps	2
Other Station Components	
Bridge crane/hoist	Electrical room
Surge control tanks	Control room
Standby generator	Ventilation system
Foul air treatment system	Restroom
Pig launch station	Spare parts storage area

4.2 Implementation Schedules

Each alternative has a unique implementation schedule as shown below in Figure 10. Due to the poor condition of the existing NSPS, all alternatives would start as soon as the City has established funding for the selected project.

Alternatives 1 and 2 require follow-on projects; these would occur after the initial upgrades have been completed to improve station reliability. Conversely, Alternatives 3 and 4 are standalone projects since these alternatives entail constructing a new pumping facility.

The gap between the two phases is designed to allow the City to shift focus to the WWTP and make upgrade investments at that facility while managing and stretching funding requirements.

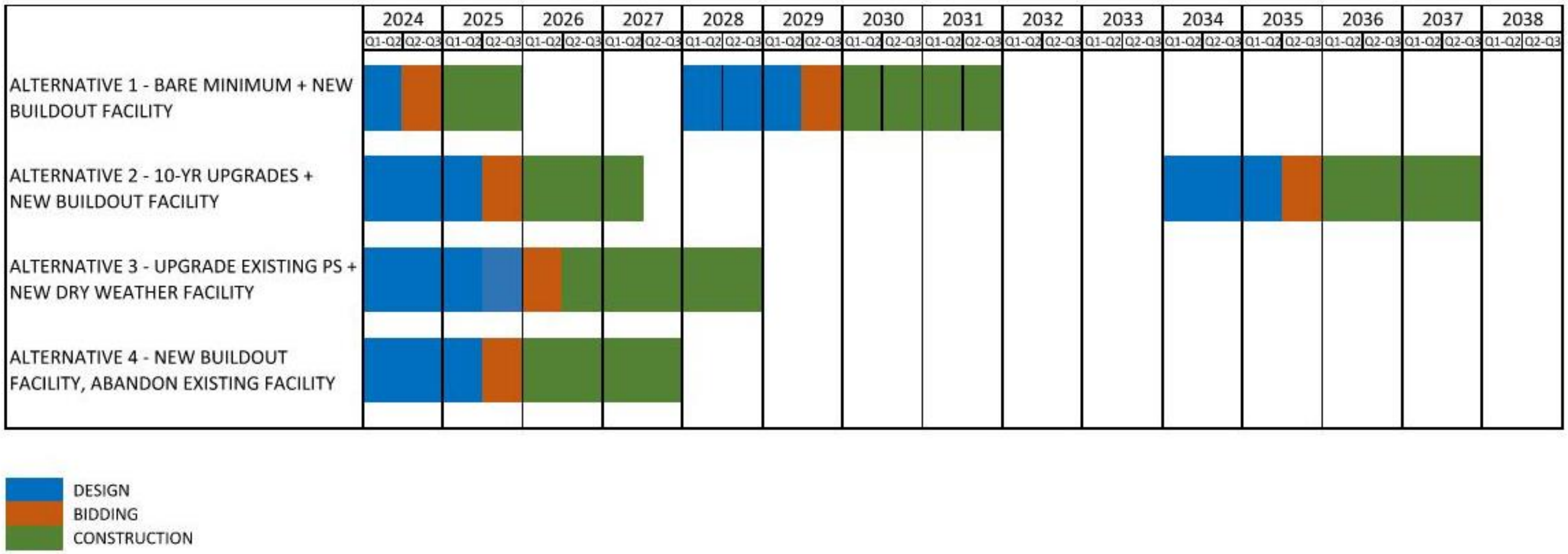


Figure 10. Implementation Schedules for NSPS Upgrade Alternatives

4.3 Cost Evaluations

The Association for the Advancement of Cost Engineering (AACE) International Class 4 level capital cost estimates have been prepared for each alternative. These are summarized in Table 7. Costs shown in Table 7 have been escalated to the approximate mid-point of construction according to the implementation schedules shown in Figure 10. Costs include a 40-percent contingency to cover unforeseen conditions and to account for unknown items that arise as the design is developed.

Table 7. Estimated Construction Costs for Northside Pump Station Alternatives			
Alternative	Description	Construction Mid-Point	Estimated Cost (Million)
1	Bare Minimum		
	Initial Upgrade to Existing Station	2025	$3.1
	New Buildout Station	2031	$27.9
	Total, Alternative 1		**$31.0**
2	10-Year Extension		
	Initial Upgrade to Existing Station	2026	$5.0
	New Buildout Station	2036	$33.9
	Total, Alternative 2		**$38.9**
3	New Dry Weather Station	2028	**$27.9**
4	New Buildout Station	2027	**$22.9**

The cost for the dechlorination facility project, which includes a limited amount of site improvements (e.g., pavement, etc.) and demolition of existing structures on the site, is not included in the alternative costs since this will be an independent, standalone project that the City will undertake for DEQ compliance.

Replacement of the geodesic dome is not included as part of any alternative that keeps the existing station in service (i.e., Alternatives 1, 2, and 3). Engineering costs for design and construction phase services are also not included.

A detailed breakdown of costs is provided in Attachment A.

Section 5: Recommended Improvement Plan

Alternatives were presented to City staff at meetings in March and April 2023 for discussion and input. Alternative 3, as stated earlier, was eliminated due the cost of implementation and need to maintain two facilities rather than just a single pumping station.

Alternative 2 was selected as the preferred alternative for several reasons. Although the total cost of this alternative is the highest of the three remaining alternatives, making a relatively small initial investment to increase station reliability fully utilizes the remaining service life of the station. By the time the buildout station is completed and operational, the existing NSPS will have reached the end of its reasonable service life.

Secondly, the gap between the initial upgrade project and the ultimate facility fits well into the overall CIP, allowing the City to spread the costs of the NSPS and WWTP upgrades over a reasonable time frame. The City will need to spend substantial funds on the WWTP improvements. If construction at NSPS overlaps with that work, funding both projects together may present an undesirable financial situation for the City. Therefore, Alternative 2 provides the City with a longer “window” to postpone costs for design and construction of the replacement buildout station until after the WWTP upgrades have been completed.

As a result, the CIP developed for the WWTMP has been based on implementation of Alternative 2.

Attachment A: Construction Cost Estimates

CITY OF NEWPORT
NORTHSIDE PUMP STATION MASTER PLAN

OVERALL COST SUMMARY OF ALTERNATIVES
MARCH 2023

Alternative	Description	Construction Mid-Point	Estimated Cost at Mid-Point (Million)
1	Bare Minimum		
	Initial Upgrade to Existing Station	2025	$3.1
	New Buildout Station	2031	$27.9
	Total, Alt 1		**$31.0**
2	10-Yr Extension		
	Initial Upgrade to Existing Station	2026	$5.0
	New Buildout Station	2036	$33.9
	Total, Alt 2		**$38.9**
3	New DW Station	2028	**$27.9**
4	New Buildout Station	2027	**$22.9**

Project: Newport Wastewater Master Plan
Client: City of Newport OR

Northside Pump Station Alternative 1 - Bare Minimum

Date of Estimate	**March-23**
February 2023 20-city ENR	**13176**
Projected Date of Mid-Point of Construction	**July-25**

Estimated Construction Costs Summary for Master Plan CIP ("Bare Minimum" Alternative)

Item	Estimated Total
Mobilization/Demobilization - Alt 1 Bare Minimum	$ 43,000
Screen Replacement, no conveyor	$ 1,181,000
Electrical Upgrades	$ 193,000
HVAC Improvements	$ 96,000
Subtotal Direct Construction Costs @ Mid-Point of Construction	**$ 1,513,000**
Div 0 General Rqmnts @ 12%	$ 182,000
Contractor OH&P @15%	$ 255,000
Bonds, Insurance, and Taxes @ 4%	$ 78,000
Subtotal, Construction Cost w Markups	$ 2,028,000
Estimating Contingency @ 40%	$ 812,000
Subtotal Estimated 2023 Construction Cost	$ 2,840,000

Project: Newport Wastewater Master Plan
Client: City of Newport OR
Northside Pump Station Alternative 2 - 10-Year Alternative

Date of Estimate	**March-23**
February 2023 20-city ENR	**13176**
Projected Date of Mid-Point of Construction	**July-25**

Estimated Construction Costs Summary for Master Plan CIP ("10-Year" Alternative)

Item	Estimated Total
Mobilization/Demobilization - Alt 2, 3, and 4 (Larger Projects)	$ 187,000
Screen Replacement, incl conveyor addition	$ 1,609,000
Grit System Replacement	$ 355,000
Electrical Upgrades	$ 193,000
HVAC Improvements	$ 96,000
Misc Building Improvements	$ 15,000
Subtotal Direct Construction Costs @ Mid-Point of Construction	**$ 2,455,000**
Div 0 General Rqmnts @ 12%	$ 295,000
Contractor OH&P @15%	$ 413,000
Bonds, Insurance, and Taxes @ 4%	$ 127,000
Subtotal, Construction Cost w Markups	$ 3,290,000
Estimating Contingency @ 40%	$ 1,316,000
Subtotal Estimated 2023 Construction Cost	$ 4,606,000

Project: Newport Wastewater Master Plan
Client: City of Newport OR
Northside Pump Station Alternative 3 - New Dry Weather PS

Date of Estimate	**March-23**
February 2023 20-city ENR	**13176**
Projected Date of Mid-Point of Construction	**July-25**

Estimated Construction Costs Summary for Master Plan CIP ("New Dry Weather PS" Alternative)

Item	Estimated Total
Mobilization/Demobilization - Alt 2, 3, and 4 (Larger Projects)	$ 187,000
Construct Dry Weather Pump Station	
Pumping System	$ 3,164,000
Screening and Grit Removal Systems	$ 5,597,000
HVAC and Foul Air Treatment	$ 913,000
Yard Piping and Yard Electrical	$ 487,000
Site Improvements	$ 112,400
Upgrade Existing Pump Station	
Screen Replacement, incl conveyor addition	$ 1,609,000
Grit System Replacement	$ 355,000
Electrical Upgrades	$ 193,000
HVAC Improvements	$ 96,000
Misc Building Improvements	$ 15,000
Subtotal Direct Construction Costs @ Mid-Point of Construction	**$ 12,728,400**
Div 0 General Rqmnts @ 12%	$ 1,528,000
Contractor OH&P @15%	$ 2,139,000
Bonds, Insurance, and Taxes @ 4%	$ 656,000
Subtotal, Construction Cost w Markups	$ 17,051,400
Estimating Contingency @ 40%	$ 6,820,600
Subtotal Estimated 2023 Construction Cost	$ 23,872,000

Project: Newport Wastewater Master Plan
Client: City of Newport OR

Northside Pump Station Alternative 4 - New Buildout PS

Date of Estimate	**March-23**
February 2023 20-city ENR	**13176**
Projected Date of Mid-Point of Construction	**July-27**

Estimated Construction Costs Summary for Master Plan CIP ("New Buildout PS" Alternative)

Item	Estimated Total
Mobilization/Demobilization - Alt 2, 3, and 4 (Larger Projects)	$ 187,000
Construct Buildout Pump Station	
PS Structure	$ 3,976,000
Pumping System + Process Piping	$ 1,300,000
Screening and Grit Removal + Process Piping	$ 2,523,000
HVAC, Plumbing, and Odor Control	$ 1,212,000
Yard Piping	$ 262,000
Sitework	$ 112,400
Electrical and Instrumentation	$ 1,095,000
Decommission Existing PS	$ 200,000
Subtotal Direct Construction Costs @ Mid-Point of Construction	**$ 10,867,400**
Div 0 General Rqmnts @ 12%	$ 1,305,000
Contractor OH&P @15%	$ 1,826,000
Bonds, Insurance, and Taxes @ 4%	$ 560,000
Subtotal, Construction Cost w Markups	$ 14,558,400
Estimating Contingency @ 40%	$ 5,823,400
Subtotal 2023 Estimated Construction Cost	$ 20,382,000

Appendix I Northside Pump Station Dechlorination Cost Estimate

Project: Newport Dechlorination Facility
Client: City of Newport OR

Date of Estimate	**November-22**
Projected Date of Mid-Point of Construction	**July-24**
Projected ENR at Mid-point Construction	**14524**

Estimated Construction Costs Summary - to assist the City in establishing funding for the new facilities

Item	Estimated Phase A Total	Estimated Phase B Total
Mobilization & Demobilization	$ 38,000	$ 9,000
Site Work	$ 230,000	$ 99,000
Pre-Engineered Metal Buildings	$ 558,000	$ -
Bisulfite Equipment	$ -	$ 357,000
Subtotal Direct Construction Costs @ Mid-Point of Construction	**$ 1,244,000**	**$ 456,000**
Div 0 General Rqmnts @ 12%	$ 149,300	$ 54,800
Contractor OH&P @15%	$ 209,000	$ 76,700
Subtotal Construction Costs	$ 1,603,000	$ 588,000
Estimating Contingency, 30%	$ 374,000	$ 137,000
Grand Total	**$ 1,980,000**	**$ 730,000**

Phase A Mobilization/Demobilization

		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Mobilization					
	Establish staging area - fencing, trailers, rock, etc.	1	LS	$ 12,000	1.00	$ 12,000
	Construction Equipment Transport	1	LS	$ 10,000	1.00	$ 10,000
	Trailer Rental (2 for 12 months)	12	Month	$ 400	1.00	$ 4,800
	Worker sanitation (handwash stations, portable toilets, etc.)	12	Month	$ 75	1.00	$ 900
	Groundwater/Stormwater Control					
	Groundwater Dewatering	1	LS	$ 2,000	1.00	$ 2,000
	Erosion Control					
	Establish EC controls	1	LS	$ 5,000	1.00	$ 5,000
	Total					**$ 34,700**

Phase B Mobilization/Demobilization

		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Mobilization					
	Trailer Rental (2 for 18 months)	18	Month	$ 400	1.00	$ 7,200
	Worker sanitation (handwash stations, portable toilets, etc.)	18	Month	$ 75	1.00	$ 1,350
	Groundwater/Stormwater Control					
	Groundwater Dewatering					
	Total					**$ 8,550**

Phase A Site Work

		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Clear site (100'x75'), remove debris, dispose offsite	900	SY	$ 7.00	1.00	$ 6,300
	Demolition					
	Old Digester Complex					
	Demo and Remove Structures	7,870	sf	$ 2	1.00	$ 15,740
	Excavate around belowgrade structure to expose	814	cy	$ 20	1.00	$ 16,281
	Haul debris to offsite disposal (10 cy dump truck + tipping fee)	29	trips	$ 200	1.22	$ 7,175
	Backfill cavity w engineered fill	1,178	cy	$ 40	1.00	$ 47,100
	Old Clarifier near Garage PEMB					
	Demo and Remove Structures	8,902	sf	$ 2	1.00	$ 17,804
	Haul debris to offsite disposal (10 cy dump truck + tipping fee)	33	trips	$ 200	1.22	$ 8,045
	Backfill w engineered fill	353	cy	$ 40	1.00	$ 14,130
	Old Clarifier Near TF					
	Remove top 5 ft of walls	1,413	sf	$ 2	1.00	$ 2,826
	Fill clarifier w clean fill	2,355	cy	$ 10	1.00	$ 23,550
	Remove miscellaneous abandoned buried piping and utilities, excavation, pipe removal, backfill, and disposal	1	LS	$ 20,000	1.00	$ 20,000
	Rough grade site	1	LS	$ 5,000	1.00	$ 5,000
	Allowance for New Asphalt + Roadway Base	1	LS	$ 20,000	1.22	$ 24,400
	Total					**$ 208,351**

Phase B Site Work

		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Yard Piping (incl trench excav, piping, trench backfill/compaction)					
	Gravity Sewer (Connect to temp pipe)	50	LF	$ 40	1.00	$ 2,000
	Potable Water	100	LF	$ 40	1.00	$ 4,000
	Chlorinated Effluent Sample	150	LF	$ 40	1.00	$ 6,000
	Dechlorinated Effluent Sample	150	LF	$ 40	1.00	$ 6,000
	Yard Electrical					
	Ductbank Construction (to Electrical Building)	1,000	LF	$ 30	1.22	$ 36,600
	Finish grade site	1	LS	$ 5,000	1.00	$ 5,000
	Allowance for New Asphalt + Roadway Base	1	LS	$ 20,000	1.22	$ 24,400
	Allowance for Landscaping	1	LS	$ 5,000	1.22	$ 6,100
	Total					**$ 90,100**

	Pre-Engineered Metal Buildings					
		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Structural Excavation					
	Bisulfite Building					
	Excavation for wall footings	74	CY	$ 20	1.00	$ 1,481
	Additional excavation for column footings	1	LS	$ 1,000	1.00	$ 1,000
	Backfill and Compact	44	CY	$ 15	1.00	$ 667
	Parking Garage					
	Excavation for wall footings	178	CY	$ 20	1.00	$ 3,556
	Additional excavation for column footings	1	LS	$ 1,000	1.00	$ 1,000
	Backfill and Compact	107	CY	$ 15	1.00	$ 1,600
	Cast-in-Place Concrete					
	Bisulfite Building					
	Perimeter footing	19	CY	$ 400	1.00	$ 7,407
	Column Footings @ 18" Thick	8	EA	$ 1,600	1.00	$ 12,800
	Stem Wall	15	CY	$ 300	1.00	$ 4,444
	Building Slab	22	CY	$ 250	1.00	$ 5,556
	Base Rock	58	CY	$ 40	1.00	$ 2,333
	Conainment Walls at Storage Area	4	CY	$ 250	1.00	$ 972
	Parking Garage					
	Perimeter footing	44	CY	$ 400	1.00	$ 17,778
	Column Footings @ 18" Thick	12	EA	$ 1,600	1.00	$ 19,200
	Stem Wall	36	CY	$ 300	1.00	$ 10,667
	Building Slab	132	CY	$ 250	1.00	$ 33,102
	Base Rock	207	CY	$ 40	1.00	$ 8,296
	Pre-Engineered Metal Buildings					
	Bisulfite Building					
	Vendor Cost w/ GC Markup	1	LS	$ 45,000	1.22	$ 54,900
	Erection	10	day	$ 4,000	1.22	$ 48,800
	Exclusions/Adders - see separate spreadsheet					$ 8,300
	Parking Garage					
	Vendor Cost w/ GC Markup	1	LS	$ 115,000	1.22	$ 140,300
	Erection	15	day	$ 4,000	1.22	$ 73,200
	Exclusions/Adders - see separate spreadsheet					$ 43,888
	Miscellaneous Adders					
	Sanitary sewer stub-out	1	EA	$ 3,000	1.00	$ 3,000
	Slab blockout for utilities	1	EA	$ 2,000	1.00	$ 2,000
	Estimated Cost for Construction of Pre-Engineered Metal Buildings					**$ 506,247**

	Pre-Engineered Metal Building Adders					
		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	PEMB Adders - Parking Garage					
	Anchor Bolts					
	Columns - 15 with 4 ABs each (1-1/4" x 24" long)	60	EA	$ 100	1.00	$ 6,000
	Doors					
	Overhead Doors					
	12' x 12' (electric)	2	EA	$ 4,000	1.68	$ 13,440
	10' x 10' (electric)	2	EA	$ 3,500	1.68	$ 11,760
	Mandoors					
	3' x 7' metal door with hardware	2	EA	$ 1,000	1.22	$ 2,440
	Wall Insulation	1	LS	$ 5,000	1.22	$ 6,100
	Vapor Barrier	3,000	SF	$ 1	1.22	$ 3,660
	Roof Drains and Downpouts	4	EA	$ 100	1.22	$ 488
	PEMB Adders - Bisulfite Building					
	Anchor Bolts					
	Columns - 22 ABs 1-1/4" x 24" long	22	EA	$ 100	1.00	$ 2,200
	Mandoor					
	3' x 7' metal door with hardware	1	EA	$ 1,000	1.22	$ 1,220
	Wall Insulation	1	LS	$ 3,500	1.22	$ 4,270
	Vapor Barrier	300	SF	$ 1	1.22	$ 366
	Roof Drains and Downpouts	2	EA	$ 100	1.22	$ 244
	Louver					
	Estimated Cost for Construction of Additional Items Excluded by PEMB Manufacturer					**$ 52,188**

	Bisulfite Facility					
		Quantity	Unit	Unit Cost	Inst'n Factor	Cost
	Bisulfite Facility					
	Chlorine Residual Analyzers	2	EA	$ 1,500	1.68	$ 5,040
	Bisulfite Storage Tank w/ Level Sensing, drain valve, overflow, truck loading control panel, etc.	1	EA	$ 12,000	1.68	$ 20,160
	Bisulfite piping, valves and supports - containment area	1	LS	$ 5,000	1.22	$ 6,100
	Tank exhaust scrubber	1	EA	$ 3,000	1.22	$ 3,660
	Bisulfite feed system w/in building - metering pump, piping, valves, supports	1	EA	$ 14,000	1.68	$ 23,520
	Paint gypsum board in restroom	300	SF	$ 16	1.22	$ 5,856
	Other Coatings	1	LS	$ 3,000	1.22	$ 3,660
	Signs	6	EA	$ 35	1.00	$ 210
	Fire Extinguishers	2	EA	$ 300	1.00	$ 600
	Emergency Shower/Eyewash + Tepid Water System	1	EA	$ 8,500	1.68	$ 14,280
	HVAC Fans and Ducting	1	EA	$ 4,000	1.68	$ 6,720
	Backflow preventer	1	LS	$ 750	1.38	$ 1,035
	Workbench and Cabinets	1	LS	$ 1,000	1.00	$ 1,000
	Floor Drains and Cleanouts	4	EA	$ 500	1.22	$ 2,440
	Restroom fixtures and piping	1	LS	$ 4,000	1.22	$ 4,880
	Electrical					
	Control Panels, Lighting Panels, electrical devices	1	LS	$ 50,000	1.38	$ 69,000
	Conduit, wiring, terminations at equipment	1	LS	$ 50,000	1.38	$ 69,000
	Electrical at existing Electrical Building	1	LS	$ 20,000	1.38	$ 27,600
	Difficult factor/unknowns in Electrical Building	1	LS	$ 10,000	1.38	$ 13,800
	Lighting protection, grounding system @ 2 Buildings	1	LS	$ 7,000	1.38	$ 9,660
	Misc electrical allowance	1	LS	$ 10,000	1.38	$ 13,800
	Fluorescent Lighting at Bisulfite Facility	10	EA	$ 600	1.38	$ 8,280
	Fluorescent Lighting at Parking Garage	16	EA	$ 600	1.38	$ 13,248
	Estimated Cost for Construction of Bisulfite Facility					**$ 323,549**

Appendix J Solids Basis of Design TM

22 August 2022

Technical Memorandum

To: Josh Johnson, Brown & Caldwell

From: Mark Cullington, Kennedy Jenks
Ben Bosse, Kennedy Jenks
Matt Horton, Kennedy Jenks

Reviewed By: Luke Werner, Kennedy Jenks

Subject: Solids Stream Basis of Design
Newport WWT Master Plan – Phase II, Brown & Caldwell Project No. 158211
City of Newport
K/J Project No. 2276008*00

Introduction

The City of Newport (City) owns and operates the Vance Avery Wastewater Treatment Plant (WWTP) constructed in 2002 and located in South Beach, Oregon. The WWTP is an activated sludge plant with a peak wet weather capacity of 15 million gallons per day (mgd) that currently receives an average annual flow of approximately 2 mgd. In 2022, the City authorized Brown & Caldwell (BC) to perform master planning for the WWTP. BC has subcontracted with Kennedy/Jenks Consultants (Kennedy Jenks) in an agreement dated 11 March 2022 to complete a Biosolids Alternatives Evaluation for the solids stream at the WWTP. The evaluation will assess biosolids management alternatives to provide a long-term biosolids handling, treatment, and beneficial use or disposal portfolio for the City's WWTP operations. Recommendations from the evaluation will account for hauled waste at the WWTP, solids stabilization and storage, dewatering, Class A and/or B treatment technologies, beneficial use, and compliance with Oregon Department of Environmental Quality's (DEQ) biosolids regulations. Regulatory trends will be incorporated in order to project compliance requirements into the planning horizon. The information from the evaluation will be incorporated by BC and the City into the Newport Wastewater Treatment Master Plan.

The purpose of this Technical Memorandum (TM) is to develop Basis of Design criteria for preliminary sizing of solids treatment processes that will be considered in the Biosolids Alternatives Evaluation. Basis of Design criteria include solids flows and loads, wasting schedules and solids characteristics such as percent total solids (TS), Total Suspended Solids (TSS) and Volatile Suspended Solids (VSS) content. This TM presents Basis of Design criteria for a 20-year design period.

Existing Conditions

The current solids process at the WWTP includes pumping waste activated sludge (WAS) to an aerobic tank for storage and thickening, dewatering using centrifuges, and stabilization of the biosolids using RDP Technologies' lime pasteurization system, resulting in a Class A Exceptional Quality (EQ) biosolids product. The WWTP process flow diagram is shown on Figure 1.

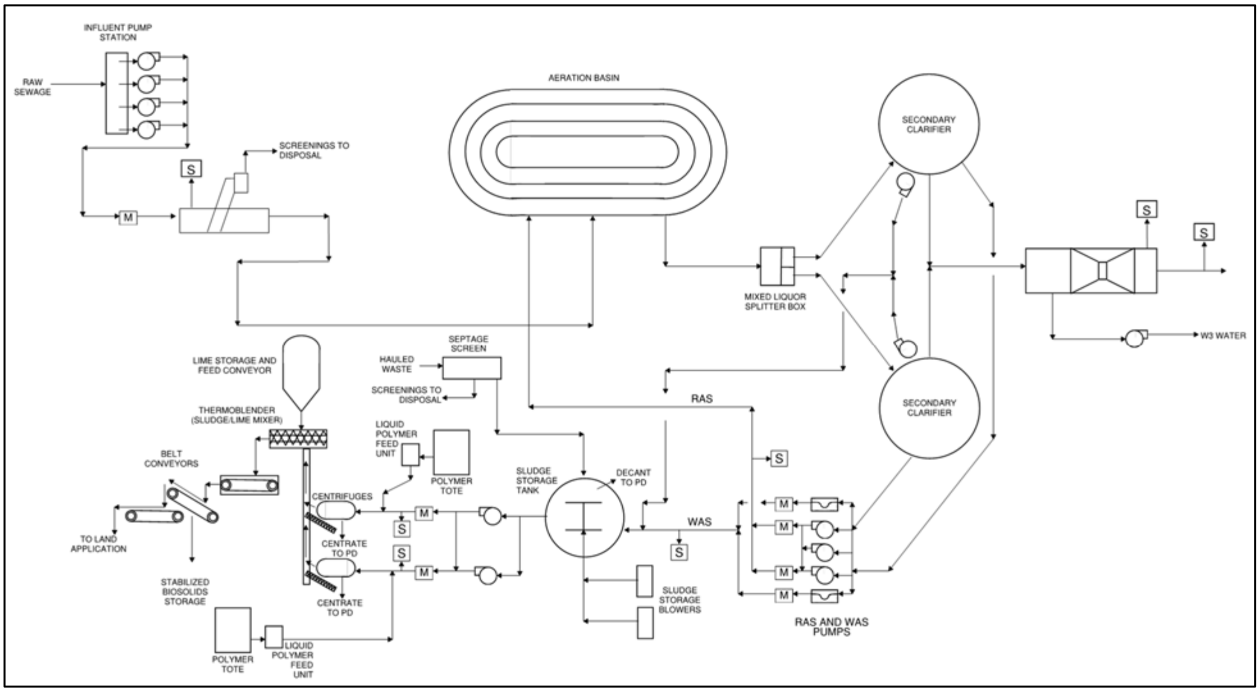


Figure 1: Current Process Flow Diagram

Solids Stream Design Criteria

Kennedy Jenks, with assistance from the City and BC, has developed the Basis of Design criteria presented in this section. The Basis of Design criteria are needed for the preliminary sizing of solids stream processes and are based on plant operational data and future flows and loads. Wastewater treatment plant flows and loads, as well as solids stream projected loadings, were developed by BC and are presented in Tables 1 and 2, respectively. Design criteria for solids stream unit processes that may be considered as part of the Biosolids Alternatives Evaluation are summarized below and presented in Tables 3 through 8.

- **<u>Hauled Waste</u>** – a packaged system to receive septage and other hauled waste will be included with each biosolids alternative. The packaged system described is based on a Huber RoFas system, which in Kennedy Jenks' research has not shown to be prone to ragging, and includes an integral grit removal process. The packaged system is available with or without a ticketing system for tracking hauled waste loads and is used in other wastewater facilities in Oregon.

- **Solids Storage** – the existing sludge storage tank will be assumed to continue to receive WAS and hauled waste, similar to current WWTP operations. The ability of the tank to thicken solids to a desirable solids concentration for dewatering will impact biosolids alternatives that do not include thickening and stabilization unit processes, such as aerobic or anaerobic digestion. Either additional storage volume or a lower dewatering feed solids concentration may be considered for these alternatives.

- **Thickening** – a mechanical thickening process may be considered for biosolids alternatives that include a stabilization unit process, such as aerobic or anaerobic digestion. Thickening facilities would receive flow from the sludge storage tank at 0.5 to 0.7% TS and produce 4 to 5% TS thickened solids product.

- **Solids Stabilization** – biosolids alternatives will be developed both with and without stabilization to understand the costs and benefits of aerobic or anaerobic digestion to reduce the overall mass of biosolids for further treatment and disposal.

- **Dewatering** – dewatering of biosolids, whether following stabilization or directly from the sludge storage tank, will be evaluated. Dewatered biosolids will consist of a 20% TS cake that will be conveyed to further treatment to produce Class A or B biosolids.

- **Class A Biosolids Treatment** – processes such as composting and mechanical dryers will be evaluated for the production of Class A biosolids in comparison to the existing RDP lime pasteurization process. These processes will result in a finished biosolids product that can be beneficially applied to agricultural lands, or sold or given away to the general public as a soil amendment.

Table 1: Wastewater Treatment Plant Flows and Loads[(a)]

Parameter	Year					
	2021	2030	2040	2050	2060	Buildout[(b)]
Flows, mgd						
Average Annual	1.8	1.9	2.0	2.0	2.0	2.0
Max Month (MMWWF)	3.3	3.6	3.7	3.8	3.8	3.8
Peak Day (PDWWF)	6.5	7.0	7.4	7.5	7.5	7.5
Loads, ppd[(c)]						
BOD_5[(d)]						
Average Annual	3,200	3,414	3,561	3,599	3,608	3,617
Max Month	4,250	4,560	4,764	4,817	4,830	4,843
Peak Day	6,500	7,024	7,375	7,466	7,488	7,510
TSS[(e)]						
Average Annual	2,775	2,993	3,142	3,180	3,191	3,200
Max Month	4,000	4,309	4,525	4,581	4,594	4,608

Parameter	Year					
	2021	2030	2040	2050	2060	Buildout[(b)]
Peak Day	6,800	7,332	7,699	7,793	7,817	7,840

Notes:

(a) Flows and loads values were developed by BC and provided via an email dated 10 May 2022.

(b) Buildout is projected to occur in year 2070 per BC.

(c) ppd = pounds per day.

(d) BOD_5 = biochemical oxygen demand.

(e) TSS = total suspended solids.

Table 2: Solids Stream Projected Loadings[(a)]

Parameter	Condition			
	2022 Average	2040 Average	2040 Maximum Month	2040 Maximum Week
Waste Activated Sludge				
Solids, ppd	3,200	3,561	4,451	5,341[(b)]
Solids, pph[(c)]	133	148	185	223
Solids concentration, %TS[(d)]	0.55	0.55	0.55	0.55
Flow, gpd[(e)]	69,720	77,580	96,970	116,440
Flow, gpm[(f)]	48	54	67	81
Hauled Waste[(g)]				
Solids, ppd	137	152	191	229
Solids concentration, %TS	1.8	1.8	1.8	1.8
Flow, gpd	913	1,015	1,269	1,523

Notes:

(a) Flows and loads values were developed by BC and provided via an email dated 10 May 2022.

(b) Based on maximum week WAS solids loading peaking factor of 1.5, per BC.

(c) pph = pounds per hour. Assumes wasting occurs 24 hours per day, 7 days per week.

(d) TS = total solids. Average WAS concentration per BC.

(e) gpd = gallons per day.

(f) gpm = gallons per minute.

(g) 2022 average hauled waste flows and loads are based on WWTP annual biosolids reports (2018 through 2021) and an average solids concentration of 1.8%. Year 2040 hauled waste flows and loads are based on WAS peaking factors.

Table 3: Hauled Waste Design Criteria

Parameter	Value
Hauled Waste	
Design Condition	Maximum Week[(a)]
Redundancy	No Standby[(b)]

Parameter	Value
Type	Packaged System[c]
Location	Covered[d]
Number of Truck Connections	1[e]
Capacity, gpm	600[f]
Maximum Solids Content, %TS	5%
Truck Unload Time	1-5 minutes[g]
On-skid Flow Meter	Yes
On-skid pH Monitoring	Yes
Load Tracking and Monitoring	Not Provided[h]
Integral Rock Trap	Not Provided[h]
Odor Control	Yes[i]
Utility Requirements	Washwater[j]
Septage Screening	
Type	Drum, Perforated Plate
Integral Washer/Compactor	Yes
Screenings Disposal	Screenings Receptacle
Washwater Disposal	Plant Drain
Grit Removal	
Type	Longitudinal Grit Trap
Grit Disposal	Grit Receptacle
Grease Removal	Yes[k]

Notes:
(a) Standard Design Condition.
(b) 1 duty system.
(c) Includes septage screening and grit removal.
(d) Adjacent to existing septage receiving.
(e) City to determine if hauler activity may justify a second truck connection.
(f) At maximum solids concentration of 5%. Based on manufacturer (Huber) capacity data.
(g) Truck volumes range from 1,000 to 2,500 gallons per load.
(h) City to verify.
(i) Enclosed Equipment with Foul Air Duct Connections.
(j) 30 gpm at 75 psi.
(k) Grease skimmer, transfer screw and pump.

Table 4: Sludge Storage Design Criteria

Parameter	Value
Sludge Storage Tank	
Design Condition	Max Week

Parameter	Value
Redundancy[(a)]	No Standby
Diameter, ft[(b)]	60
Sidewater Depth, ft	17
Volume, gallons	360,000
Performance	
HRT, Days[(c)]	3.1
Decant, gpd	59,000
Decant %TS[(d)]	0.11
Decant Solids Load, ppd	546

Notes:
(a) Assumes existing Sludge Storage Tank is maintained.
(b) ft = feet.
(c) HRT = hydraulic retention time, at maximum week WAS and hauled waste loading.
(d) Based on WWTP operating data provided by BC via email dated 28 April 2022.

The decant rate assumes the sludge holding tank is decanted on a daily basis at a rate of 50% of tank influent flow to produce a thickened solids concentration of 1% to dewatering. Discussions with WWTP operations staff indicate the capacity to effectively decant the holding tank is limited to 20% of the tank influent flow. The Biosolids Evaluation Report will need to consider increasing the storage tank volume to produce a thickened solids concentration of 1%. Alternatively, the Biosolids Evaluation Report may consider lower decant rates that produce a thickened solids concentration of 0.6 to 0.7% TS, similar to current WWTP operations.

Mechanical thickening is recommended for alternatives considering solids stabilization, ie aerobic or anaerobic digestion. Mechanical thickening design criteria are summarized in Table 5.

Table 5: Mechanical Thickening Design Criteria

Parameter	Value
Thickening	
Design Condition	Max Week
Redundancy[(a)]	No standby
Solids Capture, %[(b)]	95
Solids concentration, %TS	
Anaerobic Digestion[(c)]	5
Aerobic Digestion[(b)]	4
Polymer Usage, active lbs/dry ton[(d)]	6-10

Notes:
(a) Parallel units would be provided. Assumes 64 operating hours per week.
(b) Typical Design Standard, Metcalf and Eddy, 4th Edition.
(c) Typical range is 4 to 6% (Table 22.8 WEF Manual of Practice 8).
(d) Typical range (Table 20.8 WEF Manual of Practice 8).

Table 6: Solids Stabilization Design Criteria

Parameter	Value
Solids Stabilization	
Design Condition	Max Month
Redundancy	No standby
Volatile Solids Concentration, %VS[(a)]	83
Aerobic Digestion	
Solids Loading, lbs VS/ft^3/day[(b)]	0.1 - 0.3
VS Destruction, %[(c)]	40
Class B Solids Retention Time[(d)]	40 days at 68°F; 60 days at 59°F
Aeration Requirements[(e)]	2-3
Digested Solids Concentration, %TS[(f)]	2-3
Anaerobic Digestion	
Solids Loading, lbs VS/ft^3/day[(g)]	0.16
VS Destruction, %[(h)]	55
Class B Solids Retention Time, day[(i)]	20
Class B Temperature Requirement, °F[(j)]	95
Mixing Requirements, turnovers per day[(k)]	8-12
Digester Gas Production, ft^3/lb VS/day[(l)]	15
Digested Solids Concentration, %TS[(m)]	2.8

Notes:

(a) VSS:TSS ratio provided by BC via an email dated 10 May 2022.
(b) Typical Design Standard, Metcalf and Eddy, 4th Edition.
(c) CFR Part 503 requires minimum 38% for Class B Typical range is 35 to 50% (Page 22-98 WEF Manual of Practice 8)
(d) Per 40 CFR 503.32(b)(3)
(e) lb of O2 per lb of VSS destroyed
(f) Assumes 4% TS loading to aerobic digestion.
(g) Typical range is 0.12 to 0.16 (Page 22-33 WEF Manual of Practice 8)
(h) Typical range is 40 to 65% (Table 22.11 WEF Manual of Practice 8)
(i) Minimum SRT of 15 days per 40 CFR Part 503 at temperatures between 95 to 131ºF
(j) Temperature range 95 to 131ºF per 40 CFR Part 503
(k) Mixing energy may also be determined based on volume, at 3.3 to 4.2 Hp per million gallons.
(l) Typical design standard.
(m) Assumes 5% TS loading to anaerobic digestion.

Table 7: Dewatering Design Criteria

Parameter	Value
Dewatering	
Design Condition	Max Month
Redundancy[(a)]	No standby
Solids Capture, %[(b)]	90-95
Cake Concentration, %TS	
Aerobic Digestion[(c)]	18
Anaerobic Digestion[(d)]	22
Polymer Usage, active lbs/dry ton[(e)]	16-20

Notes:

(a) Parallel units would be provided. Assumes 64 operating hours per week.
(b) Standard range for centrifuge technology. Higher percent capture is associated with higher feed solids concentration.
(c) Typical range for aerobically digested sludge is 18 to 22%.
(d) Typical range for anaerobically digested sludge is 20 to 25%.
(e) Based on sludge testing performed by Andritz, dated 2 June 2022.

Table 8: Class A Biosolids Treatment Design Criteria

Parameter	Value
Biosolids Treatment	
Design Condition	Max Month
Redundancy	No Standby
Location	Onsite
Compost	
Bulking Agent:Solids Loading Ratio[(a)]	1.2:1
Time Requirement, weeks	6-7
Area Requirements	
Bulking Agent, ft^2 per lb[(b,c)]	2-3
Treatment, ft^2 per lb[(b,d)]	3
Finished Product Storage, ft^2 per lb[(b,e,f)]	3
Finished Product Volume, ft^3 per lb[(b,g)]	0.25
Drying	
Fuel Source	Natural Gas
Temperature[(h)]	212 to 400°F
Product Solids Concentration, %TS	> 90%

Parameter	Value
Finished Product Storage	Super Sacks
Lime Heat Pasteurization	
Lime:Solids Loading Ratio[i]	0.4
Time Requirement, minutes	30
Temperature Requirement	> 158°F
pH Requirement	12 or higher

Notes:

(a) Wet lbs basis.
(b) Lbs dewatered solids, dry basis.
(c) Assumes 90 days storage, 12' high (H) piles.
(d) Assumes 8'H piles.
(e) Assumes 90 days storage, 8'H piles.
(f) Assumes conservative mass reduction of 10%.
(g) Assumes typical mass reduction of 25%.
(h) Varies with technology (e.g. indirect dryers, direct dryers, belt dryers).
(i) Dry lbs basis from typical design criteria for existing RDP system.

Appendix K Solids Equipment Vendor Proposals

BUDGET PROPOSAL

HUBER TECHNOLOGY
WASTE WATER Solutions

Newport, OR

Equipment:
HUBER Sludge Acceptance Plant RoFAS 1

Represented by:
Goble Sampson Associates
Doug Allie
(425) 392-0491
dallie@goblesampson.com

Regional Sales Director:
Ronald Maiorana
704-990-2422
Ronald.Maiorana@hhusa.net

Project Number:	491149
Revision:	0
Date:	10/25/2022

HUBER Technology, Inc.
1009 Airlie Pkwy, Denver, NC 28037
704-949-1010 | www.HUBER-technology.com

Design Information RoFAS

Technical Data		
Maximum Flow Rate	**600**	**GPM**
Solids Content at Max Flow Rate	**5%**	**%**
Drum Perforation Sizing	**10**	**mm**
Diameter of Drum	**3.94**	**feet**
Length of Drum	**9.24**	**feet**
Approximate empty weight	**2756**	**lbs**
Approximate loaded weight	**4960**	**lbs**
Wash Water Consumption	**40**	**GPM**
Wash Water minimum pressure	**100**	**PSI**
Installation Angle of Drum	**10**	**°**
ANSI Inlet Diameter	**4**	**inch**
ANSI Outlet Diameter	**8**	**inch**

Equipment Details

Model	HUBER Sludge Acceptance Plant RoFAS 1
Quantity	1
Material	304L Stainless Steel Construction; picked and passivated in acid bath
Screenings Wash	One (1) spraybar system used to clean screenings
Solenoid Valve	One (1x) 1-1/2 inch size diameter Class1 Division1 120VAC 60Hz single phase Brass body
Drive Motor	3HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Actuator/Valve	Electric actuator with PVC Ball Valve
Flow Meter	Magnetic flow meter
Level Sensor	Pressure transducer
pH Sensor	4-20mA pH Sensor
Odor Flange	ANSI Flange for odor control connection
Supports	304L Stainless Steel Construction
Anchor Bolts	M12, 316L, Included

Design Information WAP

Technical Data		
Screenings Capacity	**212**	**cu.ft/hr**
Drain Pan Perforation Sizing	**5**	**mm**
Approximate empty weight	**1323**	**lbs**
Wash Water Consumption	**24**	**gpm**
Wash Water minimum pressure	**30-75**	**psi**
ANSI Outlet Diameter (WAP6 or Larger)	**4**	**inch**

Equipment Details

Model	HUBER Wash Press WAP 6
Quantity	1
Material	304L Stainless Steel Construction; picked and passivated in acid bath
Auger Material	304L Stainless Steel Construction; picked and passivated in acid bath with shafted screw design
Solenoid Valve(s)	Two (2x), 1-inch size diameter, Class 1 Division 1, 120 VAC, 60 Hz single phase, Brass body
Drain Pan	Latched, 3.5" NPT Connection
Inlet Hopper	Enclosed feed hopper, inspection Hatch Included
Discharge Pipe	304L stainless steel with endless bagger
Motor	7.5 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Supports	304L Stainless Steel Construction
Anchor Bolts	M12, 316L, Included

Design Information Ro6

Technical Data		
Maximum Flow	**950**	**GPM**
Approximate empty weight	**5600**	**lbs**
Approximate loaded weight	**27550**	**lbs**
ANSI Inlet Diameter	**10**	**inch**
ANSI Outlet Diameter	**12**	**inch**
Grit Tank Design	**Non-aerated**	**-**

Equipment Details

Model	HUBER Longitudinal Grit Trap Ro6
Quantity	1
Material	304L Stainless Steel Construction; picked and passivated in acid bath
Tank Covers	Removable standard non-walkable covers
Horizontal Screw	304L Stainless Steel Construction; shafted grit transfer screw
Inclined Screw	304L Stainless Steel Construction; shafted grit removal screw
Hor. Screw Motor	0.75 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Incl. Screw Motor	0.75 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Chute	Closed grit discharge chute
Grease System	Grease skimmer, grease transfer screw, and grease pump
Skimmer Motor	0.16 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Grease Screw	0.75 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Grease Pump	3.0 HP, 480 VAC, 3ph, 60 Hz, S.F. 1.15, Class 1 Division 1
Supports	304L Stainless Steel Construction
Anchor Bolts	M12, 316L, Included

Control Details

One (1) Main Control Panel	
Enclosure	NEMA 4X, Stainless Steel
PLC	Allen Bradley MicroLogix
HMI	Allen Bradley PanelView Plus 800
Pre-programmed and Factory Tested	

Pricing

Equipment	Model	Quantity	Pricing
HUBER Sludge Acceptance Plant	RoFAS 1	1	Included
HUBER Wash Press	WAP 6	1	Included
HUBER Longitudinal Grit Trap	Ro6 60	1	Included
HUBER Control Panel	HUBER Standard	1	Included
Freight and Startup Services	Standard HUBER Start-up Services	3 days, 1 trip	Included
TOTAL:			**$495,000.00**

Standard delivery is 22-30 weeks from approval of submittals.

Thank you for your interest in HUBER Technology, Inc. If you have any questions, please do not hesitate to contact our Regional Sales Director or our local sales representative.

This proposal has been reviewed for accuracy and approved for issue by: JW

Notes and Technical Clarifications

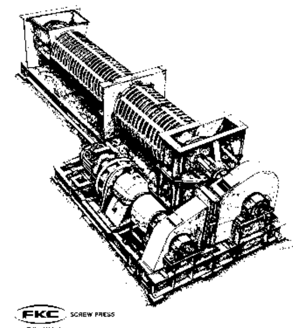
1. Equipment specification and drawings are available upon request.
2. If there are site-specific hydraulic constraints that must be applied, please consult the manufacturer's representative to ensure compatibility with the proposed system.
3. Electrical motor disconnects required per local NEC code are not included in this proposal.
4. All electrical interconnections, motor disconnects, wirings, junction boxes, and terminations between the equipment and electrical components are to be provided by installing contractor.
5. HUBER Technology warrants all components of the system against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, whichever occurs first.
6. Budget estimate is based on Huber Technology's standard Terms & Conditions and is quoted in US dollars unless otherwise stated.
7. Equipment recommendations are based on information provided to Huber Technology. Subsequent information which differs from what has been provided may alter the equipment recommendation.
8. Any item not specifically listed is not considered part of this scope of supply. Please contact the HUBER Technology representative listed for further clarification.
9. HUBER will ship all equipment to site inside of 20’, 40’ or 40’OT ocean containers as deemed appropriate by our factory. HUBER will not ship any equipment on flatbed truck. Flatbed truck shipping means that the equipment would need to be transferred at port from factory packaged containers to the flatbed. This process it out of HUBER’s control and it is our experience that equipment always gets damaged during this process.
10. Equipment that is broken out in “Pricing” tab are only valid when packaged together.
11. All piping to and from the equipment is to be supplied by the installing contractor.
12. Please note the pH sensor can be tied into our standard equipment panel, where the pH level can be displayed on the HMI for operator or SCADA use.

FKC CO., LTD.

2708 West 18th Street
Port Angeles, WA 98363

(360) 452-9472
FAX (360) 452-6880

May 24, 2023



Victor Pedroni
Pedroni & Co. LLC
Tel: (425) 369-6164
Email: victor@pedroni-co.com

Re: FKC Co., Ltd. Quotation QT04-052423RW
Newport OR WWTP – FKC Thickening Equipment

Victor:

FKC is pleased to provide this proposal for thickening of Waste Activated Sludge at the Newport, OR WWTP. This proposal includes:

(2) Two FKC Model RST-S630x2000L Rotary Screen Thickener (RST) with Support Frame
(2) Two Discharge Hopper w/ custom connection to TWAS Pump
(2) Two FKC Model 150GL Flocculation Tank with Agitator Assembly
(2) One 1.5-inch Solenoid Valve
(2) VeloBlend Liquid Polymer Blending Systems
All Required spare parts/All required start-up services
All Required training and performance testing

All items listed are shipped separate and loose to be assembled/installed by others.

Please note that the pricing found in this quote does not include all the other equipment necessary for a complete thickening application; i.e. feed pump, thickened sludge pump, local control panel, field instrumentation, etc.

We hope this information is helpful. Please contact this office if you have questions, or if you need anything further.

Sincerely,
FKC Co., Ltd.

Ryan Whitmore

FKC
Rotary Drum Thickener
with
Flocculation Tank

QT04-052423RW
May 24, 2023

Table of Contents

A. Proposed Equipment

Qty.	Description	FOB Newport OR WWTP
2	FKC Rotary Screen Thickener Model RST-S630x2000L	**See Price Summary Paragraph B.3.**
	Material:	100% Municipal WAS
	Inlet Capacity:	Up to 100 gpm
	Inlet consistency:	0.5% TS or Higher
	Polymer Dose:	Not to exceed 10 lbs active polymer per ton dry solids
	Outlet consistency:	4% TS or Higher - Aerobically Digested 5% TS or Higher – Anaerobically Digested (lab sample required to guarantee results)
	Solids Capture Rate	95%
	Materials of construction:	SS-304L wetted parts SS-304L Base SS-304L Support Legs & Frame Other Painted Carbon Steel
	Speed reducer:	SEW Eurodrive Gearbox Motor: 1.5 HP 480V/3PH/60Hz
	Other:	Two (2) 150GL Flocculation Tank SEW Eurodrive Gearbox Motor: 1 HP 480V/3PH/60Hz
	Delivery:	Delivery within seven (8) months after notice to proceed with manufacturing.

*Prices do not include taxes or bonding requirements

B. Miscellaneous

1. Delivery

On-site delivery will be within eight (8) months after notice to proceed with manufacturing.

2. Shipping Arrangements

The FKC thickening equipment will be shipped best way overland from Port Angeles, Washington to Newport, OR.

3. Equipment Summary

The following summarizes the equipment offered:

(2) Two FKC Model RST-S630x2000L Rotary Screen Thickener (RST) with Support Frame
(2) Two Custom Discharge Hopper w/ connection to TWAS Pump
(2) Two FKC Model 150GL Flocculation Tank with Agitator Assembly
(2) Two 1.5-inch Slow-Closing Solenoid Valve

US$ 181,100 FOB Newport OR WWTP

Optional Polymer Blending System Adder:
(2) Two VeloBlend Liquid Polymer Blending System

US$ 61,300 FOB Newport OR WWTP

This quotation and pricing does not include taxes or bonding.

Please note that the pricing found in this quote does not include all the other equipment necessary for a complete thickening application; i.e. polymer system, feed pump, TWAS pump, control panel, field instrumentation, etc.

4. Options Offered

No Options are offered at this time.

5. Effective Period

This proposal shall remain valid 60 days from the date of the proposal.

6. Payment Terms

10% with submittal approval
90% with delivery
Net 30 days

FKC understands that with some contract requirements, up to 10% of each milestone payment may be retained until successful performance is demonstrated.

7. Installation

The Rotary Screen Thickener is shipped ready for installation.

The Flocculation Tank is shipped ready for installation. Field assembly of the agitator drive, base and blades are required.

The Solenoid Valve is shipped loose for field installation by others.

8. Operator Training and Start Up

One (1) trips, three (3) person-days are provided for on-site services including start-up, performance testing and training of the Rotary Screen Thickener and Flocculation Tank.

Other installation and erection assistance are not included in the price of the equipment and generally are not required. However, the service is available for our standard service rates (see the enclosed rate sheet).

9. Warranty

FKC's mechanical warranty covers material and workmanship for a period of twelve (12) months from start-up or eighteen (18) months from delivery whichever occurs first.

10. Documentation Schedule

The drawings provided with this scope of supply are reference drawings only.

A. Approval Drawings - within 3 weeks after receipt of purchase order
   Buyer must return approval drawings within 14 days
   or delivery schedule will be affected
B. Certified Drawings - within 2 weeks after return of approval drawings
C. Operation and Maintenance Manuals - 14-16 weeks after receipt of order

11. Performance Guarantee

The performance figures and conditions denoted in section A of this proposal constitute FKC Co., Ltd.'s performance guarantee and the conditions required to meet the guarantee. All of the consistency figures are based on total solids (TS) not total suspended solids (TSS).

If performance is not met, FKC will provide all parts, engineering, and labor associated with the work necessary to bring the equipment into conformance with the performance guarantee.

12. Notes and Clarifications

No notes or clarification are offered at this time.

13. Spare Parts List

No spare parts are required for the first 1-2 years of operation. A list of long-term spares in available upon request.

14. Service Rates

The following are rates and terms for professional and technical services furnished by FKC: If required, round-trip airfare (coach class) from Port Angeles, WA to airport nearest work site.

<u>Weekdays</u>

$1,200.00 - Per eight (8) hour day on weekdays plus, lodging, and rental car expenses.
$225.00 - Per hour for all hours exceeding eight (8) hour workday on weekdays.

<u>Saturdays, Sundays and Holidays</u>

$1,800.00 - Per eight (8) hour day plus lodging and rental car expenses.
$350.00 - Per hour for all hours exceeding eight (8) hour workday.

<u>Travel Time - Weekdays</u>

$80.00 - Per hour travel time. (Not to exceed $990/day)

<u>Travel Time – Weekends and US Holidays</u>

$120.00 - Per hour travel time (Not to exceed $1,440/day)

Benjamin Bosse

From: Eric Hunter <erich@beaver-equipment.com>
Sent: Tuesday, May 30, 2023 7:59 PM
To: Benjamin Bosse

Subject: Re: Newport WWTP Conveyor Quote Request
Attachments: Serpentix Pathwinder (Model-P2) - Technical Data.pdf; Serpentix Flight Distribution (Model-FD) - Presentation.pdf; Pages from Newport Isometric and H Record Drawings - SX Marked (5.26.2023).pdf

Good Evening Ben,

Please see below for conveyor budget pricing from Serpentix. Keep me posted as you start to get into the design details.

CONVEYOR-A (forward running only - south direction): ~$87,650 USD
===================================
* complete mechanical Model-P2 conveyor, with fully assembled 2HP drive station and tension station
* pre-assembled chain in 401 link sections; 26in belting assembled in 4'-0" sections from factory
* track - 304 stainless steel construction
* zero speed sensor (120VAC | 1ph), emergency pull-cord switches (120VAC | 1ph)
* solenoid oiler bottle (120VAC | 1ph) for track lubrication
* skirtboards (at loading area) - 3/8" HDPE w/ 304SS brackets
* drip pans - 16ga galvanized sheet w/ 304SS brackets
* supports - ASTM A572 Grade-50, hot-dipped galvanized construction
* assembly hardware - 304SS standard
* one (1x) trip for one (1x) day of equipment start-up certification and O&M training
* Serpentix's standard NEMA 4X control panel for forward operation direction; includes motor starter, control relay logic, operator indicators / switches, run permissive for AUTO mode, select-able HAND mode
* warranty - One (1x) year warranty from equipment start-up, that covers against defects in materials and workmanship; does not include failures caused by abuse, negligence or lack of preventative maintenance. Parts only supplied by Serpentix if warranty claim is validated - time / labor of removal and installation is the responsibility of the Owner.
* freight to the jobsite

CONVEYOR-B (forward running only - west direction): ~$129,385 USD
===================================
* complete mechanical Model-P2 conveyor, with fully assembled 3HP drive station and tension station
* pre-assembled chain in 401 link sections; 26in belting assembled in 4'-0" sections from factory
* track - 304 stainless steel construction
* zero speed sensor (120VAC | 1ph), emergency pull-cord switches (120VAC | 1ph)
* solenoid oiler bottle (120VAC | 1ph) for track lubrication
* skirtboards (at loading area) - 3/8" HDPE w/ 304SS brackets
* drip pans - 16ga galvanized sheet w/ 304SS brackets
* supports - ASTM A572 Grade-50, hot-dipped galvanized construction
* assembly hardware - 304SS standard

* one (1x) trip for one (1x) day of equipment start-up certification and O&M training
* Serpentix's standard NEMA 4X control panel for forward operation direction; includes motor starter, control relay logic, operator indicators / switches, run permissive for AUTO mode, select-able HAND mode
* warranty - One (1x) year warranty from equipment start-up, that covers against defects in materials and workmanship; does not include failures caused by abuse, negligence or lack of preventative maintenance. Parts only supplied by Serpentix if warranty claim is validated - time / labor of removal and installation is the responsibility of the Owner.
* freight to the jobsite

CONVEYOR-C (both forward & reverse operation - north/south direction): ~$43,520 USD
==================================
* complete mechanical Model-FD conveyor; with fully assembled 2HP drive station and tension station
* Model-FD track - 304 stainless steel; 24" width low-profile
* open flange discharges at either end of conveyor (no knife gates)
* assembly hardware - 304SS
* suspended supports - A572 Grade-50 steel, hot-dipped galvanized
* one (1x) trip for one (1x) day of equipment start-up certification and O&M training
* Serpentix's NEMA 4X main control panel (MCP) for forward & reverse operation direction; includes REVERSING CONTACT motor starter, control relay logic, operator indicators / switches, run permissive for AUTO mode.
* Serpentix's NEMA 4X local control station (LCS) for select-able HAND mode [HOA switch], & selector switches for knife gates
* warranty - One (1x) year warranty from equipment start-up, that covers against defects in materials and workmanship; does not include failures caused by abuse, negligence or lack of preventative maintenance. Parts only supplied by Serpentix if warranty claim is validated - time / labor of removal and installation is the responsibility of the Owner.
* freight to the jobsite

==

NOTE: Excluded from the budget pricing:
* anchors / anchorage (typically contractor's responsibility)
* cross mounting beam / building beams / foundation design, if applicable (structural engineer's responsibility)
* structural design calculations, and PE stamping

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Thanks,

Eric Hunter
Sales Engineer
801.803.2082
EricH@Beaver-Equipment.com

On May 26, 2023, at 12:43 PM, Eric Hunter <erich@beaver-equipment.com> wrote:

Hi Ben,

engineeredCOMPOSTsystems

BUDGETARY QUOTATION

Client: Kennedy Jenks
Facility: Newport OR WWTP
By: Tim O'Neill, Chris Anderson
Date: 5/26/2023
Basis: Biosolids composting system sized for 2030 maximum month consisting of a reversing aeration active phase CASP with a biofilter and a positive aeration secondary (curing) ASP.

Feedstock	units		
Biosolids	Dry Ton/yr	739	
Dewatered Cake Solids	%	20%	
Fresh Woody Amendment	WT/yr	4,436	
Nominal Ratio: Woody Amendment/Feedstock	ton/ton	1.2	
Total Mix	WT/yr	8,133	
Throughput (365 d/yr)	TPD	22	
Nominal Mix Density	lb/CY	873	
Mix Moisture (initial)	%	60%	

Sizing	(US units)	Active	Secondary
Aeration Type		Reversing	Positive
Aeration Floor Type		Trench	B/G Sparger
Pile Arrangement		Bunker	Mass Bed
Retention Time	days	20	20
Independent Control & Aeration Zones	#	5	5
Zone Width	ft	20	20
Zone Length	ft	40	33
Pile Depth	ft	8.0	8.0
Cover Depth	ft	1.0	0.0
Mix Volume per Zone	CY	210	180
Total Aerated Volume Capacity	CY	1,050	900

Mechanical		Active	Secondary
Aeration Rate - Peak Single Zone Capacity	CFM/CY	6.0	2.5
Fan Power - Installed (total)	HP	22.5	5
Pile Surface Irrigation		Automated	

Process Area		Active	Secondary
Biofilter Area	ft^2	690	0

Cost Estimate		
Total ECS Scope of Work ($USD)		**$ 890,000**

Notes
- Mix volumes are approximate and should be adjusted for actual feedstock properties.
- Cost estimate assumes delivery of ECS standard submittals, parts, and technical support.
- ECS provides non-stamped shop drawings

DAP-5-R1D

NUMBER:	12843	**DATE:**	12/2/22
TO:	Kennedy Jenks	**REF:**	Belt Dryer

Proposal
City of Newport, OR
Low Temperature Belt Drying System

Centrisys Contact
Jerod Swanson
Regional Sales Manager
9586 58th place
Kenosha, WI 53144
Ph: (262) 654-6006
Direct: (612) 401-2006
Email: Jerod.swanson@centrisys.us

Centrisys Representative
Chris McCalib
Treatment Equipment Company (TEC)
249 Main Ave S, Ste 107 #322
North Bend, Washington 98045
Ph: (425) 641-4306
Direct: (206) 909-1546
Email: chris@tec-nw.com

One (1) LT 220 BELT DRYER

ITEM 1. DRYER DESIGN

Aerobic 16/4:	
Media:	Aerobic
Media Input Rate:	1172 lbs wet/hr
Operation Time:	16 hours a day, 4 days a week
DS-Concentration Inlet:	20.0%
DS-Concentration Outlet:	min 90 %
Evap. Capacity Required:	1139 lbs-H_2O/h
Aerobic 24/5:	
Media:	Aerobic
Media Input Rate:	782 lbs wet/hr
Operation Time:	24 hours a day, 5 days a week
DS-Concentration Inlet:	20.0%
DS-Concentration Outlet:	min 90 %
Evap. Capacity Required:	608 lbs-H_2O/h
Anaerobic 16/4:	
Media:	Anaerobic
Media Input Rate:	955 lbs wet/hr
Operation Time:	24 hours a day, 5 days a week
DS-Concentration Inlet:	20.0%
DS-Concentration Outlet:	min 90 %
Evap. Capacity Required:	922 lbs-H_2O/h
Anaerobic 24/5:	
Media:	Anaerobic
Media Input Rate:	510 lbs wet/hr
Operation Time:	24 hours a day, 5 days a week
DS-Concentration Inlet:	20.0%
DS-Concentration Outlet:	min 90 %
Evap. Capacity Required:	396 lbs-H_2O/h

ITEM 2. DESCRIPTION OF UNIT

DLT 220:	
Number of unit:	1
Model:	LT 220
Dimensions (HxWxL):	12 x 10.5 x 27 ft for one dryer
Clearance Requirement:	4 ft
Heat Source:	Hot water loop

DLT 320:

Number of unit:	1
Model:	LT 320
Dimensions (HxWxL):	12 x 10.5 x 36 ft for one dryer
Clearance Requirement:	4 ft
Heat Source:	Hot water loop

DLT 420:

Number of unit:	1
Model:	LT 420
Dimensions (HxWxL):	12 x 10.5 x 45 ft for one dryer
Clearance Requirement:	4 ft
Heat Source:	Hot water loop

ITEM 3. SCOPE OF SUPPLY

1. One low temperature belt dryer
2. One sludge feed cake pump
3. Controls in non-classified environment
4. In unit feed and distribution system
5. In unit heat recovery system
6. Start-up assistance
7. Freight

ITEM 4. Dryer Operation and Maintenance Requirement

1. Check feedline pressure, belt tension and temperature on the control panel monitor; take dried sludge sample (once per shift)
2. Clean the matrix of sludge feeding system and sensors (once per a week)
3. Inspect and adjust the sludge feeder system and clean belt (once per a month)
4. Grease bearing and chains (once every 3 months)
5. Clean sludge build up inside the dryer and on the heat exchanger (once a year)

ITEM 5. ANCILLARY PROCESS (NOT INCLUDED IN SOP AND PROPOSED PRICE)

1. Odor control system (i.e. biofilter or chemical scrubbers) and exhaust system
2. Heat distribution system (i.e. Hot water loop consist of CHP, boiler, primary and secondary circulation pumps, expansion tanks, heat rejection unit) to provide hot water (194F) to each dryer at the normal operational condition

ITEM 6. PURCHASE PRICE:

Aerobic 24/5: One (1) DLT220 Unit .... **$1,700,500** USD
Anaerobic 24/5: One (1) DLT220 Unit .... **$1,700,500** USD
Anaerobic 16/4: One (1) DLT320 Unit .... **$1,883,300** USD
Aerobic 16/4: One (1) DLT420 Unit .... **$2,083,000** USD

F.O.B. Jobsite, freight included, taxes excluded.

VALIDITY:

Purchase Price is valid for sixty (60) calendar days from Quotation date, for shipment of Equipment within the timetable stated below in ITEM 6.

PAYMENT TERMS:

30% with order; 60% upon shipment; 10% after startup not to exceed 90 days after shipment.

ITEM 7. TIMETABLE

Submittal phase:	8-10 weeks after the order receipt
Approval phase:	4 weeks for the customer to approve the drawings
Shipment phase:	50-60 weeks following receipt of the Approval drawings

Dates are subject to confirmation upon receipt of written Purchase Order.

ITEM 8. WARRANTY

One (1) year from the equipment start up or eighteen (18) months from delivery.

ITEM 9. START UP ASSISTANCE

Centrisys will furnish factory representatives for 20 days over 5 weeks to assist in installation inspection, start-up supervision, and operator training. Dates of service to be scheduled upon Buyer's written request.

ITEM 10. <u>BUYER/OWNER RESPONSIBILITY OR NOT INCLUDED AT THIS TIME:</u>

- Engineering support or site visit stated otherwise
- Wiring and conduit for control panel
- Dewatered cake feed pump/conveyor
- Material conveyance to, from and between equipment
- Odor control, exhaust ducting, fan and stack.
- Heat distribution system
- All utilities that are required for operation
- Unloading, uncrating, installation and installation supervision.
- Temporary dryer installation.
- Readiness of the Equipment before requesting start-up service. Non-readiness may incur additional charges.
- Compatibility of Equipment materials of construction with process environment.
- Piping connections, platforms, gratings and railings unless stated otherwise
- Bonding for the equipment
- Any other auxiliary equipment or service not detailed above.

Issued by
Brett Bevers
Applications Engineer
Date: 12/2/22

Appendix L Disinfection Improvement Costs

Alternative:	Disinfection Improvements					
Last Updated:	8/25/2023					
QC/QC Date:						
Detail Capital Costs						
Component/Item		Quantity	Units	Unit Cost	Bare Cost	Capital Cost
Disinfection						
	Peristaltic Pumps and Skids (33 GPM)	2	ea	13,000	$26,000	$57,585
	Chlorine Analyzer Assembly	1	ea	11,000	$11,000	$24,363
	0.5 HP Submersible Pump	1	ea	2,000	$2,000	$4,430
	Submersible Mixer	1	ea	6,000	$6,000	$13,289
	Installation	1	ls	7,000	$7,000	$15,504
	Electrical Allowance	1	ls	11,000	$11,000	$24,363
Assumes project will be D/B/B						
					$63,000	
Construction Markups						
	Contractor Overhead and Profit	15	%		$9,450	
	Subtotal				$72,450	
	Contractor General Conditions	12	%		$8,694	
	Subtotal				$81,144	
	Undesigned/Undeveloped Detail Contingency	40	%		$32,458	
	Subtotal				$113,602	
	Bonds and Insurance	3.5	%		$3,976	
	Subtotal				$117,578	
	Oregon Corporate Activity Tax	0.57	%		$670	
	Subtotal				$118,248	
	Escalation to Midpoint (March 2027)	18	%		$21,285	
	SUBTOTAL CONSTRUCTION COST				**$139,532**	
Other Markups						
	Risk Based Contingency	0	%		$0	
	Subtotal				$139,532	
	Soft Costs	0	%		$0	
TOTAL CAPITAL COST					**$139,532**	**$139,532**