MATANUSKA-SUSITNA BOROUGH

# SEPTAGE DISPOSAL & TREATMENT

# FEASIBILITY STUDY

***In cooperation with City of Palmer***

Prepared for:

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# 1. EXECUTIVE SUMMARY

The purpose of this feasibility study is to evaluate the relative economic feasibility of disposing of septage within the Matanuska-Susitna Borough (MSB) and treating the septage at the Palmer Wastewater Treatment Plant (PWWTP). The effort of this study generally builds upon the concepts and findings of previous studies authorized by the MSB.

This study generally analyzes the following aspects of a conceptual design:

- Location of a septage receiving station,
- Site and facility design for the septage receiving station,
- Necessary modifications and upgrades made to the PWWTP for treating septage,
- Estimated capital and operation and maintenance (O&M) costs, from which user fees are calculated.
- Comparison of septage hauler costs for local disposal versus disposal in Anchorage.

Population growth in the MSB was considered and found to be slowing over the next few decades based on estimates made by the State of Alaska in 2020. Septage hauling volumes and growth rates were based on a growth trend estimated for annual haul volumes discharged by MSB-based haulers at Anchorage Water and Wastewater Utility's (AWWU's) Turpin Street receiving station in Anchorage during the years ranging from 2011 to 2021. A base septage volume of 15.2 million gallons per year (MGY) and an average annual septage volume growth rate of 2.4% was estimated for Year 2022. Because MSB's population growth rates are diminishing, septage volume growth rates are anticipated to also decrease over time. Based on this, it is assumed that use of a constant 2.4% growth rate over the same time frame is conservative. Assuming a 5-year period for design, funding acquisition and construction, a 30-year design life was assumed thereafter, for a total study period of 35 years (2022 to 2057). From these values, a future annual septage volume of 34.8 MGY and a peak daily septage of 217,500 GPD was projected for Year 2057. These estimated septage volumes compare well to that featured in previous studies.

A site selection exercise was generally performed to determine a reasonable location for a septage receiving station, upon which cost estimating could be based. Various MSB-owned, City-owned and privately-owned properties were considered, most of which were located south of Palmer. Using several criteria, a favorable site near the Glenn Highway, south of the Alaska State Fairgrounds, was selected for use in this study.

The general strategy for addressing the receiving and treatment of septage is to substantially mitigate its characteristics and minimize the potential for adversely impacting the existing processes in operation at the PWWTP. To accomplish this objective, a significant degree of pre-treatment of the septage is needed before it enters the City's collection system, the PWWTP, and the MBBR process. The pre-treatment approach is generally as follows:

- Substantially reduce solids and biochemical oxygen demand with the use of screening and dewatering equipment at the septage receiving facility.
- Attenuate the impact of the pre-treated septage by mixing it with City wastewater flows.
- Further reduce contaminants with an intermediate, secondary pre-treatment step at the PWWTP such that the combined septage and wastewater can be treated by the MBBR and other downstream processes.

Without sufficient pre-treatment upstream of the PWWTP, the contaminant loading from the septage would exceed the capability of the plant's wastewater treatment process to provide adequate secondary treatment and meet the City of Palmer's discharge permit.

The pre-treatment process at the septage receiving facility would feature screening equipment, 250,000-gallon equalization tank, and dewatering equipment. Approximately 90% of the total suspended solids (TSS) and 70% of the biochemical oxygen demand (BOD) is assumed to be removed by the receiving station process. The screw press will produce relatively dry septage solids that would be hauled for disposal at the MSB Central Landfill. A lift station would pump effluent from the receiving facility to the City's force main located along the Glenn Highway. The pre-treated septage would then be combined with the City of Palmer's wastewater and conveyed through its collection system to the PWWTP.

At the PWWTP, it is assumed that all the combined septage/City wastewater would flow into Lagoon #1 from the PWWTP headworks through mostly existing piping. An activated sludge process featuring Parkson's *Biolac "Wave-Ox"* aeration system would further reduce BOD levels and substantially remove ammonia, which is a critical contaminant targeted by the PWWTP in meeting its stringent discharge permit requirements. Other improvements at the Palmer WWTP would include additional MBBR media, clarifiers, additional aeration blowers and activated sludge pumps.

These septage receiving and treatment improvements would result in a total estimated capital cost of <u>$19,525,723</u> and an estimate annual O&M cost of <u>$746,007</u>. Roughly half of the O&M cost would be associated with the receiving facility operation and the other half with the additional improvements at the PWWTP.

These costs would be recovered through user tipping fees, which are based on the capital and O&M costs. Tipping fees and total trip costs for use of the MSB septage facilities and use of AWWU's Turpin Street receiving station are summarized in the presentation of Table 1 below:

**Table 1: Estimated Total Trip Costs and Tipping Fees[1]**

| | Tipping Fee per 1,000 gal | Total Tipping Fee[3] | Total Hauling Expenses[4] | Total Trip Cost |
|---|---|---|---|---|
| **Year 2027 MSB** | $ 78.04 | $ 234.11 | $ 26.10 | $ 260.21 |
| **Year 2057 MSB** | $ 38.38 | $ 115.13 | $ 26.10 | $ 141.23 |
| **Flat-Rate MSB** | $ 58.21 | $ 174.62 | $ 26.10 | $ 200.72 |
| **Year 2027 AWWU[2]** | $ 30.21 | $ 90.63 | $ 182.67 | $ 273.30 |

Notes:

1. Costs and fees shown on a per trip basis.
2. 5 years inflation @ 2.5% applied to AWWU 2022 tipping fee of $26.70/1,000 gal
3. Assumes a 3,000-gal hauling volume.
4. Refer to Appendix B for itemized hauling expenses. A 70-mile round trip distance is used for AWWU, and a 10-mile round trip distance used for MSB, both measured from a common point located at the Parks-Glenn Hwy interchange. Hauling costs do not include expenses for time spent at location of septage collection nor travel from septage collection location to the Parks-Glenn Hwy interchange.

This summary shows that the highest total trip cost associated with the MSB facilities would be less expensive than the AWWU total trip cost at the beginning of the facility's life. Use of MSB's facilities is therefore assumed to be more economical for septage haulers throughout its design life relative to traveling into Anchorage to discharge septage. Based on these numbers, facility revenues could be expected to match or exceed operational and financing costs from the beginning of its operations, which thereby could be considered financially feasible.

The following conclusions are therefore made from this evaluation:

- A significant degree of pre-treatment is necessary to produce combined septage and wastewater characteristics that are readily treatable by the existing processes at the PWWTP.
- The use of screening, dewatering and mixing of septage with City of Palmer wastewater followed by an intermediate activated sludge treatment process at Lagoon #1 appears to be technically feasible in producing wastewater that can be subsequently treated by the PWWTP.
- Based on the septage volume growth assumed in this study, the costs of designing, constructing, and operating these treatment facilities in general proximity to the PWWTP could be expected to result in hauler trip costs that are less than the cost of hauling and disposing of septage at AWWU's Turpin St. receiving station in Anchorage.
- Based on the total trip costs and tipping fees estimated for this study, septage receiving and treatment facility revenues could be expected to match or exceed operational and financing costs from the beginning of its operations.

The following recommendations are made:

- Seek concurrence with the City of Palmer and approval from the Borough Assembly in pursuing further planning of the septage receiving and treatment improvements considered in this study.
- With City concurrence and Borough Assembly approval, proceed with the development of a PER for USDA grant/load funding or similar design analysis document to evaluate project alternatives in further detail, and generate estimated costs for funding acquisition.

END OF SUMMARY

## 2. INTRODUCTION

The purpose of this feasibility study is to evaluate the relative economic feasibility of disposing of septage within the Matanuska-Susitna Borough (MSB) and treating the septage at the Palmer Wastewater Treatment Plant (PWWTP). This study effort is a follow-up to several studies previously performed by the MSB in its on-going evaluation of locally collecting and treating septage.

This study generally analyzes the following aspects of a conceptual design:

- Location of a septage receiving station,
- Site and facility design for the septage receiving station,
- Necessary modifications and upgrades made to the PWWTP for treating septage,
- Estimated capital and operation and maintenance (O&M) costs, from which user fees are calculated.
- Comparison of septage hauler costs for local disposal versus disposal in Anchorage.

This study makes substantial use of and builds upon the MSB's previous work in the development of a reasonable concept design of septage receiving and treatment facilities, upon which a realistic evaluation of economic feasibility can be based. It does not attempt to provide an exhaustive evaluation of numerous options for developing the concept design. A more detailed evaluation of options would be provided in a future Preliminary Engineering Report (PER), if MSB elects to further advance this project.

## 3. BACKGROUND

The MSB has been evaluating the feasibility of collecting and treating septage within the confines of the Borough for several decades. Since 2007, the MSB has reviewed the possibility of treating septage at the existing wastewater treatment facilities operated by the City of Palmer and the City of Wasilla WWTP and at a new regional WWTP centrally located in various places within the MSB core area between Palmer and Wasilla. In context of the Palmer and Wasilla WWTPs, these previous evaluations reviewed the feasibility of adding new facilities and processes to the existing facilities for treating septage at these plants. The existing facilities at the time (i.e., aerated lagoons) were deemed not capable of adequately treating the combination of municipal wastewater and septage for meeting their respective discharge permits. A comprehensive wastewater treatment process, including pre-treatment and secondary treatment, would be needed to supplement the existing facilities at these plants in order to adequately receive and treat septage.

More recent studies evaluated the feasibility of receiving and treating septage at MSB's Central Landfill using various technologies, including a sequencing batch reactor (SBR) process and a proprietary treatment process developed and marketed by a Minnesota-based company. From these studies, the estimated costs of septage to be borne by the MSB were considered exorbitant, and other options were thereafter explored.

During the timeframe in which MSB was focused on the prospect of construction and operating a new WWTP at the Central Landfill, the City of Palmer had significant upgrades designed and constructed at its WWTP, in response to the need to meet new, more-stringent discharge permit requirements. In order to meet tighter ammonia restrictions in its treated effluent, the City of Palmer added a moving-bed bioreactor (MBBR) process to its existing aeration lagoon facilities. In a follow-up phase, the City is currently adding two secondary clarifiers to improve its ability to meet its ammonia limitations and other discharge permit requirements.

In light of these new treatment facilities, MSB is revisiting the question of possibly treating septage at the PWWTP. This study therefore reviews the new capability of the City's wastewater processes and what additional processes would be needed to receive and treat septage in Palmer, the cost of which is compared to the current cost of hauling septage to Anchorage for disposal.

## 4. REFERENCED STUDY EFFORTS

Previous studies were consulted and utilized in the development of this feasibility study including:

- *Matanuska-Susitna Borough Septage Handling and Disposal Plan (April 2007)* prepared by HDR Alaska, Inc.
- *Anchorage Water & Wastewater Utility Septage Improvements – Phase 2 Pre-Design Report (October 2008)* prepared by CRW Engineering Group, LLC.
- *Matanuska-Susitna Borough Regional Wastewater and Septage Treatment Study (July 2010)* prepared by Hattenburg Dilly & Linnell, LLC, GV Jones & Associates, Inc., and HDR Alaska, Inc.
- *Preliminary Engineering Technical Memorandum – Update to the 2007 Septage Handling and Disposal Plan (February 2013)* prepared by HDR Alaska, Inc.
- *Matanuska-Susitna Borough Central Landfill Development Plan (October 2014)* prepared by CH2M Hill.
- *City of Palmer Wastewater Facility Plan 2016 Update (September 2016)* prepared by HDR Alaska, Inc.

- *City of Palmer Wastewater Treatment Plant Engineer's Report (December 2016)* prepared by HDR Alaska, Inc.
- *Palmer Wastewater Treatment Facility Improvements (December 2016)* prepared by HDR Alaska, Inc.
- *Preliminary Engineering Report for Septage and Leachate Treatment Facility at Matanuska-Susitna Borough (January 2018)* prepared by Clark Engineering and HDL Engineering Consultants.
- *Anchorage Water & Wastewater Utility Septage Receiving Station Improvements Design Study Report (May 2020)* prepared by CRW Engineering Group, LLC.

# 5. ESTIMATED SEPTAGE VOLUME FLOW RATES

## 5.1. POPULATION GROWTH CONSIDERATIONS

A septage volume flow rate analysis was performed to estimate current and future flow rates generated in the MSB to be used in the conceptual design of septage receiving and treatment facilities. For this study and in previous analyses, future population growth was considered to generally relate to the growth in septage hauling volumes. These population projections were influenced by various developmental, geographic, and economic factors. Over the last 15 years, the population projections have varied due to changes in these factors. Population growth is expected to continue in the MSB, but not at the more-optimistic rates forecast in previous studies. In general, projected growth rates for the MSB are anticipated to steadily decrease in the next few decades (Chart 1). During the timeframe from 2019 to 2045, the average annual population growth rate in the MSB is estimated to be about 1.7% by the State of Alaska in 2020[1]. This compares to the growth rate of 2.75% forecast for the MSB in nearly the same timeframe in a previous estimate published by the State in 2016[2]. Reasons for this reduction in growth rates include a slower economy from depressed oil revenues, and the delay of various developments (such as ANWR drilling, natural gas line construction) that were anticipated to increase economic growth in the MSB.

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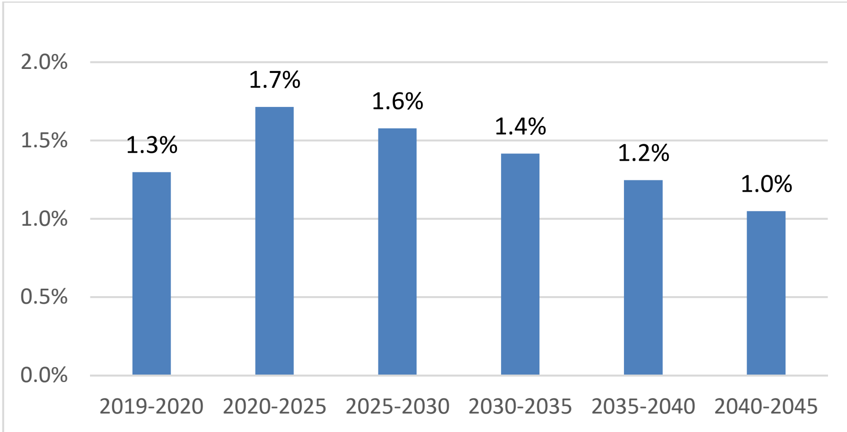
[1] Alaska Department of Labor and Workforce Development – Research and Analysis Section, *Alaska Population Projections: 2019 to 2045, April 2020.*

[2] Alaska Department of Labor and Workforce Development – Research and Analysis Section, *Alaska Population Projections: 2015 to 2045, April 2016.*

**Chart 1: 2019 to 2045 MSB Population Growth Rates**




### 5.2. SEPTAGE HAULING VOLUME TREND

Septage haulers from MSB currently travel to Anchorage to discharge septage. The Anchorage Water and Wastewater Utility (AWWU) keeps records of all hauler discharge times and volumes, the more recent of which was used to estimate the volume of septage produced in the MSB. A summary of the MSB hauling information as recorded by AWWU over several years (2011 to 2021) is shown in Chart 2. The trend in septage hauling volume generally increases in the years preceding the present time, with significant variations evident in Year 2012 and Years 2019 to 2021. The reasons for these variations are uncertain, but are likely reflective of various socioeconomic factors, including the regional economy and the COVID pandemic. Accounting for this variability, a "best fit" calculation was made to approximate the average growth trend in hauled septage volumes during this period, which is depicted by the sloped line in Chart 3. Using this approximation, the average growth rate is estimated to be 0.358 MG per year, which projects to a yearly septage volume of 15.2 MG for Year 2022. Based on this trend analysis, the base volume for MSB-originated septage is assumed to be 15.2 million gallons per year (MGY).

**Chart 2: 2011 to 2021 MSB Septage Hauling Volumes**

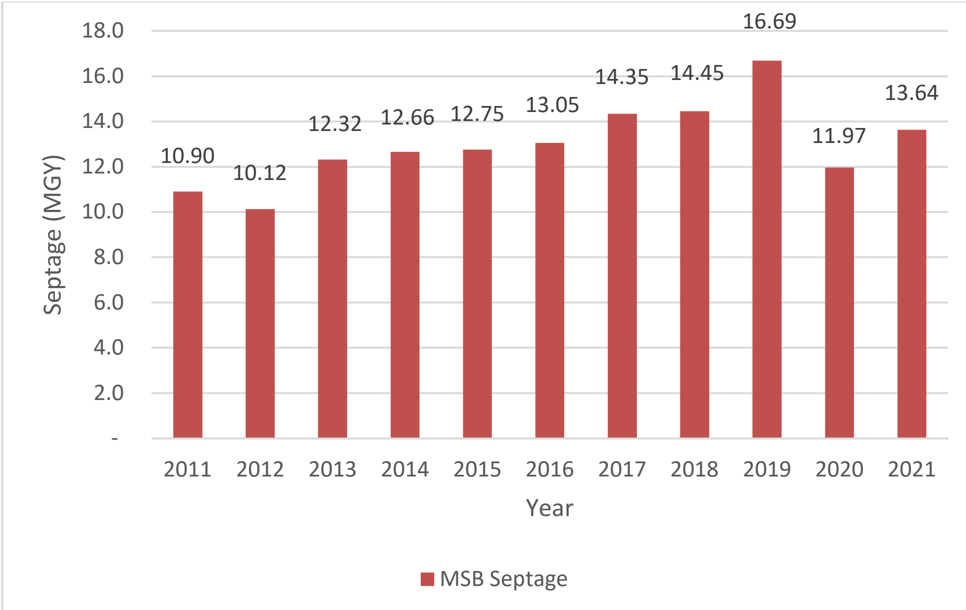
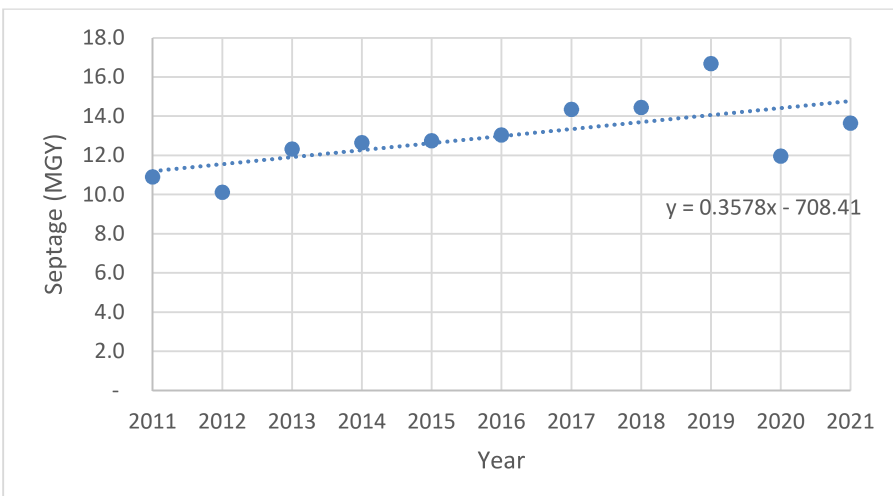



**Chart 3: Best-Fit Linear Septage Increase, 2011 to 2021**




### 5.3. Future Septage Volumes

For this study, the growth rate for future septage volumes is simply based on the average rate estimated in the trend analysis noted above. Using the base volume of 15.2 MGY, the average growth rate would be 2.4% for the present year, 2022. Since the population growth in the MSB is projected to slow down over the next few decades, it is also assumed that the septage volume growth will also slow down during this time frame. Therefore, it is believed that use of a constant average growth rate of 2.4% over the timeframe featured in this study is a conservative assumption.

A 30-year design life is assumed, which would correspond to a 30-year general obligation (GO) bond payback period. A period of 5 years is added to the 30-year design life to account for time needed to acquire funding and design and construct the improvements, for a total timeframe of 35 years. The growth rate of 2.4% was therefore applied directly to the estimated base septage volume of 15.2 MGY to determine the 35-year annual septage volume of 34.8 MGY. The criteria used for calculating the future average annual MSB septage volume is summarized in Table 2.

**Table 2: Future MSB Septage Volume Criteria**

| | |
|---|---|
| 2022 Septage Volume | 15.2 MG/year |
| Facility Life | 30 years |
| Funding Acquisition, Design and Construction Timeframe | 5 years |
| Total Growth Period | 35 years |
| 35-year MSB Avg Yearly Growth Rate | 2.4% |
| 2057 Septage Volume | 34.8 MG/year |

Like previous reports, seasonal variability of septage flow rates is considered in this study. Summer septage disposal rates are typically greater than winter rates, with peak rates tending to occur in the late fall, right before winter arrives (October and November). A peak value of 217,500 GPD was estimated as a percentage of the peak rate calculated for both the 2007 and 2013 studies, and was simply prorated based on the proportion of yearly septage volumes between this study and the 2007/2013 studies.

### 5.4. Comparison to Previous Estimates

The estimated yearly septage volume used in this study differs but compares reasonably well with that used in previous studies. Septage growth rates and future yearly volumes are lower than the numbers previously estimated, but this result is reasonable when considering that future population growth rates are predicted to continue slowing down as noted above. Following is a brief summary of the estimated septage volumes previously used by the MSB.

### 2007 MSB Septage Handling and Disposal Plan (HDR Alaska, Inc.)

The 2007 MSB Septage Plan determined a future annual septage volume (Year 2030) of 38.1 MG/year, using a present-day (2007) septage volume of 13.6 MG/year. This was calculated from the total volume of septage received from outside Anchorage multiplied by a factor of 0.95, which was the estimated proportion of MSB septage versus the total volume for all locations outside of Anchorage. A 4.0% growth rate was used, matching the actual MSB growth rate from years 2000 to 2008, and assuming that the same growth would continue with the anticipated construction of the Knik Arm Crossing Bridge.

### 2013 Update to the 2007 Septage Handling and Disposal Plan (HDR Alaska, Inc.)

No changes were made from the 2007 study's estimated future annual septage volume in the 2013 Update.

### 2010 MSB Regional Wastewater and Septage Treatment Study (HDL, GV Jones, HDR)

The 2010 Regional Study estimated a future daily peak septage flow rate (Year 2048) of 0.2 MGD. This flow rate was defined as the "summer" flow rate, and was calculated by estimating septage volumes based on the percentage of MSB population served by septic systems, average household sizes, average septic tank sizes, and average septic pumping rates. A community growth rate of 2.8% was used, assuming ANWR drilling in 2010 and the construction of a natural gas pipeline.

To compare the peak summer flow of 0.2 MGD with an average annual septage volume, winter flows (October – April) were reduced to a third of the summer rate to develop a future average annual septage volume of 44.8 MG/year. This calculation assumed that the ratio of summer to winter volumes varied by a factor of 3.

### 2018 Preliminary Engineering Report for Septage and Leachate Treatment Facility at Matanuska-Susitna Borough (Clark Engineering, HDL)

The 2018 PER by Clark Engineering determined a daily peak septage volume using a temporal dynamics analysis to account for fluctuations in the flow patterns and presented the estimated volumes based on five statistical "confidence levels" of 25%, 50%, 75%, 95% and 99% percentiles. This analysis was based on the variability of leachate and septage hauling rates as measured by AWWU at the Turpin Street Receiving Station in Anchorage for Years 2011 to 2016. This report did not indicate that its data were confined only to MSB septage haulers. An annual septage volume growth rate of 6% was considered for deriving the year (2025) in which additional treatment skids may need to be added to the initial installation. A 95$^{th}$ percentile daily flow volume of 242,282 GPD was recommended for use with a "mitigated risk" approach using a 100,000 GPD capacity treatment skid and a 400,000-gallon treatment volume.

Table 3 compares flow calculation criteria from previous reports to the current estimate.

**Table 3: Septage Flow Comparison**

| | Current Estimate (2021) | 2007 - 2013 Estimates | 2010 Estimate | 2018 Estimate |
|---|---|---|---|---|
| **Future Average Annual Septage Volume (MG/year)** | 34.8 | 38.1 | 44.8 | 16.4 to 36.4 [1] |
| **Future Year** | 2057 | 2030 | 2048 | 2025 [2] |
| **Average Annual Growth Rate** | 2.4% | 4.0% | 2.8% | 6% [3] |
| **Estimated Peak Daily Volume (gallons per day)** | 217,500 | 238,165 | 200,000 | 243,282 [4] |

1. Clark Report does not predict a future annual yearly septage volume. It instead proposes an initial 16.4 MGY treatment capacity, with outlook to expand an additional 20+ MGY in capacity as septage volumes grow.
2. Year 2025 is based on reaching the 100,000-gallon capacity of a specific treatment skid model using a "mitigated risk analysis," and assuming the concurrent use of an equalization basin having a capacity of 400,000 gallons. After this time, a modular expansion of the treatment process may be needed.
3. This growth rate is based on annual septage volume trend received at AWWU's Turpin Street receiving station between Years 2011 and 2016.
4. This flow rate is estimated in the Clark Report using a statistical analysis based on the Turpin Street receiving station data mentioned in Note 3 above, and is identified as having a 95% percentile confidence level.

## 6. SEPTAGE DISPOSAL FACILITY SITING

A site selection exercise was generally performed to determine a reasonable location for a septage receiving station, upon which cost estimating could be based. Various MSB-owned, City-owned and privately-owned properties were considered, most of which were located south of Palmer. One site was located near the Mat-Su Regional Hospital. Using the criteria outlined below, a favorable site near the Glenn Highway, south of the Alaska State Fairgrounds, was selected for use in this study. This site offered good access from the Glenn Highway and located within close proximity to an existing sewer force main that is tied to the City's wastewater collection system. It is anticipated that a more-specific site selection exercise would be performed in the future if this project is further pursued by the MSB.

For this siting effort, nine criteria were used to score properties, as follows:

- Proximity to sewer utility
- Accessibility to major roadways
- Cost of land
- Public vs. private property
- Proximity to PWWTP
- Site topography
- Proximity to water utility
- Proximity to residential areas
- Zoning

### 6.1. Proximity to Sewer Utility

This criterion evaluated whether the property has existing access to the collection system based on sewer utility data acquired from the City of Palmer. Factors considered included the relative O&M expense of conveying the septage-laden wastewater through a gravity main versus a force main, and the number of lift stations that it would travel through to reach the PWWTP. Candidate properties near a force main serving a high count of lift stations ranked lower in this category. Properties near a gravity sewer main that conveys wastewater through few or no lift stations ranked higher.

### 6.2. Accessibility To Major Roadways

This criterion evaluated the accessibility of the property in terms of ease of access for large septage trucks from major roadways to the site. Narrow roads, residential streets, and locations that required a high number of turns ranked lowest in this category. Properties along or close to major roadways scored the highest in this category. Properties farther away from major roadways and in densely populated areas scored lower. This category considered that favorable access to major roadways would provide shorter driving times for haul trucks traveling from locations throughout the MSB.

### 6.3. Cost of Land

The cost of the land for the septage disposal facility is an important consideration in assessing site viability. Because the properties varied in size, the assessed value of each property was used and divided by its total acreage. This allowed an apples-to-apples evaluation of each property based on a unit price per acre.

### 6.4. Public vs. Private Property

This criterion assumes that private property will be more difficult to acquire than publicly-owned property. Acquiring land from any entity poses unforeseen challenges, but acquiring property from a private owner generally results in higher costs and longer acquisition times for negotiation and has a higher risk of the transaction falling through. For this study, scores were assigned based on ownership information and assumed to favor publicly-owned property.

### 6.5. Proximity to Treatment Plant

Scoring the properties on their proximity to the PWWTP assumed that being closer to the treatment plant is more desirable. Over time, solids deposition in sewer mains from septage facility usage may occur, requiring periodic cleaning. This cleaning, while not frequent, would incur costs for maintenance. Properties located closer to the treatment plant would tend to accumulate less solids deposition and were therefore scored higher. Properties located further from the PWWTP were scored lower in this category.

### 6.6. Site Topography

This scoring criteria viewed flatter property as more desirable than hilly and/or steeply-graded property. Flatter property would tend to incur lower earthwork costs during construction. Steeper grades would make truck access more challenging.

### 6.7. Proximity To Water Utility

While not as critical as the sewer utility, it is preferred that the selected site connect to the City of Palmer water distribution system. This evaluation considered the presence of the municipal water system at the property. A larger water main was considered to be more desirable than a smaller main. If no water was available, a well was considered to suffice as a water source, albeit at a greater construction cost than a tie-in to the City's distribution system.

### 6.8. Proximity To Residential

This criterion assumed that a septage disposal facility located near residential areas is less desirable and potentially would receive resistance from adjacent homeowners. Candidate properties in close proximity to residential housing scored lower than properties located further away.

### 6.9. Zoning

This criterion assumed that re-zoning of a property was less desirable than a property that fell within areas having no current zoning, or within zoning that allows for a septage receiving facility.

# 7. SEPTAGE RECEIVING FACILITY CONCEPTUAL DESIGN

## 7.1. GENERAL DESIGN CONSIDERATIONS

Septage is typically more difficult to treat relative to domestic wastewater. The consistency of septage is highly variable, with substantially greater concentrations of organics, solids, fats/oils/grease (FOG), fat, ammonia, and other compounds. These septage characteristics typically develop from the accumulation of waste products captured and held in septic tanks over 1 to 5 years of time between pumpings. Consequently, the treatment and maintenance associated with septage generally requires increased effort and attention, by way of additional processes and cleaning. By its nature of lacking in oxygen, septage typically produces objectionable odors caused by the long-term anaerobic treatment that occurs inside septic tanks. With these characteristics, septage has a higher potential of causing process upsets in wastewater treatment systems.

For this study, the general strategy for addressing the receiving and treatment of septage is therefore to substantially mitigate its characteristics and minimize the potential for adversely impacting the existing processes in operation at the PWWTP. To accomplish this objective, a significant degree of pre-treatment of the septage is needed before it enters the City's collection system, the PWWTP, and the MBBR process. The pre-treatment considerations are generally outlined as follows:

- Substantially reduce solids and biochemical oxygen demand with the use of screening and dewatering equipment at the septage receiving facility, prior to conveying it into the City collection system (Figure 1). This primary pre-treatment step will mitigate the tendency for solids and FOG deposition in the City's pipelines, downstream lift station(s) and the PWWTP headworks facility.

- Attenuate the impact of the pre-treated septage by mixing it with City wastewater flows, which typically have lower contaminant concentrations, and will tend to "dilute" the concentration of contaminants in the septage. However, while mixing with City wastewater will dissipate the septage contaminant concentrations, the mass loadings (i.e, the dry weight quantities) of the septage and City wastewater contaminants will be additive.

- After the initial screening, dewatering and mixing described above, these combined contaminant loadings will still likely be greater than that which can be treated by the PWWTP's treatment process. Therefore, an intermediate, secondary pre-treatment step will be needed upstream of the PWWTP's MBBR process, to further reduce contaminants such that the combined septage and wastewater can be treated by the MBBR and other downstream processes (further described in Section 8). The secondary pre-treatment approach for this intermediate step is based on making substantial use of the existing first lagoon and aeration system to mitigate capital costs.

In addition to these objectives, a sustainable septage receiving facility is also desired, that enables the efficient disposal and initial processing of raw septage and provides good functionality for septage haulers. These goals will be pursued in the siting and layout of the receiving facility and its process components. Ultimately, the MSB seeks a facility that will provide a cost-effective disposal option for local septage haulers, and one that can be collaboratively operated with the City of Palmer.

These design considerations are described in more detail in the following sections.

### 7.2. General Process Description

The pre-treatment process at the septage receiving facility will need to be capable of removing a significant amount of biochemical oxygen demand (BOD) and total suspended solids (TSS) quantities to accommodate the capabilities of downstream treatment processes. For this study, the receiving facility is assumed to consist of the following basic processes (Figure 2):

- With a hose connection, septage will be directly discharged into an automated receiving/ screening system. With this system, raw septage will receive initial screening of rocks, grit, and large solids.
- The septage will then be discharged into a single equalization tank capable of receiving and storing the estimated peak daily volume.
- From the equalization tank, the screened septage would be mixed with polymer, and then conveyed through a screw press and be dewatered. In the dewatering process, significant reductions of TSS (90%) and BOD (70%) are assumed, based on data provided by the equipment vendor. Dewatered sludge would have a solids content of around 20%.
- Effluent from the dewatering process would be conveyed to a lift station and pumped into the City's force main and combined with City wastewater. From the force main, the combined septage and wastewater would be conveyed through the City's Lift Station No. 6 and to the wastewater main that feeds the PWWTP.
- The receiving station tankage would be ventilated directly through an odor-control system.
- Screenings and dewatered solids would be collected into roll-off dumpsters and regularly hauled to the landfill. It is assumed that the landfill will continue to accept solids from the septage receiving station for the life of the facility. Biosolids to be disposed of at the landfill would be subject to periodic testing (such as the paint filter and toxicity characteristic leaching procedure (TCLP) tests).

This study assumes that two trains would be used for screening septage. However, only one screw press is assumed, with critical spare parts kept on-hand. In the event of a prolonged screw press breakdown, it is assumed that hauler traffic would be re-directed to the Turpin Street facility in Anchorage. Information on the process equipment is found in Appendix A.

### 7.3. SEPTAGE FACILITY SITE LAYOUT

A generic septage receiving facility layout was developed to allow easy access for septage hauler trucks, adequate space for security and maintenance of the facility, and a footprint that mitigates the amount of property required for the site. Figure 3 shows the facility layout, which presumes that the site would be located in close proximity to the Glenn Highway and sufficiently near to a controlled traffic intersection that facilitates truck movements on to and off of the highway.

The site layout is linear with a common entrance and exit driveway. The driveway connects to either a local road or a collector road that provides access to the highway. Turning radii are provided with a minimum of 40 feet to accommodate septage hauler trucks. The site is generally level to minimize site grading, and the finished floor of the buildings is established for positive drainage away from the structures. The septage receiving facility would be fenced for controlled access and security, and the driveways and aprons are paved with asphalt concrete. A weigh scale would be located at the facility entrance.

A septage receiving building, equalization tank, and screw press building are featured in this site layout. The receiving building will provide an enclosed, heated space for discharging septage directly into screening equipment. A 250,000-gallon equalization tank will be provided to receive screened septage from trucks and provide temporary storage of the septage so that it can be metered into a downstream screw press housed in an adjacent building. The size of the equalization tank is based on providing a day's worth of peak septage in-flow (i.e. 217,500 GPD). All connections for handling septage will be enclosed with the use of direct couplings to control odors.

The septage receiving building, equalization tank and screw press building would be built as adjacent structures and have a common foundation for economy and minimize the need for pumps and extensive process piping. The septage receiving building would house two automated screening systems, one on either side of the building. A roll-up door would be installed on the end of the building to allow screenings to be loaded and hauled to the landfill. The equalization tank would be positioned next to the septage receiving building. This tank would be constructed of reinforced concrete. The equalization tank would feed a screw press located in the screw press building. This building would also feature a roll-up door to facilitate the loading and hauling of dewatered solids to the landfill. A lift station in the screw press building would pump effluent from the screw press to the City's force main located along the Glenn Highway. Water service to the facility would be provided from the City's water main also located along the Glenn Highway. The electric and gas services would access the facility from the nearest suitable transmission lines.

With this layout, the daily maximum treatment capacity of the receiving station would tend to be limited by the capacities of the equalization tank and the screw press. However, the ability to move haulers through the receiving station would also be a limiting factor on the hourly influent flow rate. With two trains, and assuming a 3,000-gallon hauler truck could pass through the facility in an average of 20 minutes, a maximum septage rate of around 18,000 gallons could flow into the receiving process in a given hour (i.e. six trucks per hour). With a screw press output of 9,000 GPH and an equalization tank working volume of 224,000 gallons, this maximum inflow could theoretically be sustained for about 24 consecutive hours before plant operations would need to be suspended to allow the screw press to process the full tank contents.

### 7.4. Septage Receiving Facility Usage

Septage haulers are assumed to use and progress through the receiving facility as follows (Figure 3):

- On entry, the driveway splits to the right and the septage hauler truck pulls up to an automatic gate activated by an MSB-issued key card. Space is provided for queuing at least six trucks at the entry gate.
- From the entry gate, the septage hauler truck proceeds onto a commercial weigh scale to measure the combined weight of the truck and septage load, and the gate closes behind the truck. Use of the weigh scale would allow the tracking of septage volumes for the purpose of billing haulers and inter-agency payments between MSB and City for the transacting of operational revenues.
- Based on the truck's previously determined and validated tare weight (unladen weight), an unattended weighing terminal records the combined weight of the truck and septage. The weight of the septage load is calculated and stored for billing purposes.
- The intermediate gate then opens and allows the truck to proceed to one of the concrete discharge pads located on either side of the septage receiving building. The gate automatically closes behind the truck.
- Each discharge pad features an automated receiving/screen unit for discharge and measurement of the quantity of septage. The septage hauler connects the truck to the Septage Receiving System with either a 4-inch or 6-inch hose with camlock fittings. The hose is assumed to belong to the hauler. A second key card assigned to the septage hauler driver activates the septage receiving station and allows the truck to drain until empty.

- After disconnecting and stowing the hose, the septage hauler exits the facility through a loop-operated gate and drives out of the facility on the parallel driving lane.

Testing of septage could be provided at the receiving facility to discourage the discharge of hazardous materials dumping and other undesirable compounds. This type of testing is usually performed on a periodic basis on samples collected from septage volumes that can be associated with specific discharges. This method is used by AWWU at the Anchorage receiving stations and is assumed in this study. A more rigorous testing program would significantly increase the cost of receiving septage at the facility and discourage septage haulers from disposing there.

### 7.5. COMPOSTED BIOSOLIDS

The MSB might consider opportunities to sell the septage-generated biosolids for other uses, such as fertilizer, as a way for offsetting its receiving station costs. The Golden Heart Utility (GHU) in Fairbanks is pursuing this endeavor. However, only a small amount of revenue is being generated because the pricing of its composted biosolids product ($20/1000 lbs) is established just to cover loader and operator costs. This operation is currently suspended due to the presence of per- and polyfluoroalkyl substances (PFAS) detected in the biosolids.

Susitna Organics in Knik markets compost at $90 per CY, but this product does not contain human-originated biosolids. A lower pricing rate might need to be considered for compost containing human biosolids given a general concern for residual contaminants in the product. Assuming that 80% of removed TSS (moderate average loading rate = 4,635 lb/day) is recovered and dewatered, a daily biosolids volume rate of 2 to 3 CY would be generated. Assuming the biosolids were mixed with sufficient quantities of bulking agent at a ratio of 1 to 5.5 [3], about 11 to 16 CY of compost could be produced on a daily basis. At a market price of $50/CY, these production rates would generate a potential gross revenue of $500 to $800 per day or $180,000 to $290,000 per year. The cost of processing and testing the compost would need to be considered, but would likely offset the aforementioned market price by a substantial amount. Assuming that a profit rate of $10/CY could be achieved, a net revenue of $36,000 to $58,000 per year might be recovered in the selling of composted biosolids. MSB might also consider marketing the biosolids for other businesses to mix with composting materials. However, net revenues for this operation are not expected to be significant.

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[3] This ratio was obtained from a pilot study on biosolids mixed with wood chips for the use of roughly estimating potential composted biosolids production from the receiving station. Reference: *City of Kodiak Biosolids Composting Pilot Test Final Report-April 2010* by CH2M Hill.

Depending on the demand for composited biosolids in the MSB, the revenue from a similar MSB-operated enterprise might be limited. A market analysis would be needed to ascertain how much revenue might be generated from this product assuming various price levels. A risk analysis would also be needed to evaluate the costs of testing the product for hazardous substances generated by the concentration of septage-originated contaminants in the treatment process.

# 8. PALMER WASTEWATER TREATMENT PLANT EVALUATION

## 8.1. EXISTING CONDITIONS

The PWWTP has recently undergone significant upgrades in order to meet more stringent discharge permit requirements. In 2018 and 2019, an MBBR system was designed and constructed, as well as a new control building. In a follow-on phase of improvements, two secondary clarifiers, a waste activated sludge (WAS) vault, a flow splitter vault and associated piping and controls are currently being constructed at this plant. The targeted completion date for these improvements is July 2022.

The MBBR system is located downstream of the existing headworks facility, and currently receives wastewater flows directly from the headworks. With this arrangement, Lagoon #1 has been bypassed and is currently being used as an equalization pond for extreme flow events. Treated effluent currently flows from the MBBR to Lagoon #2, then to Lagoon #3 before being sent through the UV disinfection process, and then to the outfall in the Matanuska River. After the second construction phase is completed in 2022, the new secondary clarifiers will directly receive the MBBR effluent. WAS will be pumped to Lagoon #2 from the clarifiers and the clarified effluent will be conveyed directly to the disinfection system (bypassing Lagoons #2 and #3). Lagoon #1 would continue to be bypassed and used only during extreme flow events.

The MBBR system is comprised of a concrete tank having two reactor trains. Each reactor train is comprised of three basins. The first basin in each train mainly provides BOD reduction. The second and third basins provide ammonia reduction. All the basins are partially filled with plastic carrier media, to which microorganisms can attach and form biofilms. The media is manufactured as complex shapes that provide a very large surface area where the biofilm cultures can interface with the surrounding wastewater. Vigorous aeration is also provided in each basin, which keeps the media in suspension and well-mixed with the oxygenated wastewater.

The biofilm provides an environment that is particularly suitable for nitrifying bacteria, which are essential for the reduction of ammonia through the process of nitrification. Relative to organics-stabilizing bacteria, nitrifiers are slower growing and require warmer water temperatures to thrive. Hence, longer retention times are typically needed for ammonia reduction. The MBBR process compensates for the relatively slow action of nitrifiers by providing a biofilm environment having an enormous surface area within which very large populations of nitrifying bacteria can contact and treat the wastewater. This unit process is situated downstream of the BOD reactor basin, beyond which nitrifiers can better thrive. To date, this process has been producing wastewater effluent that meets the stringent ammonia limits of the plant's discharge permit. However, the wastewater ammonia levels increase after being passed through Lagoons #2 and #3. This increase is attributed to the MBBR effluent being mixed with the lagoon water, which has a higher ammonia concentration produced from aging lagoon sludge. Implementation of the new secondary clarifiers is expected to resolve this problem.

The MBBR system is designed for treating the following future flow rates and loadings of the four common wastewater constituents, BOD, TSS, Total Kjeldahl Nitrogen (TKN) and ammonia nitrogen:

**Table 4: MBBR System Design Flow Rates and Loadings**

| Constituent | Units | FLOW RATE | | |
|---|---|---|---|---|
| | | Average Annual = 1.0 MGD | Max Month = 1.2 MGD | Peak Day = 1.5 MGD |
| **BOD** | mg/L | 224 | 282 | 380 |
| | lb/day | 1868 | 2818 | 4754 |
| **TSS** | mg/L | 244 | 310 | 395 |
| | lb/day | 2035 | 3102 | 4754 |
| **TKN** | mg/L | 38 | 48 | 65 |
| | lb/day | 318 | 479 | 808 |
| **Ammonia-N** | mg/L | 26 | 32 | 43 |
| | lb/day | 213 | 321 | 541 |

The 2016 PWWTP Engineer's Report identifies these values as "Phase I". The mg/L concentrations noted in Table 4 are derived from the lb/day loadings at the corresponding flow rate. If actual flow rates were less than the design values, the concentrations of these constituents could theoretically be higher (and vice versa) as long as the maximum loading value is not exceeded. "Phase II" design values are also identified in the Engineer's Report with higher flow and loading rates. Another set of MBBR reactor trains would need to be constructed for handling Phase II flows and loadings. Currently, plant flow rates have been averaging around 0.5 to 0.6 MGD.

### 8.2. COMBINED WASTEWATER AND SEPTAGE CHARACTERISTICS

The general approach for treating septage at the PWWTP is previously outlined in Section 7.2. Septage would be screened and dewatered at the receiving facility to remove a substantial portion of its BOD and TSS, and then combined with the City's wastewater flow. The combined flow would then be conveyed to the PWWTP headworks for treatment.

To estimate the characteristics of the combined wastewater flow, the individual characteristics of the septage and the City wastewater were first estimated. City wastewater characteristics were taken from the 2016 PWWTP Engineer's Report, most of which are reflected above in Table 4. Septage characteristics were taken mostly from the previous reports outlined in Section 4, which summarize constituent values determined by historic testing of septage collected from the MSB. The largest testing value of a given constituent cited in the previous studies was used in this study. For constituent values not determined by testing or referenced in the previous studies, national average values were used for characterizing the influent septage. The values assumed for use in this study are summarized in Table 5, below.

**Table 5: Assumed Septage Characteristics at Peak Daily Volume**

| Annual Septage Volumes | Units | Raw Septage | Pre-Treated Septage Leaving Receiving Station [1] |
|---|---|---|---|
| **Peak Daily Volume (2057)** | GPD | 217,500 | 217,500 |
| **Average Annual Volume (2057)** | GPD | 34,800,000 | 34,800,000 |
| **BOD** | mg/L | 2,800 | 840 |
| **BOD** | lb/day | 5,079 | 1,524 |
| **TSS** | mg/L | 7,138 | 714 |
| **TSS** | lb/day | 12,948 | 1,295 |
| **TKN** | mg/L | 217 | 195 |
| **TKN** | lb/day | 394 | 354 |
| **Ammonia-N** | mg/L | 112 | 101 |
| **Ammonia-N** | lb/day | 203 | 183 |
| **Alkalinity** | mg/L as $CaCO_3$ | 970 | 873 |

1. 70% removal assumed for BOD; 90% removal assumed for TSS; 10% removal assumed for TKN, ammonia-N and alkalinity.

For the effluent leaving the septage receiving facility, it was assumed that 70% of the BOD and 90% of the TSS is reduced through the screening and dewatering process at the receiving facility. These percentages are conservatively downgraded from the removal performance data provided by the equipment vendors. TKN, ammonia and alkalinity were assumed to be reduced by 10% in this same process.

Peak flow rates and loadings from the receiving station effluent were combined with future average daily, future peak day and present-day average rates of the City's wastewater. These estimated combined rates are summarized in Table 6 below, and are those assumed to be entering the PWWTP as influent characteristics. These rates were used to help derive a range of septage characteristics for use in estimating the size of the secondary pre-treatment improvements. Spreadsheets for these calculations are shown in Appendix C.

It is noteworthy that the combined flow rate derived from the City's present-day average rates is termed "Low Day" in the table. This term is defined to evaluate the condition when City wastewater flows are *relatively low*, and when mixed with peak septic flows would result in a reduced dilution of septage concentrations. This condition would tend to produce stronger combined wastewater characteristics that would need to be treated by the proposed improvements. Despite higher (mg/L) concentrations produced by the Low Day condition, the highest contaminant (lb/day) loadings would be produced when Palmer's Peak Day flows are combined with peak septage flows.

**Table 6: Estimated Combined Septage and City Wastewater Loading Rates**

| Combined Loading | Units | Average Daily Flow Rate | Peak Day Flow Rate | "Low Day" Flow Rate |
|---|---|---|---|---|
| **Summer Flow** | GPD | 1,217,500 | 1,717,500 | 867,500 |
| **Winter Flow** | GPD | 1,072,500 | 1,572,500 | 722,500 |
| **BOD** | mg/L | 334 | 438 | 567 |
| | lb/day | 3,392 | 6,278 | 4,099 |
| **TSS** | mg/L | 328 | 435 | 549 |
| | lb/day | 3,330 | 6,236 | 3,971 |
| **TKN** | mg/L | 66 | 81 | 109 |
| | lb/day | 672 | 1,162 | 792 |
| **Ammonia-N** | mg/L | 39 | 51 | 66 |
| | lb/day | 396 | 724 | 476 |
| **Alkalinity** | mg/L | 320 | 285 | 369 |

Most of these values exceed the MBBR design values summarized in Table 4. A previous iteration of these values (with somewhat lower magnitudes) were shared with the MBBR process manufacturer, Veolia-Kruger, to explore how well they could be accommodated with increased treatment capacity provided by adding carrier media to the MBBR process. The MBBR process manufacturer reviewed the data and responded that the peak loadings could not be handled by using the maximum amount of carrier media in the existing reactor trains. A second set of reactor trains would need to be constructed to sufficiently treat these peak loadings, according to Veolia-Kruger. From this dialogue, it was concluded that the existing MBBR system alone could not be expected to adequately treat the combined septage and City wastewater flows. Either the MBBR system would need to be expanded (at a relatively high capital cost) or an intermediate process would be needed to provide secondary pre-treatment upstream of the MBBR.

## 8.3. INTERMEDIATE SECONDARY PRE-TREATMENT SYSTEM AT PWWTP

With much of the infrastructure already in place at the PWWTP, the operation of Lagoon #1 was explored for cost-effectively providing the intermediate secondary pre-treatment needed upstream of the MBBR system. For this arrangement, it was assumed that all of the combined septage/City wastewater would flow into Lagoon #1 from the PWWTP headworks. Effluent from Lagoon #1 would be conveyed through mostly existing piping to the MBBR. It is conservatively assumed that no significant BOD or TSS reductions would be provided from the primary treatment provided in the headworks.

A simplified modelling exercise of Lagoon #1 indicated that, by continuing to operate the lagoon as an aerated pond, BOD levels from the combined septage/City wastewater could be reduced to levels that could thereafter be treated by the MBBR. TSS levels could be reduced as well, but mostly by being captured via sedimentation in the lagoon (which would gradually produce a sludge blanket needing periodic removal). However, the excessive ammonia levels in the combined wastewater could not be reduced significantly, due to the predominance of BOD-reducing organisms treating the lagoon influent, the relatively short retention time in this lagoon for effective nitrification, and the relatively-cold water temperatures during the winter season, which substantially slows the activity of nitrifiers.

The Parkson Corporation, manufacturer of the *Biolac* aeration system currently used at the PWWTP, was consulted to explore the potential effectiveness of their *Biolac* process for improving ammonia removal in Lagoon #1. The combined wastewater loadings generated from the exercise noted in Section 8.2 were shared with Parkson, who thereafter proposed a concept design for Lagoon #1 using their *Biolac "Wave-Ox"* system within a complete-mix activated sludge treatment process. According to Parkson, only about half of the Lagoon #1 volume would be needed with their aeration system to reduce the BOD and ammonia concentrations of the combined wastewater to levels that can thereafter be treated by the MBBR process. Reducing the volume of Lagoon #1 would tend to reduce the heat loss from the wastewater that ordinarily occurs during winter. Twin clarifiers would be needed on the downstream end of the process to collect and remove suspended solids. Return activated sludge (RAS) and waste activated sludge (WAS) systems would also be needed with this process.

A simplified activated sludge model of Lagoon #1 subsequently indicated the likely need for adding alkalinity to sustain the nitrification process. According to Parkson, the *Biolac "Wave-Ox"* aeration system would produce alternating zones of oxygenated and anoxic wastewater, which would provide efficient nitrification and denitrification, and allow some of the oxygen and alkalinity demand to be recovered in the denitrification process. This approach would reduce the amount of oxygen and alkalinity to be fed into the activated sludge process.

Based on the anticipated performance provided by the Parkson *Biolac* aeration system with "*Wave-Ox*," the following scope is assumed for upgrading Lagoon #1 as an intermediate pre-treatment step for processing the combined septage/City wastewater:

- Lagoon size reduction by filling a portion of the existing volume. The integral clarifiers associated with the *Biolac* system (i.e., "*EZ Clarifier*" product) could be constructed within this filled area or on the south side of the existing lagoon to provide more flexibility with the future use of the remaining lagoon volume. The clarifier tanks would be constructed of reinforced concrete.
- Full replacement of the existing *Biolac* fine-bubble aeration system with new components in the reduced lagoon volume. Much of the existing aeration system in Lagoon #1 has been reportedly dismantled and used to make repairs to the *Biolac* system in Lagoon #2. It is not known how much of the existing system is suitable for re-use, hence full replacement is conservatively assumed.
- Addition of two 120 HP blowers and an associated expansion of the existing blower facility. It is assumed that one set of the existing 110 HP and 40 HP blowers could be used to serve Lagoon #1 as standby units.
- Although Parkson indicates that the proposed RAS and WAS systems can operate with gravity flow, it is conservatively assumed that a pump vault would be needed to convey RAS and WAS flows. RAS and WAS piping would also be needed.
- *"Wave-Ox"* aeration control system.
- Aluminum covers for the clarifiers to mitigate heat loss. An alternate to this approach would be to construct a heated enclosure over the clarifiers. Doing so would incur significant heating costs to counter the effect of cold water entering the heated envelope and the effect of increased ventilation requirements if the enclosed space is deemed a fire code classified zone. These heating costs may be justified by the need to maintain sufficiently warm water temperatures entering the MBBR.
- Alkalinity feed system is assumed to be an expansion of the existing sodium hydroxide system that currently feeds the MBBR.
- The existing insulated covers for Lagoon #1 could be re-used to slow heat loss during the winter season. However, the covers would tend to slow the warming of the lagoon water during spring and early summer, which would hinder ammonia removal during this timeframe.
- The remaining volume of Lagoon #1 could be left unfilled and available for any future development needs.

Equipment for the proposed improvements at the PWWTP can be viewed in Appendix A.

# 9. COST ESTIMATES

## 9.1. Capital Cost Estimate

An updated capital cost estimate was developed based on the presentation format of the *2010 Regional Wastewater and Septage Treatment Study* (HDR Alaska, Inc.). Septage treatment equipment costs were updated with vendor budgetary quotes. Applicable line items, such as unit earthwork costs, were updated with current estimates, or by applying a 2.5% annual inflation rate from the 2010 estimate and modifying quantities as needed. A detailed capital cost estimate is included in Appendix B.

**Table 7: Capital Cost Estimate**

| Item | Subtotal |
|---|---:|
| Construction | $ 12,425,621 |
| City Administration (2%) | $ 248,512 |
| Design (10%) | $ 1,242,562 |
| Construction Management (12%) | $ 1,491,074 |
| Project Contingency (20%) | $ 2,485,124 |
| Inflation (5 years @ 2.5%) | $ 1,632,829 |
| Project Total (2027 Dollars) | **$ 19,525,723** |

## 9.2. Operations and Maintenance (O&M) Cost Estimate

An updated O&M cost estimate was developed based on the presentation format of the *2010 Regional Wastewater and Septage Treatment Study* (HDR Alaska, Inc.). Line items were updated based on proposed equipment from vendor packages. Remaining unit prices were updated by applying 2.5% annual inflation. A detailed O&M cost estimate is included in Appendix B.

Based on this cost estimate, it is anticipated that the septage receiving station and the PWWTP will each require less than the full time of an operator to manage the respective septage-related systems.

**Table 8: Annual O&M Cost Estimate**

| Item | Subtotal |
|---|---|
| *Septage Receiving Facility O&M* | |
| Labor - Operation | $ 41,055 |
| Labor - Maintenance | $ 6,480 |
| Power | $ 90,182 |
| Heating | $ 40,393 |
| Miscellaneous Supplies | $ 4,425 |
| Miscellaneous Services and Equipment | $ 23,553 |
| Major Equipment Amortization | $ 69,833 |
| Receiving Facility Subtotal | $ 275,920 |
| | |
| *Palmer WWTP O&M* | |
| Labor - Operation | $ 4,489 |
| Labor - Maintenance | $ 23,401 |
| Power | $ 188,262 |
| Heating | $ 9,730 |
| Miscellaneous Supplies | $ 17,824 |
| Miscellaneous Services and Equipment | $ 39,794 |
| Major Equipment Amortization | $ 40,000 |
| WWTP Subtotal[1] | $ 323,499 |
| Subtotal Annual O&M Costs | $ 599,419 |
| Contingency (10%) | $ 59,942 |
| 5 Years Inflation @ 2.5% | $86,645 |
| O&M Total (2027 Dollars) | **$ 746,007** |

1. Palmer WWTP O&M Subtotal includes only costs associated with upgrades for treating MSB septage, not the full WWTP O&M costs.

### 9.3. TIPPING FEE ANALYSIS

Tipping fees for the proposed improvements were calculated from the capital cost estimate and O&M cost estimate. It was assumed that a USDA Rural Development loan would be obtained to finance the project, with a portion of the capital cost covered by a USDA Rural Development grant. The current financing rate is 1.75%, and it is assumed that the loan life will be 30 years and that 30% of the capital cost will be grant-funded.

The required tipping fee to cover the yearly debt service and annual O&M costs was calculated in volumetric unit cost. The first-year (2027) tipping fee is determined by dividing Year 2027 septage flows by the yearly bond debt service, and therefore would be the highest cost to septage haulers. The Year 2057 tipping fee is determined by dividing Year 2057 septage flows by the yearly bond debt service and would be the lowest cost to septage haulers. Estimated tipping fees are summarized in Table 9 below.

The MSB could structure the tipping fee in various ways. The fee could remain a flat rate for the life of the facility as an average of the Year 2027 and Year 2057 tipping fees, or the fee could be adjusted periodically over the life of the facility with changing septage volumes. Using a flat rate tipping fee could allow more competitive pricing relative to using AWWU's septage facility (Table 9), but would also produce lower revenues during the early years of the facility's design life.

Existing and proposed total trip costs were compared by including mileage-dependent hauler expenses such as fuel costs, labor costs, and vehicle maintenance in the tipping fee. AWWU currently charges $26.70 for every 1,000 gallons of septage. Five years of inflation at 2.5% were applied to the AWWU tipping fee to normalize it with project costs, which are shown in 2027 dollars.

An estimated round-trip commute of 70 miles was included in the existing total trip cost for Anchorage disposal, compared to a round-trip commute of 10 miles for the proposed MSB facility. These mileage numbers assume that hauler trips heading either to the Anchorage facility or the MSB facility near Palmer begin at the Glenn Hwy/Parks Hwy interchange, and that the preceding mileage needed for haulers to travel to this interchange is the same for either disposal option. Since approximately 90% of the hauled septage volume originates from the west side of the MSB, this calculation makes a simplifying assumption that these round-trip distances are representative for all MSB haulers. First year (2027), Year 2057, and current AWWU total trip costs are also summarized in Table 9.

**Table 9: Estimated Tipping Fees and Total Trip Costs[1]**

| | Tipping Fee per 1,000 gal | Total Tipping Fee[3] | Total Hauling Expenses[4] | Total Trip Cost |
|---|---|---|---|---|
| **Year 2027 MSB** | $ 78.04 | $ 234.11 | $ 26.10 | $ 260.21 |
| **Year 2057 MSB** | $ 38.38 | $ 115.13 | $ 26.10 | $ 141.23 |
| **Flat-Rate MSB** | $ 58.21 | $ 174.62 | $ 26.10 | $ 200.72 |
| **Year 2027 AWWU[2]** | $ 30.21 | $ 90.63 | $ 182.67 | $ 273.30 |

Notes:
1. Costs and fees shown on a per trip basis.
2. 5 years inflation @ 2.5% applied to AWWU 2022 tipping fee of $26.70/1,000 gal
3. Assumes a 3,000-gal hauling volume.
4. Refer to Appendix B for itemized hauling expenses. A 70-mile round trip distance is used for AWWU, and a 10-mile round trip distance used for MSB, both measured from a common point located at the Parks-Glenn Hwy interchange. Hauling costs do not include expenses for time spent at location of septage collection nor travel from septage collection location to the Parks-Glenn Hwy interchange.

This summary shows that the highest total trip cost associated with the MSB facilities would be less expensive than the AWWU total trip cost at the beginning of the facility's life. Use of MSB's facilities is therefore assumed to be more economical for septage haulers throughout its design life relative to traveling into Anchorage to discharge septage. **Based on these numbers, facility revenues could be expected to match or exceed operational and financing costs from the beginning of its operations, which thereby could be considered financially feasible. Relative to the AWWU total trip costs, the much lower hauling expenses associated with the MSB septage facility are expected to more than offset its higher tipping costs.**

Continuing inflation is assumed to affect both the AWWU and MSB hauling costs equally. Predictions of AWWU tipping fee increases or reductions would be speculative; but any such variations would be mitigated by a substantially larger customer base in AWWU's service areas. Because hauler trip costs are significantly larger than the tipping fee component for AWWU's costs, tipping fee changes would not be expected to greatly affect the total costs of hauler trips to Anchorage.

## 10. DISCUSSION

The primary context of this study is to evaluate the feasibility of incorporating the PWWTP into the MSB's programming for receiving and treating locally-generated septage. Based on inputs given by the MBBR manufacturer, without sufficient pre-treatment upstream of the PWWTP, the contaminant loading from the septage would exceed the capability of the MBBR process to provide adequate secondary treatment and meet the City of Palmer's discharge permit. Therefore, this study considers the use of two pre-treatment steps: a primary treatment facility for screening and dewatering the septage to greatly reduce BOD and TSS concentrations; and an activated sludge treatment process that makes use of the PWWTP's existing Lagoon #1 to provide further BOD reduction and substantial ammonia removals. All of these steps are necessary to minimize the impact on the PWWTP's treatment process. In essence, a two-step treatment process is needed ahead of the PWWTP to meet the objective of incorporating this plant into the MSB's vision of locally treating and disposing of its septage. This is not a surprising conclusion given the highly variable, challenging characteristics of septage combined with the very stringent wastewater treatment requirements imposed on the City of Palmer.

This study generally evaluates the use of time-tested conventional treatment methods to meet the pre-treatment objectives of producing a wastewater effluent from septage that can be readily treated at the PWWTP. Other treatment approaches might be explored in subsequent studies or in detailed design that may incrementally improve the quality of wastewater effluent, or may be more cost-effective in construction and/or treatment performance. Nevertheless, the conceptual sizing of these conventional processes based on the growth rates assumed in this study lead to capital and O&M cost estimates that are believed to be reasonable and conservative. The conceptual layouts of the facilities also anticipate the need for future expansion. This study is therefore believed to reflect a reasonable degree of technical and financial feasibility with the conventional treatment approaches presented in it. From these standpoints, it appears that the next planning steps could be pursued.

However, there exists a financial and technical risk involved for both the MSB and City of Palmer. A loan is anticipated for financing the design and construction of the proposed improvements that would be borne by the MSB. Operations and maintenance (O&M) costs would increase for both the MSB and the City, in addition to the need of operators certified to manage the receiving facility and a higher level of wastewater treatment at the PWWTP. With every treatment plant that integrates numerous hydraulic, chemical, biological and digital processes, a wide variety of issues can arise that can complicate the operation of these facilities. These risks need to be evaluated against the benefits of providing local treatment and disposal of Borough-wide septage and wastewater. Commitments from both entities would be needed to proceed with further planning.

Presuming that both entities agree to move forward with this undertaking, it is anticipated that the financial costs of designing, constructing, and operating the proposed septage receiving and treatment improvements will be shared between the MSB and City of Palmer. It is envisioned that the design and construction of the improvements would be funded using a combination of grants and loans obtained by the MSB (although the City might elect to participate in the financing). The O&M of the facilities would be funded by both the MSB and City of Palmer. The two-step arrangement of the pre-treatment processes appears to lend well to the sharing of O&M costs: the receiving station operations and handling of process solids could be the responsibility of MSB; and the operations of the intermediate secondary process at Lagoon #1 could be the City's responsibility. The preliminary O&M costs estimated in this study appear to be generally balanced (Table 8, above). A memorandum of agreement would be executed between the Borough and the City detailing the financial arrangements of the shared enterprise and the recovery of revenues to pay back the loan(s).

With the necessary agreements and approvals in place, the next step would be to proceed with a more detailed evaluation of project alternatives and cost estimating for funding acquisition. These steps would be accomplished in the development of a preliminary engineering report (PER) or similar design analysis document. Assuming that funding would be pursued through USDA-RD, a PER would be produced.

## 11. CONCLUSIONS

The following conclusions are made from this evaluation:

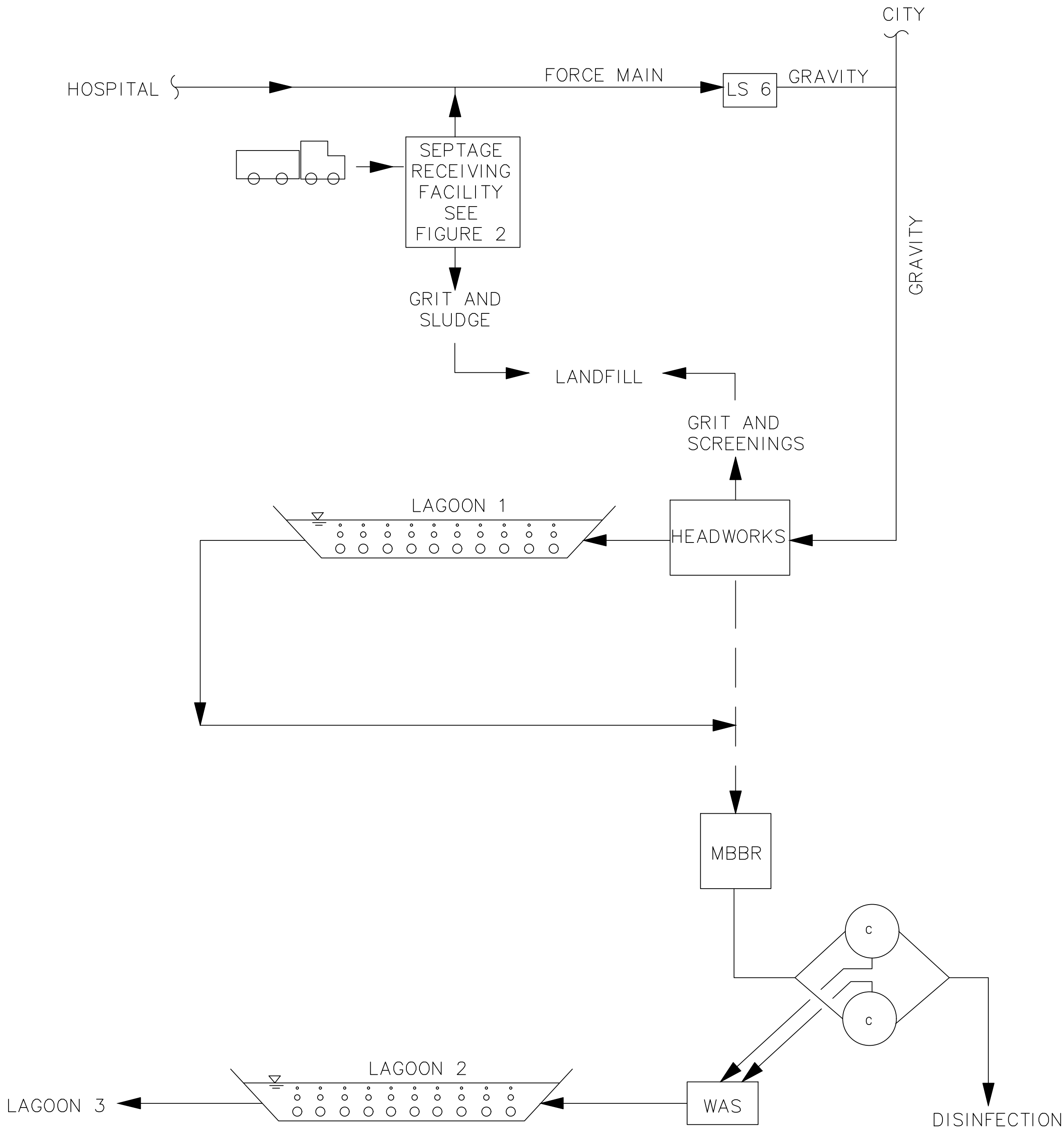
- Pre-treatment is necessary to produce combined septage and wastewater characteristics that are readily treatable by the existing processes at the PWWTP.
- The use of screening, dewatering and mixing of septage with City of Palmer wastewater followed by an intermediate activated sludge treatment process at Lagoon #1 appears to be technically feasible in producing wastewater that can be subsequently treated by the PWWTP.
- A receiving facility site located south of Palmer near the Glenn Highway is considered the preferred location based on this study's research and assuming availability for purchase.
- Based on the septage volume growth assumed in this study, the costs of designing, constructing, and operating these treatment facilities in general proximity to the PWWTP could be expected to result in hauler trip costs that are less than the cost of hauling and disposing of septage at AWWU's Turpin St. receiving station in Anchorage.
- Based on the total trip costs and tipping fees estimated for this study, septage receiving and treatment facility revenues could be expected to match or exceed operational and financing costs from the beginning of its operations.

## 12. RECOMMENDATIONS

The following recommendations are made:

- Seek concurrence with the City of Palmer and approval from the Borough Assembly in pursuing further planning of the septage receiving and treatment improvements considered in this study.
- With City concurrence and Borough Assembly approval, proceed with the development of a PER for USDA grant/load funding or similar design analysis document to evaluate project alternatives in further detail, and generate estimated costs for funding acquisition.

END



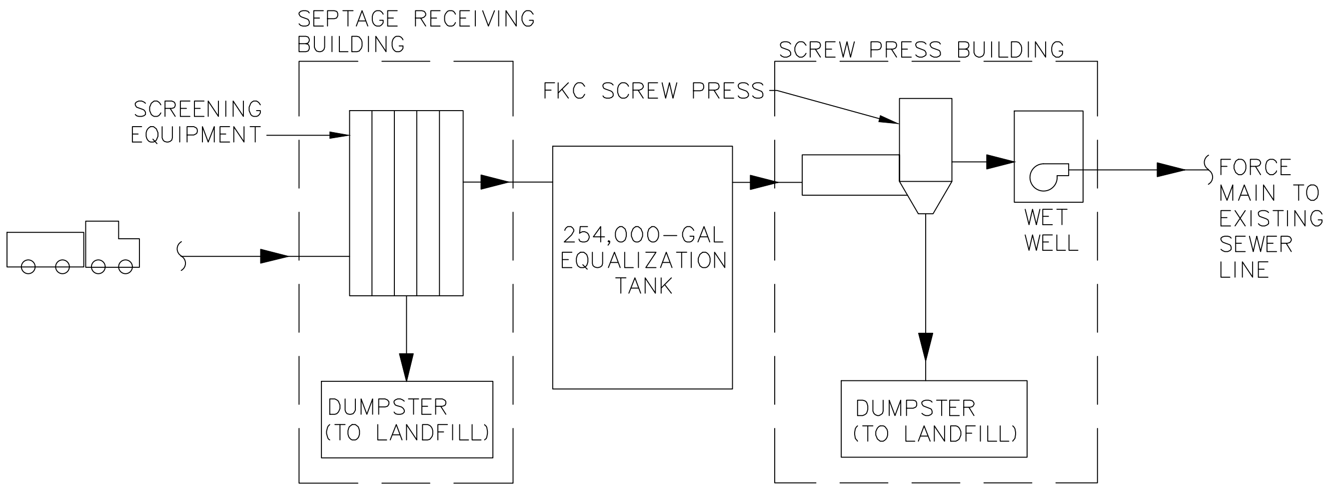

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

MSB SEPTAGE TREATMENT & DISPOSAL FACILITY
FEASIBILITY STUDY

PALMER WWTF FLOW SCHEMATIC

| | |
|---|---|
| Project No: | 20813.00 |
| Drawn By: | CRM |
| Scale: | NTS |
| Date: | 3/22/2022 |
| Figure: | 1 |

FILE NAME: J:\JobsData\20813.00 Septage Treatment And Disposal Study\00 CADD 2019\01 Working Set\01 Civil\Septage Facility Schematic.dwg




FILE NAME: J:\JobsData\20813.00 Septage Treatment And Disposal Study\00 CADD 2019\01 Working Set\01 Civil\Septage Facility Schematic.dwg

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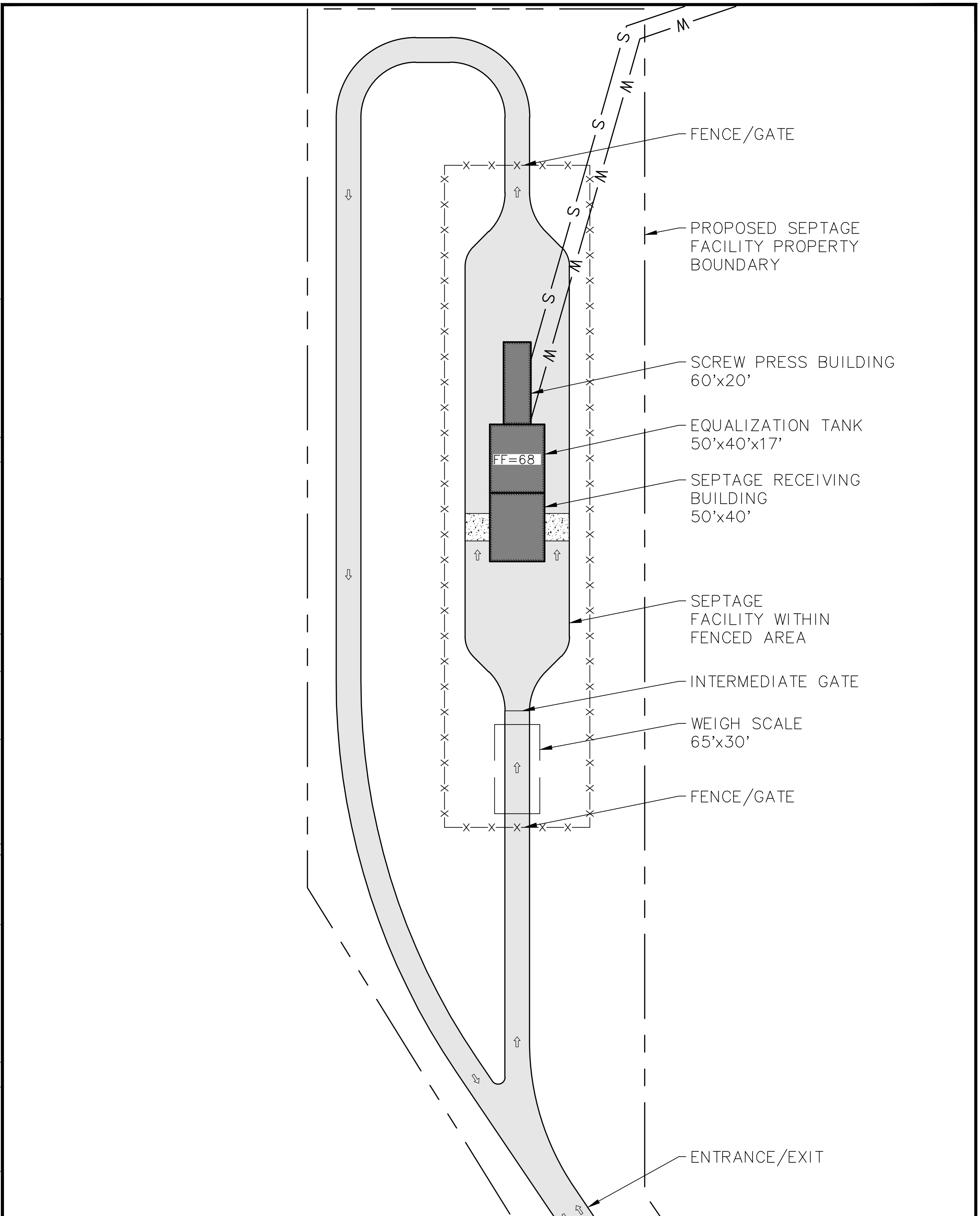
PHONE: (907) 562-3252
#AECL882-AK

MSB SEPTAGE TREATMENT & DISPOSAL FACILITY
FEASIBILITY STUDY

RECEIVING FACILITY FLOW SCHEMATIC

| | |
|---|---|
| Project No: | 20813.00 |
| Drawn By: | CRW |
| Scale: | NTS |
| Date: | 3/22/2022 |
| Figure: | 2 |

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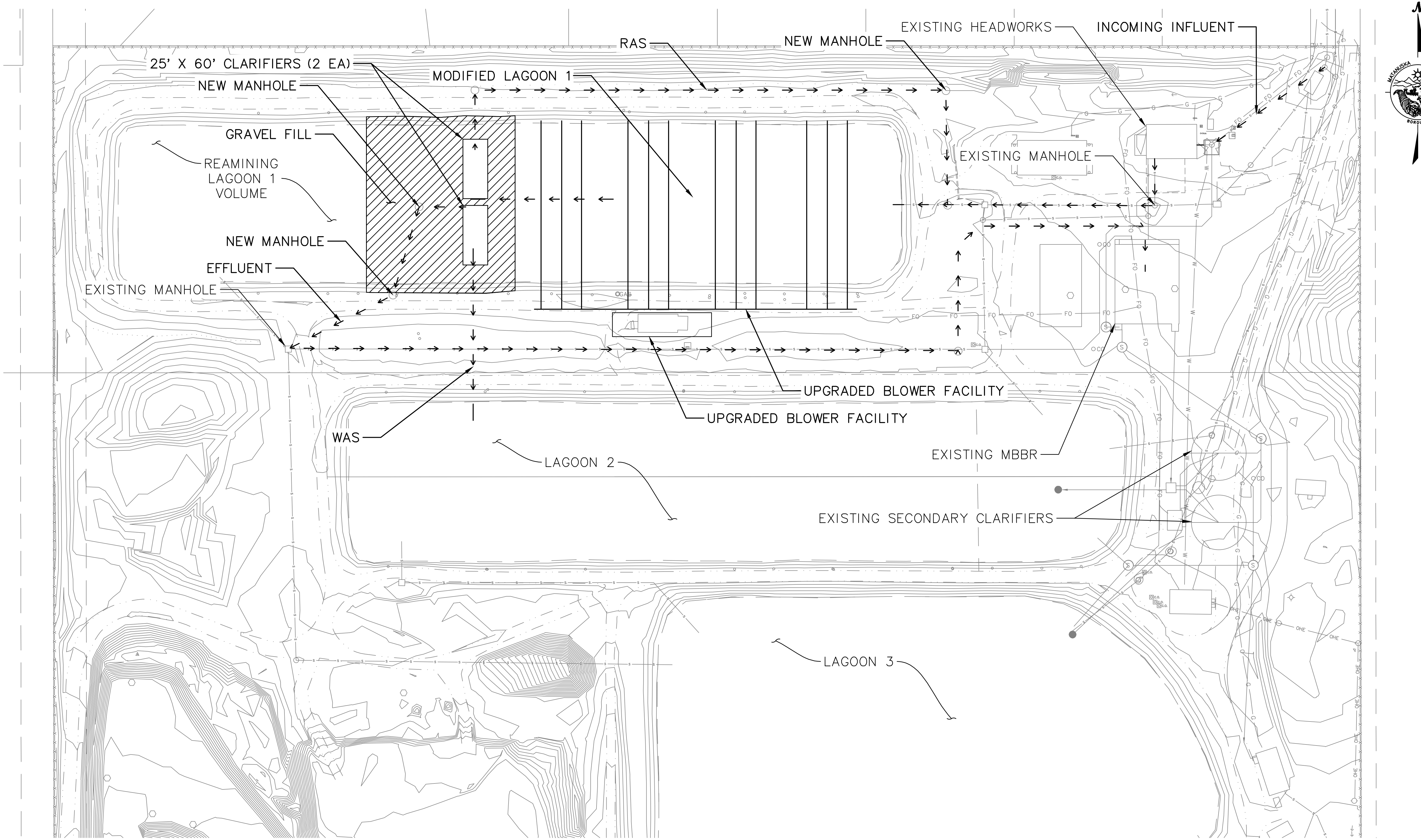
CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK


0 50 100

MSB SEPTAGE TREATMENT & DISPOSAL FACILITY
FEASIBILITY STUDY

GENERIC SEPTAGE FACILITY LAYOUT

| | |
|---|---|
| Project No: | 20813.00 |
| Drawn By: | PB/CMK |
| Scale: | 1"=100' |
| Date: | 3/2/2022 |
| Figure: | 3 |




CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

MATANUSKA-SUSITNA BOROUGH
CAPITAL PROJECTS DEPARTMENT

SEPTAGE DISPOSAL AND TREATMENT STUDY

PALMER WASTEWATER TREATMENT PLANT SITE LAYOUT

| REV | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

DATE: DEC. 21, 2021
STATUS: DRAFT
SCALE:
HORZ SCALE: N/A
VERT SCALE: N/A
SHEET NO.

**FIG. 4**

ACAD FILE: \\CRWENG.COM\PROJECTS\JOBSDATA\20813.00 SEPTAGE TREATMENT AND DISPOSAL STUDY\00 CADD 2019\02 FIGURES\20813.00 PALMER WWTF FIGURE.DWG Plot Date: 12/21/2021 2:40 PM

# APPENDIX A

## Honey Monster SRS Proposal

## FKC Screw Press Proposal

## Schwing Bioset Screw Press Proposal

## Parkson Biolac Proposal

2850 S. Red Hill Ave. Suite 125
Santa Ana, CA 92705
phone (949) 833-3888
toll-free (800) 331-2277
fax (949) 833-8858
jwce@jwce.com

# HONEY MONSTER® SRS BUDGET INFORMATION

DATE: 11/5/2021

PROJECT: Matanuska-Susitna Borough, AK

TO**:** Apsco, LLC - Joe Buckman

Thank you for choosing JWC's equipment. Enclosed you will find a specification and drawing based on the design parameters listed below. Please let us know if any of the information below changes.

| | |
|---|---|
| Number of units: | 1 |
| Model: | SRS3235-1004 Standard |
| Material: | 304 |
| Weight: | 5950 lbs. (2698.9 kg) |

4" Diameter cast aluminum cam & groove inlet connector

Rock Trap with 4" inlet/outlet, 304SS

30004T-1204 Muffin Monster grinder w/5 Hp TEFC motor

4" Milliken plug valve w/Rotork actuator

4" interconnect piping, 304SS

Stainless steel tank with 4" inlet and 12" outlet, with ALE3200-480 auger with a 2 Hp TEFC motor

PC2450 MonsterTrack controller, NEMA 4X 304SS enclosure

| | |
|---|---|
| **BUDGET PRICE PER UNIT** | **$136,000** |
| Optional adder; discharge bagger | $1,100 |

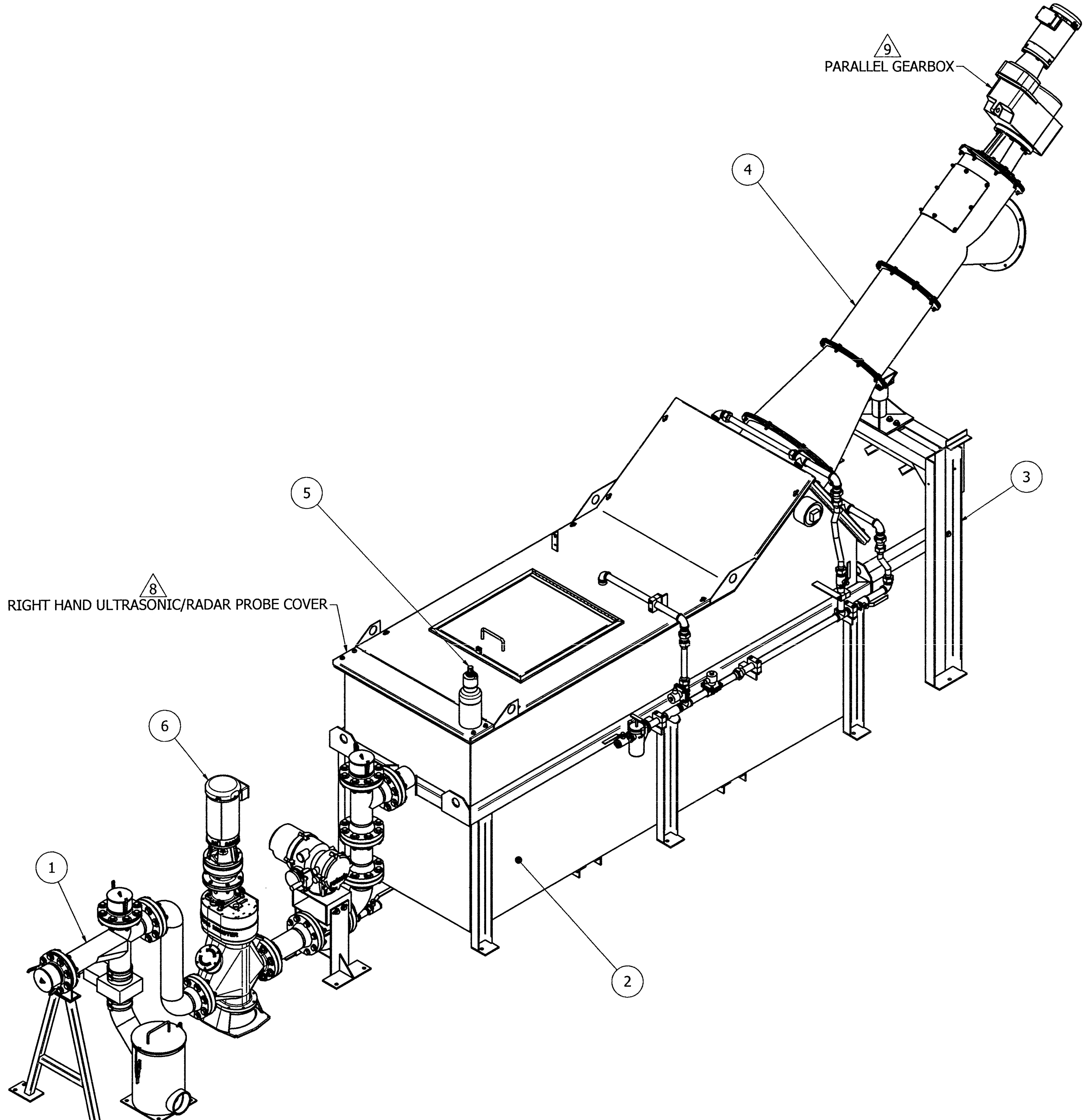
*Not to be used for construction*

Please contact JWC if you have any questions.

DRAWING NO. SRS3235-1004-GA

REVISION HISTORY

| ZONE | REV | DESCRIPTION | ECO NO. | DATE | CHKD | PE | MFG | QC |
|---|---|---|---|---|---|---|---|---|
| ALL | A | INITIAL RELEASE | SR-0154 | 2/19/19 | | | | |




NOTES UNLESS OTHERWISE SPECIFIED:

1. INTERPRET DIMENSIONS IN ACCORDANCE WITH ASME Y14-1994 STANDARDS.
2. 1/2" X 3-3/4" (13MM X 145MM) MIN (QTY 20) ANCHOR BOLTS REQUIRED (BY OTHERS) FOR ANCHORING INLET PIPE ASSY., TANK ASSY. & PIVOT SUPPORT STAND ASSY.

   3/8" X 3-3/4" (10MM X 145MM) MIN (QTY 4) ANCHOR BOLTS REQUIRED (BY OTHERS) FOR ANCHORING GRINDER.
3. A DOUBLE BACK-FLOW PREVENTOR IS RECOMMENDED (BY OTHERS) WHEN USING POTABLE WATER FOR SPRAY/FLUSH CONNECTION TO PREVENT SIPHONING INTO WATER SUPPLY.
4. REQUIRED WATER SUPPLY 10-15 GPM AT 20-30 PSI (63-.95 L/S AT 138-207 KPA) FOR EACH SPRAY WASH CONNECTION.
5. FIELD MEASUREMENTS MUST BE TAKEN PRIOR TO INSTALLATION TO VERIFY ADEQUATE CLEARANCE AROUND THE EQUIPMENT EXISTS.
6. PIVOT AUGER OUT OF TANK BY USING LIFTING POINT "1" ONLY. DO NOT PULL DOWN ON DRIVE END OF AUGER TO PIVOT OUT OF TANK.
7. BACK DISCHARGE SHOWN. SEE DRAWING SRA0001-0480 FOR OTHER OPTIONS.
8. RIGHT HAND ULTRASONIC/RADAR PROBE COVER SHOWN - SEE DRAWING SRA0001-0480 FOR LEFT HAND VERSION.
9. PARALLEL GEARBOX SHOWN - SEE DRAWING SRA3235-0480 FOR RT. ANGLE GEARBOX.
10. MATERIAL OPTIONS VARY.

    ZZ = SS FOR 304 SST

    = SU FOR 316 SST
11. ESTIMATED SHIPPING WEIGHTS (LARGE COMPONENTS:

    AUGER: 2500 LBS./1134 KG
    TANK: 2050 LBS./930 KG

CONTROLLED

PARTS LIST

| ITEM | QTY | PART / ASSEMBLY NUMBER | DESCRIPTION | MATERIAL |
|---|---|---|---|---|
| 6 | 1 | 30004T-1204-DI | INLINE GRINDER | DI/ALY STL |
| 5 | 1 | E15-022-106 | RADAR LEVEL PROBE WITH 20M/66 FT. CABLE | PVDF |
| 4 | 1 | SRA3235-480-1250 | INCLINED AUGER ASSY. W/1250MM TRANSPORT | ALY STL/SST |
| 3 | 1 | SRA1030-0480-ZZ | PIVOT SUPPORT STAND ASSY. | SST |
| 2 | 1 | SRA0001-0480-B-ZZ | SRS TANK ASSY. | SST |
| 1 | 1 | SRA0100-1004-ZZ | 4-INCH INLET PIPE ASSY | SST |



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
FRACTIONS ± 1/8 (3MM) DECIMALS .XX ± .XXX± ANGLES ± 1°

MATERIAL AS NOTED

FINISH

DO NOT SCALE DRAWING

| CONTRACT NO. | | |
|---|---|---|
| APPROVALS | | DATE |
| DRAWN | S. ANDERSON | 02-07-19 |
| CHECKED | | 2/19/19 |
| MANUF. | | 3-6-19 |
| Q.C. | | 3-5-19 |

JWC ENVIRONMENTAL
2850 S. RED HILL AVE, SUITE 125, SANTA ANA, CA 92705

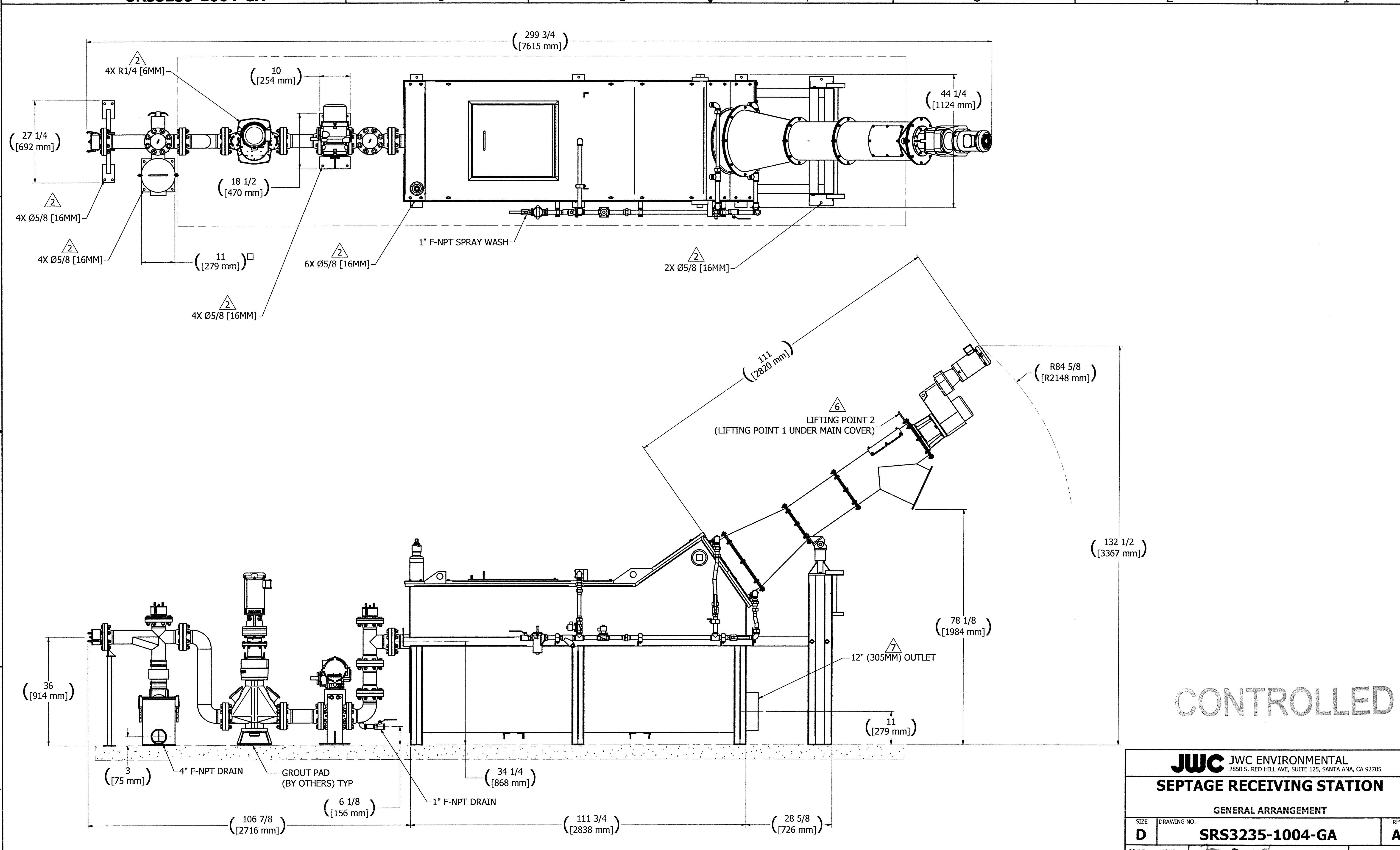
**SEPTAGE RECEIVING STATION**

**GENERAL ARRANGEMENT**

SIZE D | DRAWING NO. SRS3235-1004-GA | REV A

SCALE: NONE | SHEET 1 OF 2

DRAWING NO. SRS3235-1004-GA




CONTROLLED

JWC ENVIRONMENTAL
2850 S. RED HILL AVE, SUITE 125, SANTA ANA, CA 92705

**SEPTAGE RECEIVING STATION**

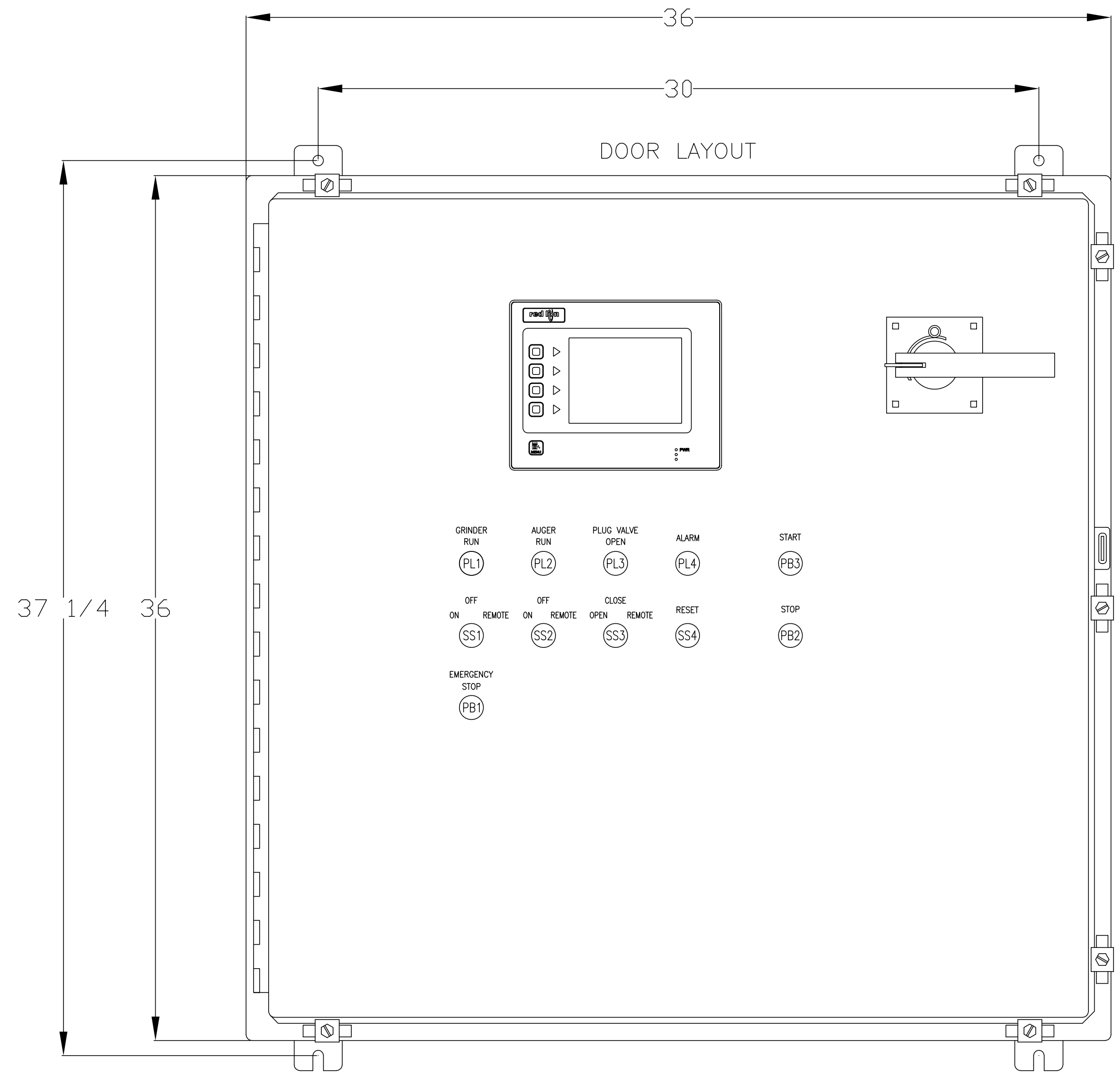
**GENERAL ARRANGEMENT**

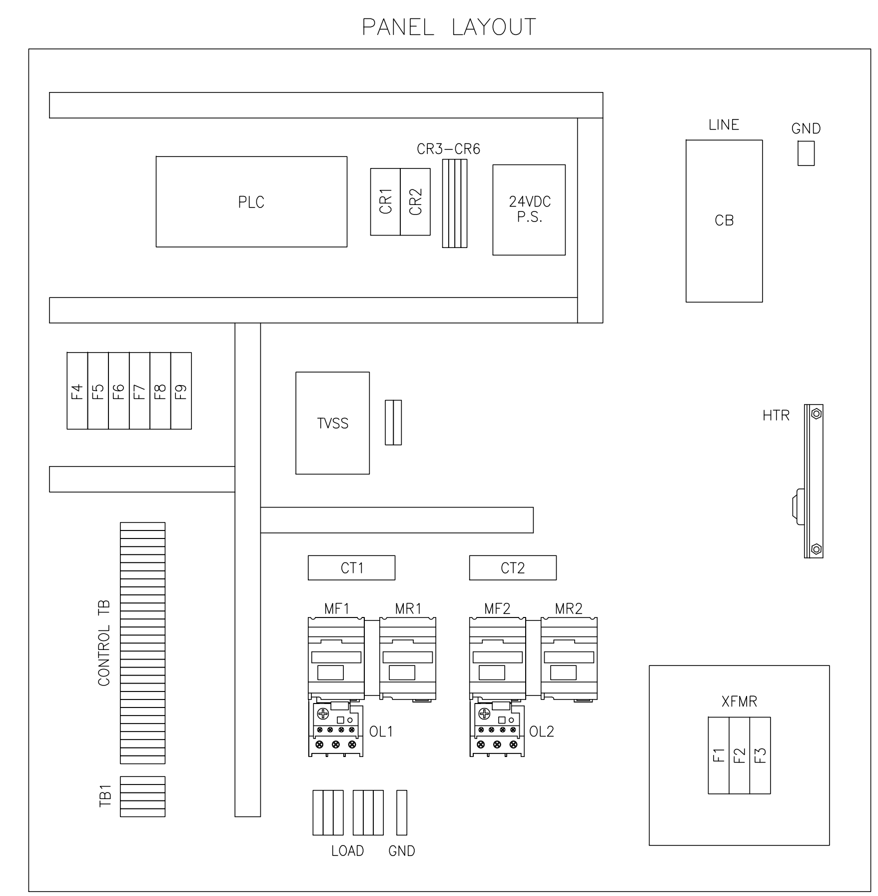
| SIZE | DRAWING NO. | REV |
|---|---|---|
| D | SRS3235-1004-GA | A |

SCALE: NONE — SHEET 2 OF 2

| DRAWING NO. |
|---|
| PC2450–10XXXX |
| PROGRAM #PC2450–10XXXX |

| REVISIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| REV | DESCRIPTION | ECO NO. | DATE | APPROVED CK'D | PE | MANF | QC |
| A | INITIAL RELEASE | | 05–29–13 | | | | |




ENCLOSURE

TYPE 4X, 304 STAINLESS STEEL

DEPTH IS APPROX. 12"




JWCE JWC Environmental
2600 South Garnsey
Santa Ana, CA 92707


| APPROVALS | DATE |
|---|---|
| DRAWN: TRAN, K. | 05–29–13 |
| CHECKED: | |
| MANUF.: | |
| QUALITY: | |

MODEL PC2450
MOTOR CONTROLLER

| SIZE | CODE IDENT NO. | DRAWING NO. | REV. |
|---|---|---|---|
| B | 53242 | PC2450–10XXXX | A |
| SCALE: NTS | | SHEET: 1 OF 3 | |

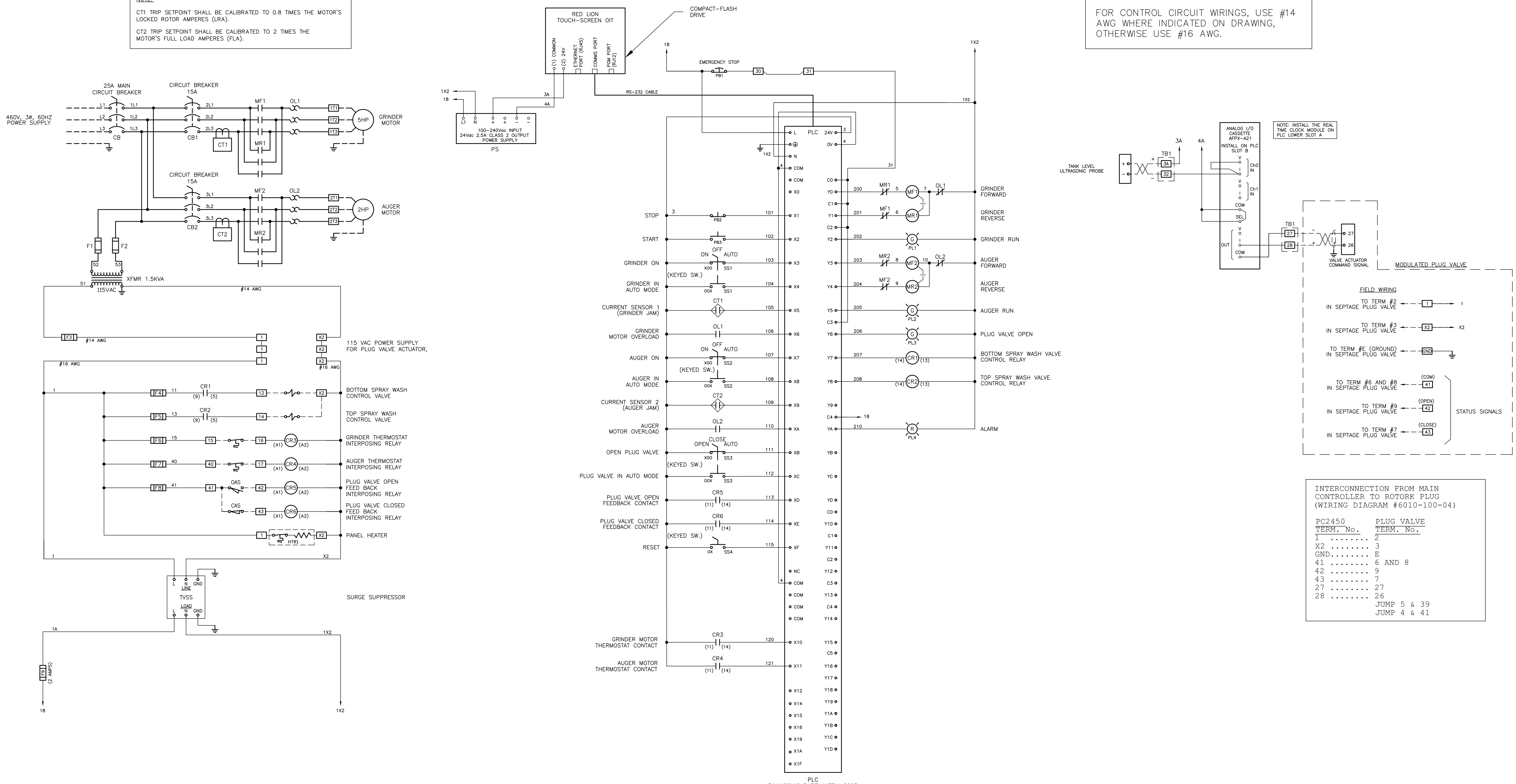
NOTE:

CT1 TRIP SETPOINT SHALL BE CALIBRATED TO 0.8 TIMES THE MOTOR'S LOCKED ROTOR AMPERES (LRA).

CT2 TRIP SETPOINT SHALL BE CALIBRATED TO 2 TIMES THE MOTOR'S FULL LOAD AMPERES (FLA).

ASSEMBLY NOTE:

FOR CONTROL CIRCUIT WIRINGS, USE #14 AWG WHERE INDICATED ON DRAWING, OTHERWISE USE #16 AWG.




INTERCONNECTION FROM MAIN CONTROLLER TO ROTORK PLUG (WIRING DIAGRAM #6010-100-04)

| PC2450 TERM. No. | PLUG VALVE TERM. No. |
|---|---|
| 1 | 2 |
| X2 | 3 |
| GND | E |
| 41 | 6 AND 8 |
| 42 | 9 |
| 43 | 7 |
| 27 | 27 |
| 28 | 26 |
| | JUMP 5 & 39 |
| | JUMP 4 & 41 |

MODEL PC2450
MOTOR CONTROLLER

| SIZE | CODE IDENT NO. | DRAWING NO. | REV. |
|---|---|---|---|
| B | 53242 | PC2450-10XXXX | A |
| SCALE: NTS | | SHEET: 2 OF 3 | |

**ALARM MESSAGES:**

*Grinder Jammed*
*Grinder Motor Overload*
*Grinder Motor Overtemp*
*Auger Jammed*
*Auger Motor Overload*
*Auger Motor Overtemp*
*High Level Alarm*

**NON-PASSWORD PROTECTED SCREENS:**

Main Screen:

*Time Display (mm/dd/yy hh/mm)*
*Compact Flash Card Status (Blank if ok/CF Card Not installed/CF Formatting Fault)*
*System Status (System Not Ready/System Ready/ High Level/Auger Off Delay/System in Manual)*
*Off Delay Countdown (xx Secs.)*
*Press Start Button to run the system (Displays when system is in auto)*
*Grinder (Stopped/Running/Reverse)*
*Auger(Stopped/Running/Reverse)*
*Valve(Open/Closed)*
*Tank Level (xx.xx)*

*Press "Stat. Data" button to go to the read only statistical data screen.*
*Press "PLC I/O Status" button to go to the PLC I/O screen.*
*Press "Alarm" button to view the Alarm Screen.*
*Press "Cancel" button to return to the previous screen.*

Statistical Counters:
*View motor run hours, starts, overloads, overtemps, reversals, jams.*
*Press the "Back" button to return to the main screen*

I/O Status
*Press "PLC I/O Status" button to go to the PLC I/O screen.*

Alarm List Screen:
*Active Alarms are Shown*
*Press Accept to acknowledge the Alarm.*
*Press Alarm History to view the Alarm History Screen.*
*Press Exit to return to the previous screen.*

*Setup Menu Access:*
*Press the "Setup Menu" button to go to the Setup Menu screen.*

**PASSWORD PROTECTED SCREENS:**

Setup Menu Screen:
*Press the desired setup screen button.*
*Enter the user name using the popup keypad (default = user)*
*Touch the symbol key to change the popup keypad to numeric keys*
*enter the password on the popup keypad (default = 9999)*
*Press the "Exit" button to exit and log out.*

Set Clock
First, Load Time/Date by pressing the appropriate number field
*Touch the contrast number field to adjust the screen contrast (0-100)*
*Touch the brightness number field to adjust the screen brightness (0-100)*
*Press the "Setup Menu" button to return to the setup screen*

Change Password Screen:
*Touch the number field to enter the password on the popup keypad*
*Press the "Setup Menu" button to return to the setup screen*

Statistical Counters:
View motor run hours, starts, overloads, overtemps, reversals, jams.
*Press the appropriate counter reset button 3 Seconds to reset counters*
*Press the appropriate counter reset button 10 Seconds to reset run times*
*Press the "Setup Menu" button to return to the setup screen*

I/O Status

*Press "PLC I/O Status" button to go to the PLC I/O screen.*

Reverse Jog

*Press "Grinder REV JOG" to reverse jog the Grinder.*
*Press "Auger REV JOG" to reverse jog the Auger.*
*Press "Top Spray Valve Manual On" to manually actuate the top spray valve*

Operating Parameters
*Touch the appropriate number field to enter the value on the popup keypad*
Empty Calibration: X.XX (ft. or meter) (Default 3.83)
Full Calibration: X.XX (ft. or meter) (Default: 3.00)

Press the "Next" button to go to the Auger Run Cycle Timers setup
*Press the "Setup Menu" button to return to the setup screen*

Auger Run Cycle Setup Screens
*Touch the appropriate number field to enter the value on the popup keypad*
*Forward Cycle: ### Sec (Default 999)*
*1st stop cycle: ### Sec (Default 0)*
*Reverse Cycle: ## Sec (Default 0)*
*2nd Stop Cycle: ### Sec (Default 0)*
*Off-Delay Cycle: ### Sec (Default 300)*

Press the "Next" button to go to the PID setup
*Press the "Setup Menu" button to return to the setup screen*

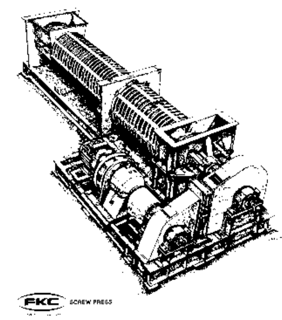
PID Setup Screen
*Touch the appropriate number field to enter the value on the popup keypad*
*PID Mode: Auto/Man (Default: Auto)*
*SetPoint (%): XX.XX (Default 83.00)*
*Gain, Kp: X.X (Default 1.0)*
*Integral Time, Ti: XX.X (Default 12.0)*
*Derivative Time, Td: X.X (Default 0.0)*

| | | | |
|---|---|---|---|
| MODEL PC2450 MOTOR CONTROLLER | | | |
| SIZE B | CODE IDENT NO. 53242 | DRAWING NO. PC2450-10XXXX | REV. A |
| SCALE: NTS | | SHEET: 3 OF 3 | |

**FKC CO., LTD.**

2708 West 18th Street
Port Angeles, WA 98363

(360) 452-9472
FAX (360) 452-6880



November 24, 2021

Dan Campbell PE
CRW Engineering Group, LLC
Anchorage, AK

RE: FKC Dewatering Equipment Proposal
Matanuska-Susitna Borough Septage Receiving Plant

Dan,

Please find a quotation for FKC dewatering equipment for Matanuska-Susitna Borough, AK septage receiving plant. In summary, the following screw press has been offered:

| Units | Dry Lbs. per hour | Screw Press Model |
|---|---|---|
| 1 | 925 dry # / hr | BHX-800x4500L |

Components not included, but required, for a complete system are as follows:

- Sludge feed pump
- Polymer make-down and feed system
- Access platform to top of flocculation tank
- Structural support legs for Screw Press
- Additional grating as required

These items are available from FKC. Please let me know if you would like pricing on any of these items.

Please contact me if you have questions or if you need additional information

Sincerely,
FKC Co., Ltd.

Paul Kohl

# Table of Contents


A. Proposed Equipment

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11. Service Rates........................................................................................... 6

## A. Proposed Equipment – Screw Press

| Qty. | Description | | Extended Price FOB Seattle |
|---|---|---|---|
| **1** | FKC Screw Press<br>Model BHX-800x4500L | | **$328,200**** |
| | Material: | | Septage Sludge |
| | Inlet capacity: | | 925 Dry lbs per hour (165 gpm max) |
| | Inlet consistency: | | 1% – 3.5% |
| | Outlet consistency: | | 20% (Lab Testing Required) |
| | Materials of construction: | | SS-304 wetted parts<br>Other Carbon Steel, galvanized base |
| | Speed reducer: | | Sumitomo Cyclo Reducer |
| | Motor: | | 5 HP, 1800 rpm, NEMA B<br>Suitable for variable speed operation w/<br>PWM constant torque inverter |
| | Screw: | | 304 stainless steel, brushless |
| | Other: | | 1 sets standard tools<br>1 sets drum covers<br>3 Solenoid Valves<br>4 spare screens |
| | Delivery: | | Delivery within 8 (eight) months after approved submittals |

**Taxes and Bonding not included

## 2. Flocculation Tank

| Qty. | Description | | Included |
|---|---|---|---|
| 1 | Flocculation Tank 285 gal with | | |
| | Drive: | SEW Eurodrive | |
| | Motor: | 1.5 HP, 1800 rpm, manufactured by SEW<br>480 VAC, 3 Ph, 60 Hz included | |
| | Materials of construction: | SS-304 wetted parts | |

## A. Proposed Equipment – Controls

**Control Panel including:**

Enclosure, NEMA 4
*PLC – Allen Bradley Micrologix 1400*
*Operator Interface – Panelview 1000*
Software, Programming, & Documentation

Screw Press VFD – AB Powerflex 525
Flocculation Tank VFD – AB Powerflex 525

Headbox Level Transmitter's
Solenoid Valves for Screw Press Wash Water – 1
Solenoid Valves for Screw Press Wash Water – 2
Solenoid Valves for Screw Press Wash Water – 3

All Discrete Output for System
All Analog Output for System
All Discrete Input for System
All Discrete Outputs for System

Includes field testing and start-up labor

## B. Miscellaneous

### 1. Delivery

The screw press will be delivered to the site within eight (8) months after approved submittals.

### 2. Shipping Arrangements

The FKC screw press will be shipped via 40' and/or 20' open top container from Fukoku Kogyo's (FKC Japan) Ishinomaki, Japan factory to the nearest port then best way to your facility.

### 3. Effective Period

This proposal shall remain valid **30** days from the date of the proposal.

### 4. Payment Terms

30% with certified drawings
30% with notice to proceed with manufacturing
40% with delivery
Net 30 days

### 5. Installation

The screw press is shipped fully assembled for ease of installation. Installation drawings are provided.

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).

### 6. Operator Training and Start Up

Operator and maintenance training and start up services are included in the price of the equipment.

Operator and maintenance training can be accomplished in approximately two hours per group. Ideal training sessions include both classroom and on-site (at the screw press) sessions.

Generally speaking, training and start up can be accomplished in a three day period.

A follow-up/performance testing visit of a two-day duration is also included in the price of the equipment.

Erection assistance and a separate trip for training are not included in the price of the equipment. Additional engineering service days are billed at the rates on the enclosed rate sheet.

## 7. Warranty

A. Warranty shall extend for 12 months after start-up or 18 months after delivery, whichever comes first.
B. Warranty shall include all parts, labor, and coatings for repairing or replacing equipment that fails during the warranty period. Defects occurring within the warranty period shall be repaired or replaced by the manufacturer at no cost to the OWNER.

## 8. Documentation Schedule

C. Approval Drawings - within 3 weeks after receipt of purchase order
   Buyer must return approval drawings within 14 days
   or delivery schedule will be affected.
D. Certified Drawings - within 2 weeks after return of approval drawings
E. Operation and Maintenance Manuals - 14-16 weeks after receipt of order

## 9. 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).

In the event that 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.

## 10. Service Rates

If required, round-trip airfare (coach class) from Port Angeles, WA to airport nearest work site.

Weekdays

$1000.00 - Per eight (8) hour day on weekdays plus, lodging, and rental car expenses.
$187.00 - Per hour for all hours exceeding eight (8) hour workday on weekdays.
$108.00 - Per hour for office engineering services and telephone consultations.

Saturdays, Sundays and Holidays

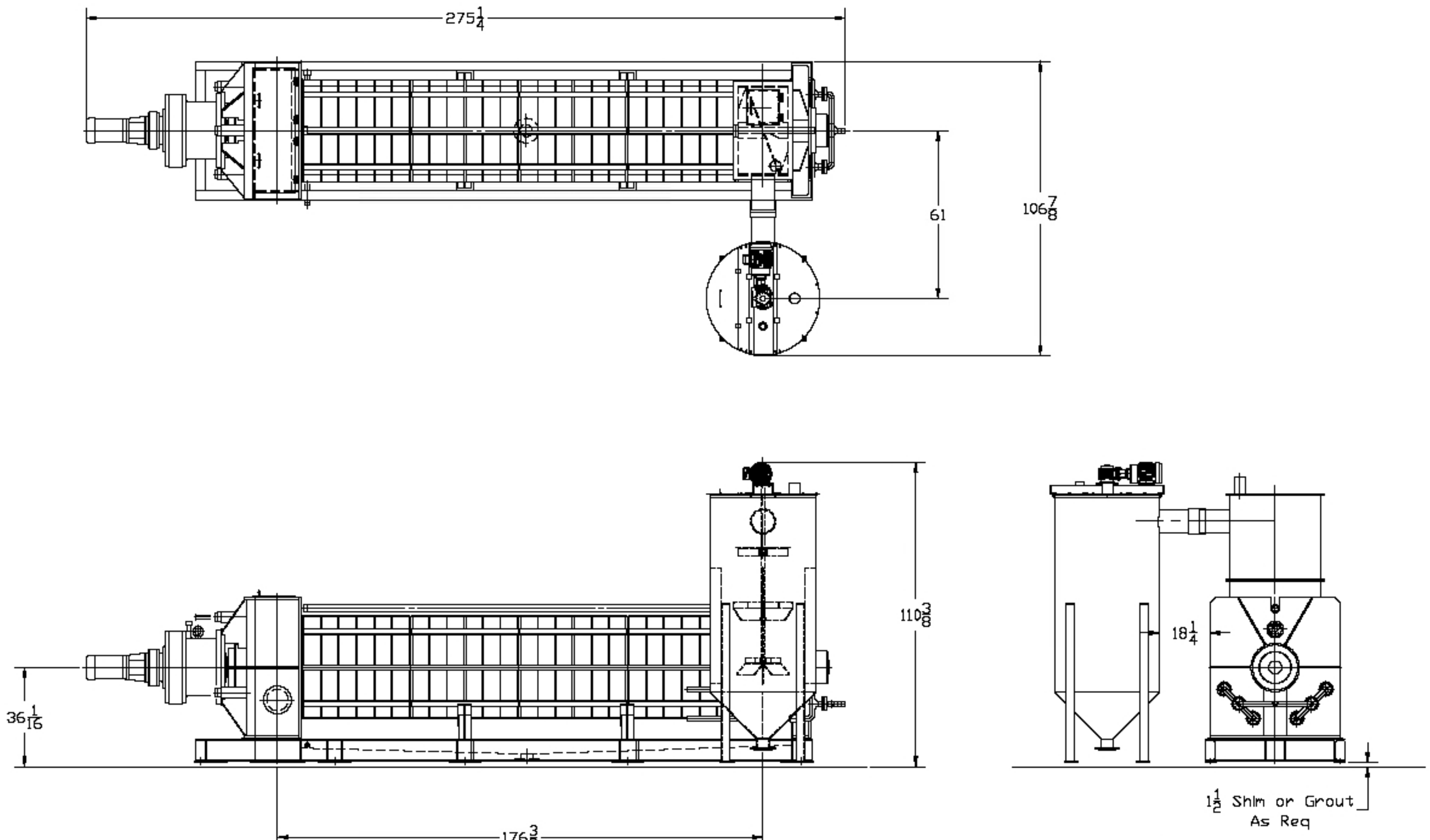
$1,440.00 - Per eight (8) hour day plus lodging and rental car expenses.
$270.00 - Per hour for all hours exceeding eight (8) hour workday.

Travel Time - Weekdays

$80.00 - Per hour travel time. (Not to exceed $990/day)

Travel Time – Weekends and US Holidays

$120.00 - Per hour travel time (Not to exceed $1,440/day)




PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF FKC CO LTD. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF FKC CO LTD IS PROHIBITED.

| No. | Alteration | Date | Sign |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |
| 0 | Issued for Approval | 8/18/21 | RTB |

Job No. 448

Drawing No. L448-900

Title: BHX-800x4500L
285 GAL Floc Tank
Layout Details

Wt. Lbs.

Quantity 1

Date 8/18/21

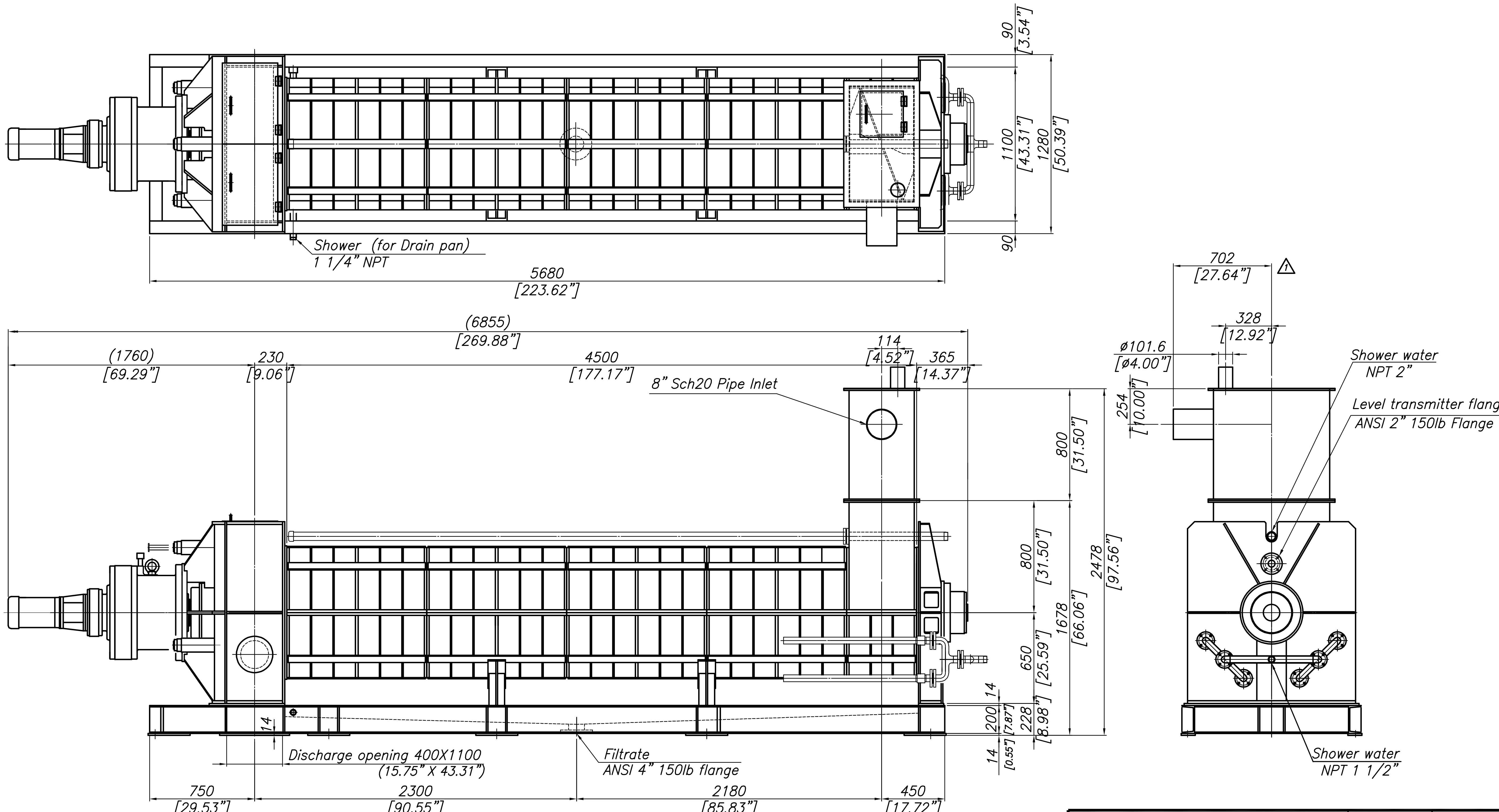
Drawn By RTB

FKC

FKC CO. LTD
2708 W 18th St.
Port Angeles, WA 98363
(360) 452-9472 Fax (360) 452-6880

Revision

SHEET 1 OF 1




Speed reducer
CHVJ-6255DA-3481

with C-face adaptor
Variable speed
5 HP, 1800rpm (Frame No. 184TC)

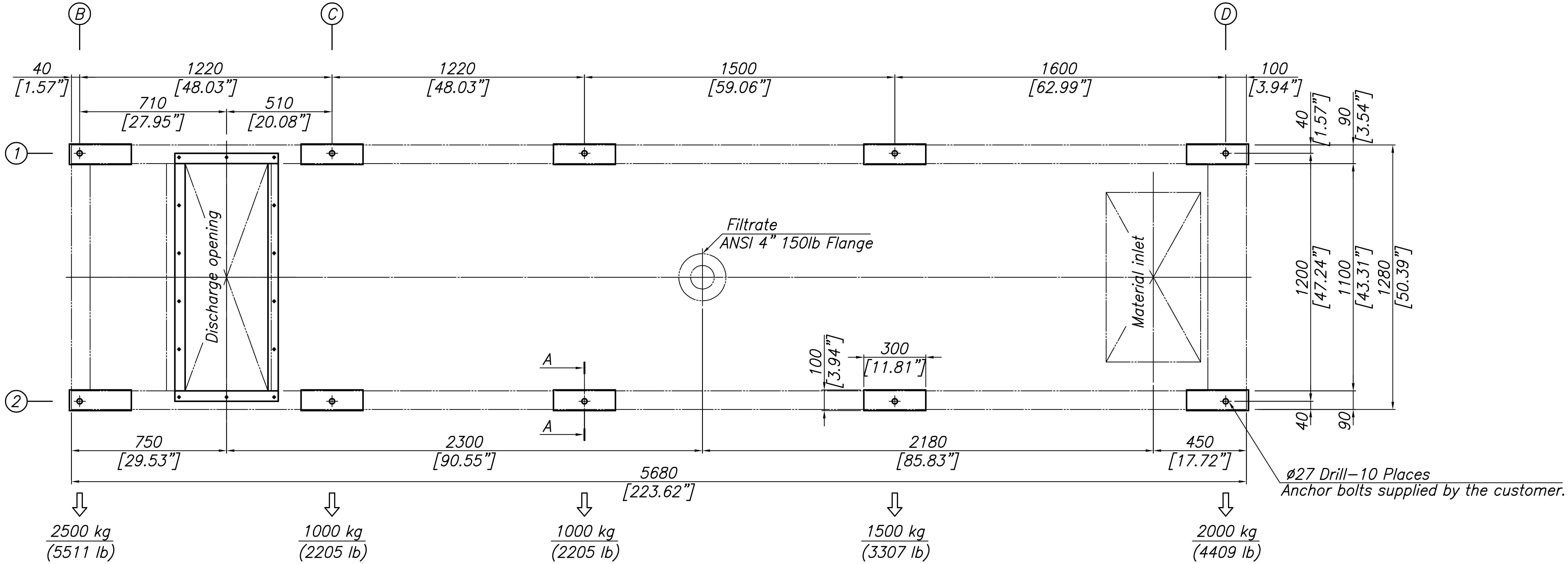
Screw rev.
180 ~ 1800 X 1/3481 = 0.0517 ~ 0.517 rpm

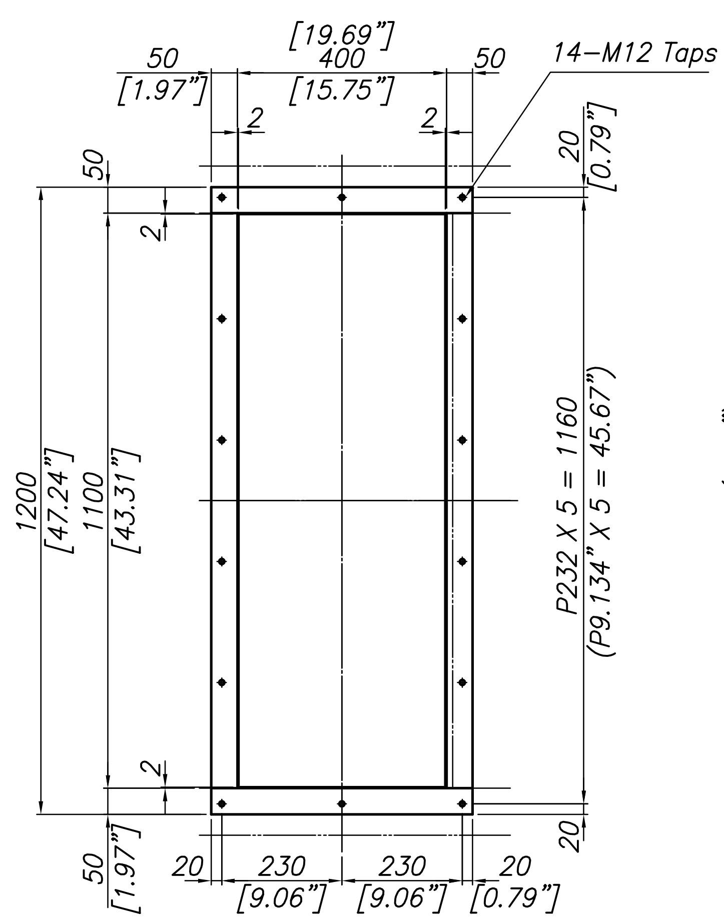
Total weight = 6,000 kg (13,228 lbs)
Operating weight = 8,000 kg (17,637 lbs)

| Rev. | Date | Description | Drawn by | Rev. by | Appd. by |
|---|---|---|---|---|---|
| 1 | 8/18 '21 | Feed Pipe | RTB | | |
| 0 | 8/18 '21 | Approval | S.ENDO | Y.ITO | H.ABE |

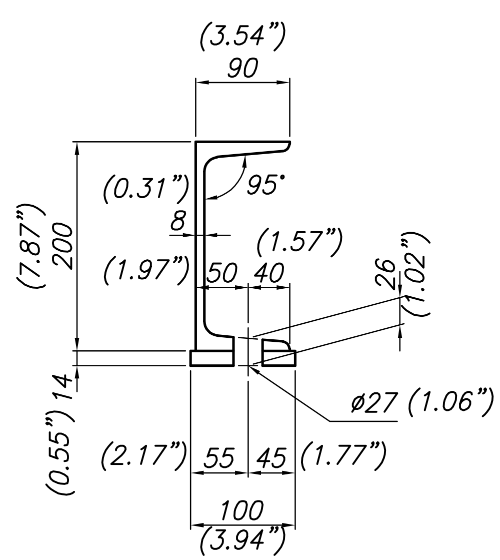
| | | |
|---|---|---|
| Purchaser | | Quantity: 1 |
| End user | | Scale: 1/20 |
| Job name | BHX-800X4500L Screw press | |
| Dwg. name | Assembly | |
| Job No. | M-3384 | |
| Dwg. No. | S3384-01 | Ref. job No. |

FUKOKU KOGYO CO., LTD.




Flange of Discharge opening




A–A View

Dynamic load

| | B | C | D |
|---|---|---|---|
| 1 | 190 kg (419 lb) ↓ | 265 kg (584 lb) ↓ | −455 kg (−1003 lb) ↑ |
| 2 | −190 kg (−419 lb) ↑ | −265 kg (−584 lb) ↑ | 455 kg (1003 lb) ↓ |

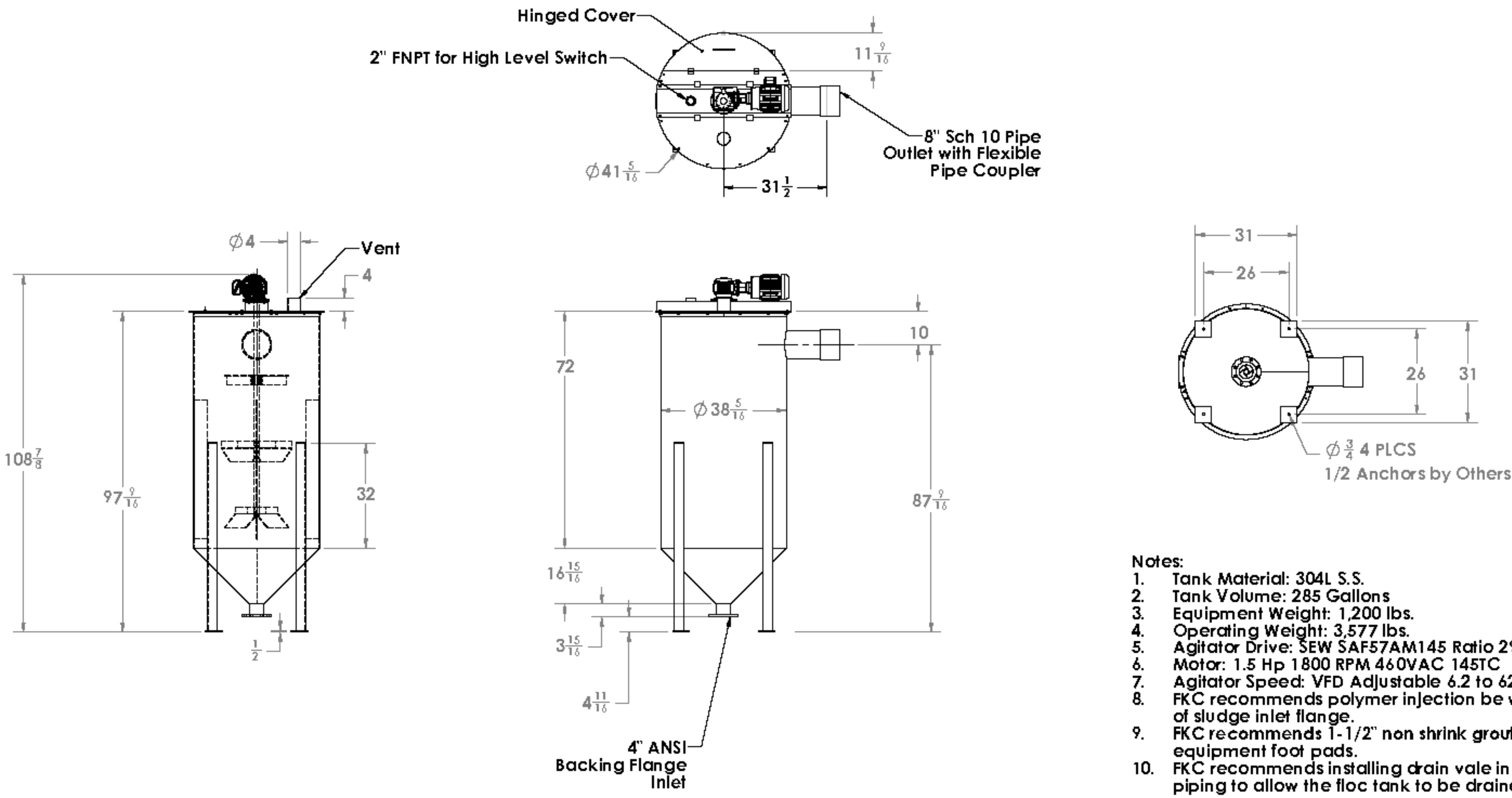
Note: Loads shown above are worst case dynamic loads during plugged condition.

Total weight = 6,000 kg (13,228 lbs)
Operating weight = 8,000 kg (17,637 lbs)

| Rev. | Date | Description | Drawn by | Rev. by | Appd. by |
|---|---|---|---|---|---|
| 0 | 8/18 '21 | Approval | S.ENDO | Y.ITO | H.ABE |

| | | | |
|---|---|---|---|
| Purchaser | | Quantity | 1 |
| End user | | Scale | 1/15 |
| Job name | BHX–800X4500L | | |
| Dwg. name | Foundation | | |
| Job No. | M–3384 | | |
| Dwg. No. | S3384–02 | Ref. job No. | |

FKC FUKOKU KOGYO CO., LTD.



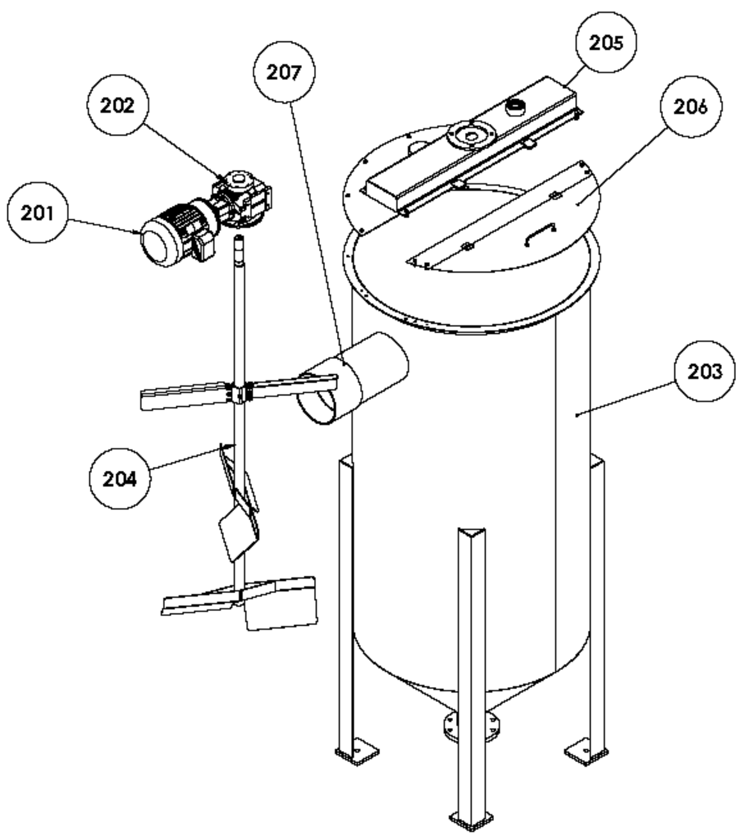

Notes:
1. Tank Material: 304L S.S.
2. Tank Volume: 285 Gallons
3. Equipment Weight: 1,200 lbs.
4. Operating Weight: 3,577 lbs.
5. Agitator Drive: SEW SAF57AM145 Ratio 29.0:1
6. Motor: 1.5 Hp 1800 RPM 460VAC 145TC
7. Agitator Speed: VFD Adjustable 6.2 to 62 RPM
8. FKC recommends polymer injection be within 10' of sludge inlet flange.
9. FKC recommends 1-1/2" non shrink grout under all equipment foot pads.
10. FKC recommends installing drain vale in feed piping to allow the floc tank to be drained.

| | |
|---|---|
| Job No. | FT-448 |
| Drawing No. | A448-200 |
| Title | 285 GAL Floc Tank Assembly Details |
| Wt. Lbs. | |
| Quantity | 1 |
| Date | 3/1/13 |
| Drawn By | RTB |
| Revision | |
| | SHEET 1 OF 2 |


FKC CO. LTD
2708 W 18th St.
Port Angeles, WA 98363
(360) 452-9472 Fax (360) 452-6880


| No. | Alteration | Date | Sign |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |
| 0 | Issued for Approval | 8/18/21 | RTB |

| Item # | Flocculation Tank | Manufacturer | Part Number | QTY | Material of Construction |
|---|---|---|---|---|---|
| 201 | Motor 1.5 HP 1800 RPM | Toshiba | Y154SDSR42A-P | 1 | CS |
| 202 | Gear Box 29.0:1 Ratio | SEW | SAF57AM145 | 1 | CS |
| 203 | Tank Body | FKC | NA | 1 | 304 L SS |
| 204 | Agitator Shaft | FKC | NA | 1 | 304 L SS |
| 205 | Mixer Base | FKC | NA | 1 | 304 L SS |
| 206 | Lid | FKC | NA | 1 | 304 L SS |
| 207 | Flexible Pipe Coupler | Fernco | 1056-88 | 1 | Rubber |






| No. | Alteration | Date | Sign |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |
| 0 | Issued for Approval | 8/18/21 | RTB |

Job No. FT-448

Drawing No. G448-201

Title: 285 GAL Floc Tank Parts List

Wt. Lbs.

Quantity: 1

Date: 3/1/13

Drawn By: RTB

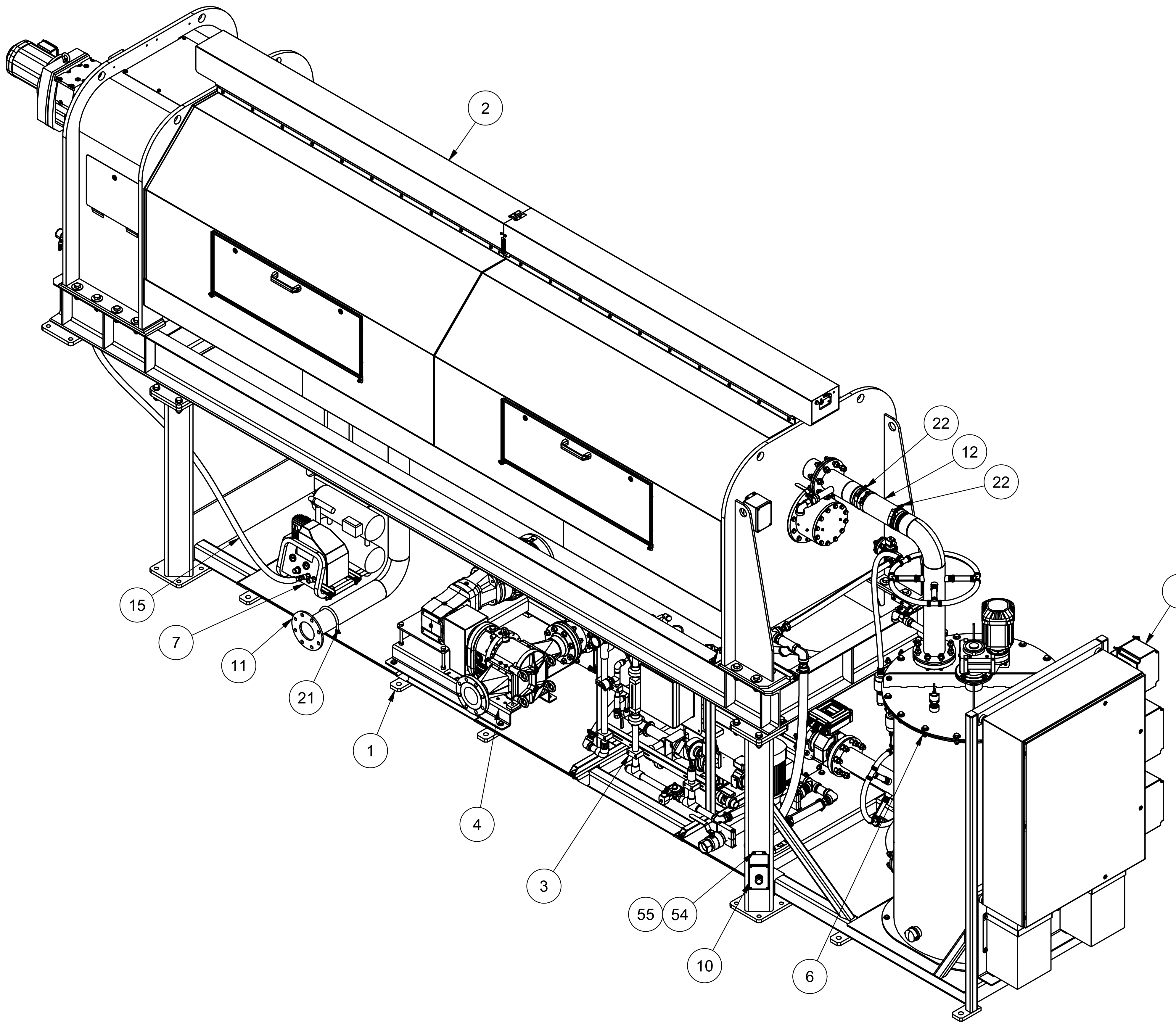
FKC

FKC CO. LTD
2708 W 18th St.
Port Angeles, WA 98363
(360) 452-9472 Fax (360) 452-6880

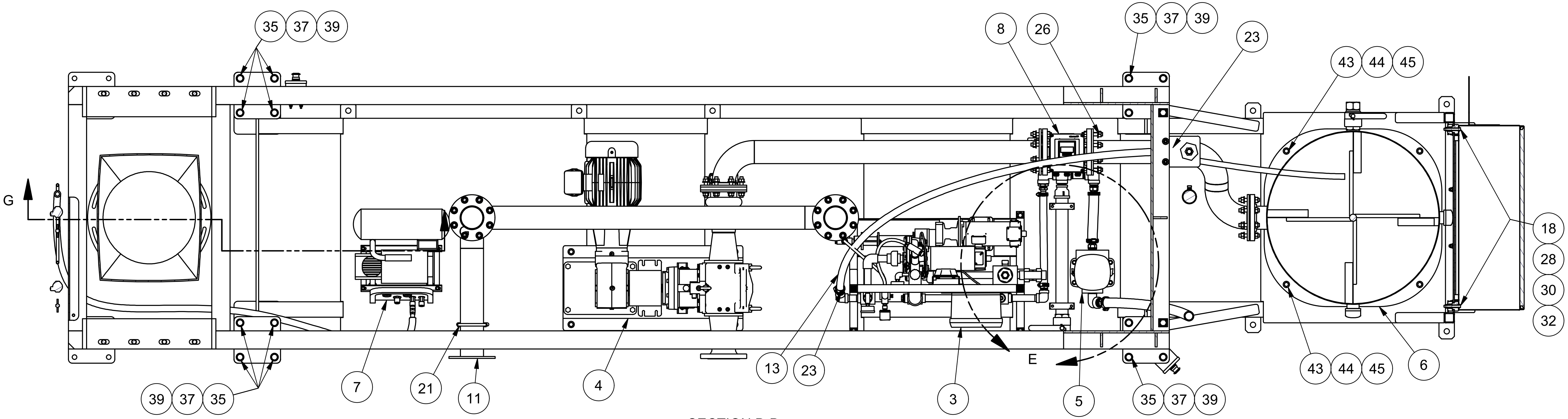
Revision

SHEET 2 OF 2

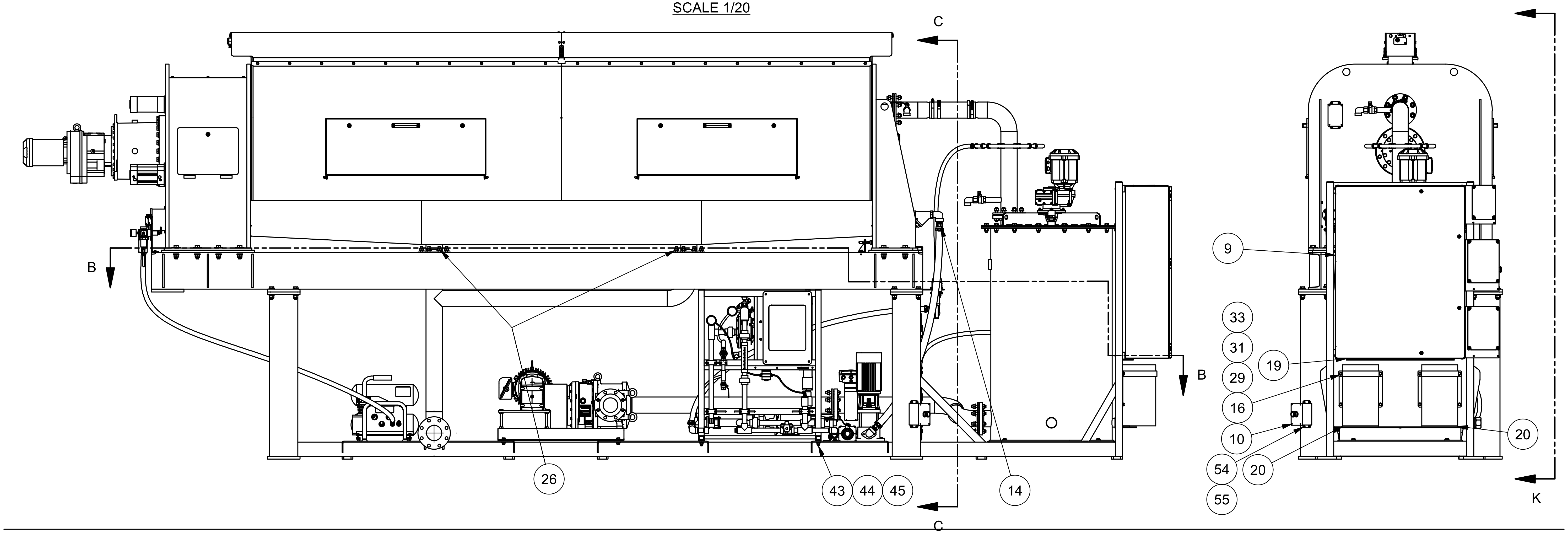
# ASM-SCREWPRESS MODULE
## FSP703 #2-1159

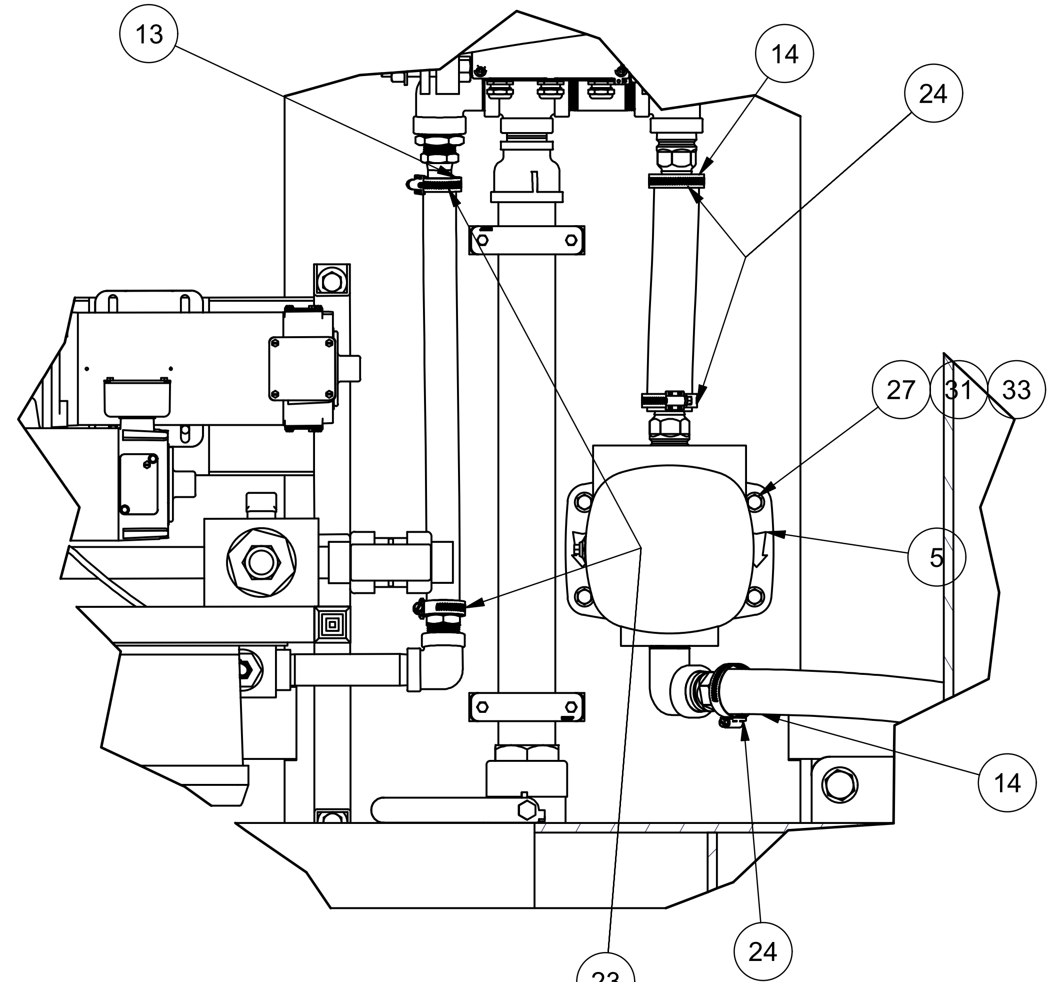



| EQUIPMENT LIST | | | |
|---|---|---|---|
| ITEM | PART NO. | DESCRIPTION | QTY |
| 1 | 39325001 | WMT-FRAME, SCREW PRESS MODULE, FSP703-1159 | 1 |
| 2 | 39605578 | ASM-SCREW PRESS FSP703 | 1 |
| 3 | 39605544 | ASM-POLYMER SYSTEM AND PIPING, SBI SOLUTIONS | 1 |
| 4 | 39605540 | ASM-SLUDGE FEED PUMP, SBI SOLUTIONS | 1 |
| 5 | 39605539 | ASM-WASHWAER BOOST PUMP & PIPING BDS #2 | 1 |
| 6 | 39605542 | ASM-REACTION TANK AND PIPING | 1 |
| 7 | 39605543 | ASM-AIR COMPRESS AND ACCESSORIES | 1 |
| 8 | 39117235 | INST-MAGNETIC FLOW METER 4"150# 24V L400 | 1 |
| 9 | 39680715 | ENCL-SCREW PRESS-CP1, PLANT CITY | 1 |
| 10 | 39680349 | ENCL-DW-ESTOP,SBI SOLUTIONS | 1 |
| 11 | 39315882 | WMT-PIPING,4",FSP703 DISCHARGE | 1 |
| 12 | 39112086 | HOSE - 4" ID MARINE EXHAUST WIRE REINFORCE | 2 FT |
| 13 | 39118209 | HOSE-AIR/WATER 1" RUBBER 200 PSI | 10 FT |
| 14 | 39118210 | HOSE-AIR/WATER 1-1/4" RUBBER 200 PSI | 10 FT |
| 15 | 30305010 | HOSE - PNEU, 1/2" PFT-88 PLASTIC AIR LN | 10 FT |
| 16 | 39315912 | BRACKET-TRANSFORMER SUPPORT, 316SST | 2 |
| 17 | 39317261 | GASKET-1/4" FSP702 DISCHARGE | 1 |
| 18 | 39110234 | MOUNT - VIBRATION DAMPENING RUBBER 55A | 4 |
| 19 | 39315913 | SHEET-CONTROL PANEL SHIPPING DAMPNER | 1 |
| 20 | 39315914 | SHEET-TRANSFORMER SHIPPING DAMPNER | 2 |
| 21 | 39116015 | U-BOLT - 4" PIPE ANVIL FIG137 W/NUTS | 1 |
| 22 | 39116550 | CLAMP-HOSE, T-BOLT 4.28-4.6" 300SST | 4 |
| 23 | 39118171 | CLAMP-HOSE, WORM DRIVE 0.81-1.75" 300SST | 4 |
| 24 | 39118223 | CLAMP-HOSE, WORM DRIVE 1.31-2.25" 300SST | 4 |
| 26 | 30368849 | KIT-HARDWARE & GASKET 4" 150# ANSI | 3 |
| 27 | 39112126 | SCREW - HHCS, 3/8"-16x2.0" 304SST | 4 |
| 28 | 39118140 | SCREW-HHCS, 3/8"-16x3.0 316SST | 4 |
| 29 | 30323972 | SCREW-HHCS, 3/8"-16x1.25" 304SST | 8 |
| 30 | 39116534 | WASHER-FLAT 3/8" 316SST | 8 |
| 31 | 30323755 | WASHER-FLAT, 3/8" 304SST | 24 |
| 32 | 39112129 | NUT-NYLOCK 3/8"-16 316SST | 4 |
| 33 | 30337722 | NUT-NYLOCK, 3/8"-16 304SST | 12 |
| 35 | 39111118 | SCREW - HHCS, 3/4"-10x3.0 316SST | 14 |
| 36 | 39118247 | SCREW - HHCS, 3/4"-10x3.75" 316SST | 2 |
| 37 | 30370693 | WASHER-FLAT, 3/4" 316SST | 32 |
| 38 | 39118246 | WASHER-TAPER, DIN434 M20 & 3/4" 316SST | 2 |
| 39 | 30380510 | NUT - NYLOCK, 3/4"-10 316SST | 16 |
| 40 | 39116091 | SCREW-HHCS, DIN933 M8x30 304SST | 10 |
| 41 | 39118161 | FITTING-PNEU, STR 1/2"NPTx1/2" PUSH-LOCK | 1 |
| 42 | 39118139 | WASHER-CONICAL, SKM M8 & 5/16" 316SST | 10 |
| 43 | 39116645 | SCREW-HHCS 1/2"-13x1.5" 316SST | 16 |
| 44 | 39117176 | WASHER-FLAT, 1/2" 316SST | 32 |
| 45 | 39112001 | NUT-NYLOCK 1/2"-13 316SST | 16 |
| 54 | 39116574 | SCREW-HHCS, 1/4" - 20 x 1.25" 316SST | 4 |
| 55 | 39112128 | WASHER-FLAT 1/4" 316SST | 4 |

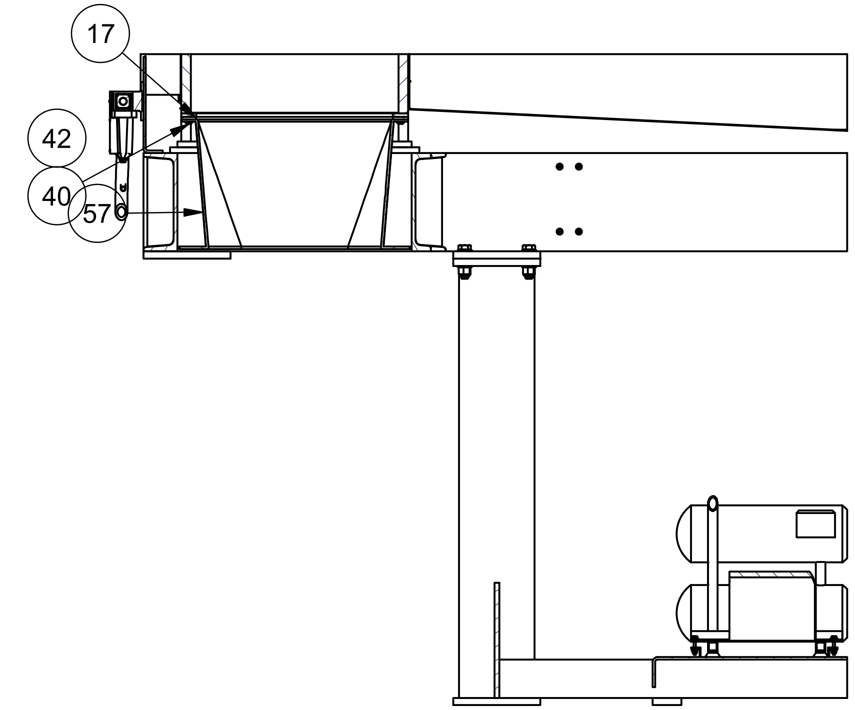



SECTION B-B
SCALE 1/20

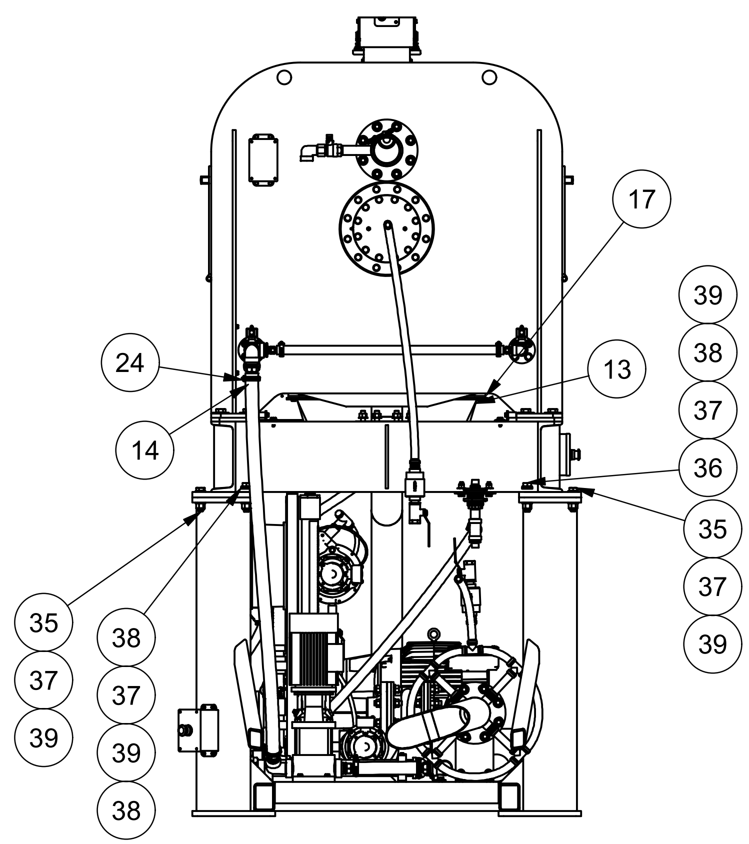




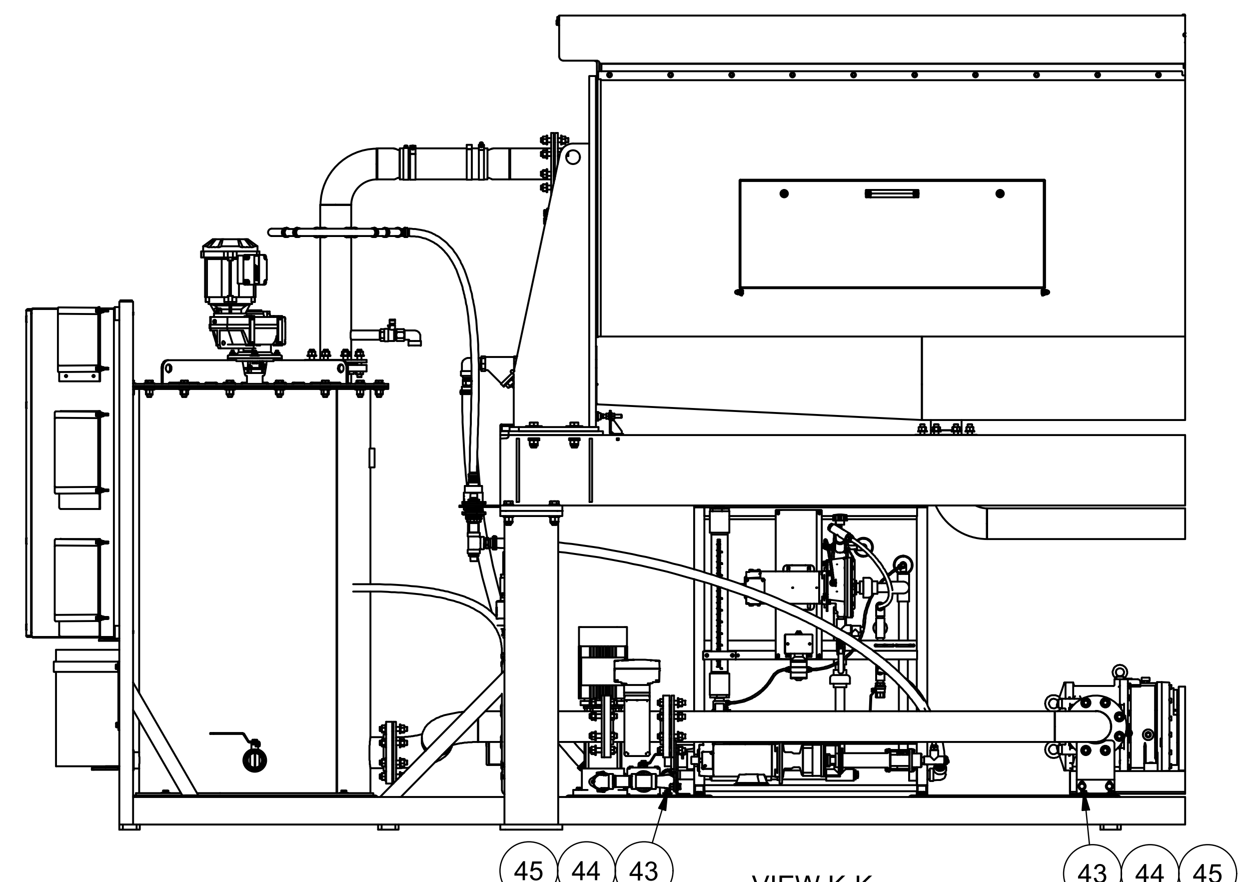

DETAIL E
SCALE 1 / 8




SECTION G-G
SCALE 1/20




SECTION C-C
SCALE 1/28




VIEW K-K
SCALE 1/28

Palmer AK
Quotation No.: 2021385
December 9, 2021

# Proposal

Prepared for:

*Dan Campbell*

*CRW*

Project:

*Septage Dewatering Screw Press*

*Palmer AK*

*Engineered to Excel*

350 SMC DRIVE
SOMERSET, WI 54025
PH: (715) 247-3433
FAX: (715) 247-3438
www.schwingbioset.com

A message from our President/CEO:

Thank you for your inquiry. We are honored you have chosen to discuss how a Schwing Bioset solution can solve your specific challenges. We feel you will soon discover our contributions will provide recognizable value, and our solution will provide the long-term peace of mind only felt when quality products have been selected. Along each step of the way, we are sure your confidence will build that you have made the right choice in selecting Schwing Bioset to assist with the development, design, and execution of your project.

Schwing Bioset has been solving the challenges faced by Wastewater Treatment Plants and Biosolids Management professionals for over thirty years from our simple beginnings as a piston pump supplier. Now in our fourth decade, we offer a wide range of products with best-in-class performance and reliability that we feel is unmatched by anyone in our industry.

Additionally, Schwing Bioset offers best-in-class aftermarket service and spare parts to support our ever expanding customer base. After all, without the support of quality trained service technicians and rapid spare parts delivery, the best technology in the world can't do its job if you can't turn it on.

But we aren't stopping here. Schwing Bioset continues to invest in Research & Development to continually improve our current products and to develop and identify new technology that will help sustain our Cities for the next generations to come. Reducing power demands, recovering nutrients, increased efficiency, and creating value-added products from biosolids are just a few of the many ways we are evolving from our beginnings in this business as a pump supplier.

And speaking of our business, it is guided by the Core Values shared on the following page. These values act as a beacon to guide us into the future as we grow, keeping us in line with our original goals. Also included is your list of primary contacts into our company. As you communicate your challenges and work towards a solution with us, know that each of these individuals, along with everyone else in our Company, was hired with these Core Values as a benchmark. This team of experts, collectively known as Schwing Bioset, will be working diligently to make your project a success.

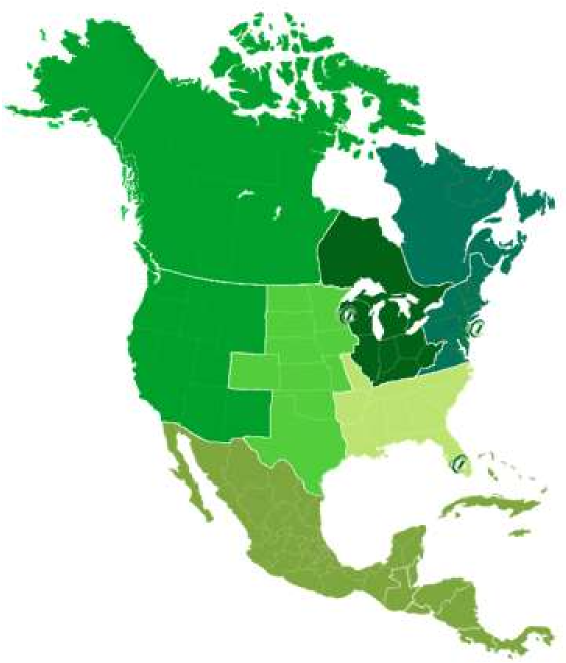
Continually looking to the future, we believe the solution offered in this proposal will prove to be your most cost effective and sustainable option to implement within your project. We look forward to your favorable review and to welcoming you to the hundreds of other Wastewater Plants whom already enjoy the benefits of a Schwing Bioset solution. We are *Engineered to Excel.*

Sincerely,
Thomas Anderson
President/CEO

# Core Values:

- Caring: Every employee has pride of ownership in their work with a genuine interest in our Client's success. We offer a workplace that allows a healthy balance between work and home life to inspire exceptional performance.
- Decent People: We are true professionals who respect the people we work with, both inside and outside of the company, and earn the respect of others.
- Dedicated Experts: We are comprised of the top talent in our respective fields, recruited and trained for the singular goal of contributing to the success of our Clients and our Company.
- Solutions Above and Beyond: We develop, provide, and support customer solutions that surpass our Client's expectations.
- Absolute Customer Satisfaction: We sleep well knowing our customers are happy.

# Your Schwing Bioset, Inc. Contacts:



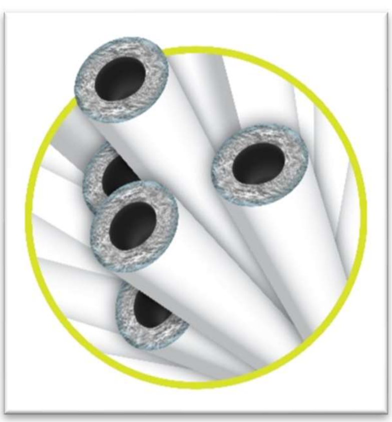
| | |
|---|---|
| Great Lakes<br>Eric Wanstrom<br>203-731-0977<br>ewanstrom@schwingbioset.com | Northeast<br>Abis Zaidi<br>715-243-9723<br>azaidi@schwingbioset.com |
| Central<br>Kevin Bauer<br>715-243-4597<br>kbauer@schwingbioset.com | West<br>Joshua DiValentino<br>612-867-4429<br>jdivalentino@schwingbioset.com |
| Southeast<br>Tom Welch<br>239-216-1776<br>twelch@schwingbioset.com | Mexico & Latin America<br>Jose Luis Diaz<br>011-55-1-662-937-3189<br>ldiaz@schwingbioset.com |
| Service<br>Jim Dickerman<br>715-500-1912<br>jdickerman@schwingbioset.com | Spare Parts<br>Brad Dopp<br>715-350-6912<br>bdopp@schwingbioset.com |

***** Introducing Schwing Bioset's Newest Product Offering *****

# Membrane Bioreactor (MBR) Technology

Schwing Bioset is proud to announce our newest product, an end-free hollow fiber PVDF MBR offered under license from Econity. Econity has over 2,000 installations worldwide and offers a unique cartridge design that assembles into larger cassettes. Because of this flexibility the dimensions can be easily adjusted to enable easy retrofits into existing installations of other technologies. The end-free hollow fiber design boasts:

- Higher operation flux
- Higher fiber packing density
- Compact footprint
- Drawer style design for easy installation and removal
- Efficient air scouring with bubble confinement
- End-free design eliminates likelihood of fiber breakage
- Shorter fiber length reduces internal losses and increases flux
- NSF/ANSI 61, California Title 22, and LT2 certifications



# Capabilities:

(Click the images below to link to web page)












350 SMC DRIVE
SOMERSET, WI 54025
PH: (715) 247-3433
FAX: (715) 247-3438
www.schwingbioset.com

December 10, 2021

CRW
3940 Arctic Blvd, Suite 300
Anchorage AK 99503

Attention: Dan Campbell, P.E.

Reference: Septage Dewatering Screw Press for Palmer AK

Subject: Schwing Bioset, Inc. Quotation No. 2021385

Schwing Bioset, Inc. is pleased to propose the following budgetary scope of supply as requested:

## DEWATERING SCREW PRESS

Design Condition: 138,000 gallons per day septage at 0.7 % solids
Dewatered over 12 hours / day; Solids loading approximately 672 dry #/hour

Qualities of septage is variable, observed performance on similar streams:
Dewatered solids: 15 – 25%
Polymer Dose: 20 – 32 # active per dry ton

| | |
|---|---|
| Model: | FSP 703 |
| **Quantity:** | **One (1)** |
| Press Length: | 21 feet 3 inches |
| Press Width: | 57 inches |
| Press Height: | 73 inches |
| Press Shipping Weight: | 11,700 lbs |
| Press Operating Weight: | 15,500 lbs |
| Screw Press Motor: | 5 HP TEFC |
| Reaction Tank Volume: | 225 gallons |
| Tank Operating Weight: | 2,500 lbs |
| Reaction Tank Motor: | 1.5 HP TEFC |

**Scope includes:**

1. The SBI Screw Press system is designed for continuous dewatering of flocculated slurry. The system consists of a skid mounted Screw Press dewatering unit, reaction tank, magnetic flow meter, polymer blending unit, and controls.
2. The Screw Press dewatering unit compresses and dewaters flocculated slurry using a screw rotating at very slow speed in a perforated screen. The filtrate will discharge from a drip tray below the perforated screen into a discharge pipe. Access doors allow a direct view of the dewatering process. The simple operating principle is achieved with only a few functional component groups. Slow movement and the high quality design of the structural components guarantee a high service life.

3. For general housekeeping purposes the back washing cycle cleans the screens automatically (cycle lasts approx. 2-3 minutes). Dewatering operations are not interrupted during washing cycle. Washwater solenoid valve mounted at screw press. Water pressure to be 60 psi minimum.
4. Washwater booster pump provided on skid to guarantee 60 psi wash pressure.
5. Air compressor provided for discharge pressure cone actuator and movement of wash ring.
6. Effective flocculation is achieved in the mixing reaction tank. It is a closed design with rotating paddles and fixed flow breakers for effective mixing and gentle transport of the flocks.
    - Diluted/activated polymer from the polymer feed system is injected into an injection ring upstream of reaction tank.
    - A second injection ring is provided after the reaction tank to permit optimization of the polymer feed.
7. Liquid polymer dosing system provided for blending emulsion polymer per the dosage and solids loading described above.
    - Polymer system delivered as a pre-assembled skid complete with progressive cavity polymer pump, polymer/water blending unit, mixer, NEMA 4X junction box, and all internal wiring and plumbing.
    - Polymer unit to derive its power from the Screw Press control panel.
8. Magnetic sludge flowmeter and reaction tank pressure sensor included for control of sludge feed to Screw Press. Magnetic sludge flowmeter to be installed between feed pump and reaction tank.
9. The Screw Press dewatering unit and reaction tank mixer each include a TEFC motor, speed reducer, and a dedicated VFD drive in separate NEMA 4X enclosure (480V/3Ø/60Hz).
10. Screw Press is shipped with motor and gear reducer fully assembled to screw press.
11. Reaction tank is shipped fully assembled including motor and speed reducer.
12. All wetted parts of Screw Press and Reaction Tank are **316 stainless steel**. Carbon Steel drive and non-wetted end plate/support are painted with standard enamel finish rated for application.
13. Rotary lobe type sludge pump mounted on skid, designed for up to 250 gpm flow rate;
14. Twin shaft grinder provided on skid with 5 HP motor.
15. Equipment is factory wired and plumbed on a modular carbon steel skid.

## SCREW PRESS CONTROL PANEL

| | |
|---|---|
| Quantity: | One (1) |
| Power Supply | 480V/3Ø/60Hz |
| Enclosure Type: | NEMA 4X, 304SS, wall-mount |

**Scope includes:**

1. Local Control Panel shall be mounted, and factory wired on the skid.
2. Control Panel is UL listed.
3. Programmable Logic Controller (PLC) shall be Allen Bradley CompactLogix.
4. Human Machine Interface (HMI) shall be Allen Bradley Panelview color touch screen.
5. Local Control Panel shall be used to control and/or monitor the following equipment:
    a. One (1) Screw Press
    b. One (1) Reaction Tank
    c. One (1) Feed Pump
    d. One (1) Inductive Flow Measuring System
    e. One (1) Liquid Polymer Dosing System
    f. One (1) Booster Pump
    g. One (1) Feed Pump
    h. One (1) Grinder
6. Includes VFDs for Screw Press, Reaction Tank Mixer, Neat Polymer pump, Sludge Feed pump.

Starter provided for Polymer mixer, grinder, and booster pump.

7. Schwing Bioset standard analog input and output devices shall be provided.

**SPARE PARTS**

Available upon request.

**FIELD SERVICE**

Schwing Bioset shall provide a trained service technician to supervise system installation, assist start-up, and / or to train the owner's personnel in the operation and maintenance of the Schwing Bioset supplied equipment.

The service technician shall be made available for eight (8) days over two (2) trips.

If required, additional service may be purchased at the prevailing rates at the time service is performed. Current service rates are as follows:

- US $145.00 per hour – standard eight (8) hour day.
- US $218.00 per hour – overtime (over and above the standard eight (8) hour day.)
- US $290.00 per hour – double time (Sundays and holidays).
- Travel and per diem (i.e., hotel, food, car) expenses at cost + 15%.

**SYSTEM SUMMARY**

| | |
|---|---|
| Dewatering Screw Press: | One (1) FSP 703 |
| Sludge Feed Pump: | One (1) |
| Liquid Polymer Blending System: | One (1) |
| Magnetic Flow Meter: | One (1) |
| Local Control Panel: | One (1) |
| Grinder: | One (1) |
| Washwater Booster Pump: | One (1) |
| Skid Mounting: | As described |
| Local Control Panel: | One (1) |
| Field Service: | (8) days, (2) trips |

Total budget price for the above listed scope of supply ........................................................... **$ 500,200**

All prices are quoted:

DDP Seattle Port
Price is valid for 60 days
Price is in US dollars

**OPTIONAL SCOPE OF SUPPLY – MIX TANK**

SBI proposes to use modular 18,000 gallon mix tanks as buffer storage to receive septage. Multiple units may be provided with inlet and discharge manifolds to manage inventory of incoming septage; CRW to consider incoming traffic and peaking to determine quantity of storage tanks needed.

Unit price for mix tank provided below; mix tanks include:

1. Enclosed steel storage tank with nominal dimensions of 46' long, 13' high, 8.5' wide.
2. Each tank includes (4) 10 HP mixers with stainless steel agitators.
3. Rear axle and towing hitch for easy transport.
4. Enclosed construction with manways and vent ports.
5. NEMA 4X starter panel provided separately with full voltage non reversing starters for mixer motors.

Total budget unit price for 18,000 mix tank ........................................................................ **$ 383,600**

All prices are quoted:
DDP Seattle Port
Price is valid for 60 days
Price is in US dollars

**TERMS:**

20% due at time of order
20% due at time of submittal approval
55% due at time goods are shipped
5% due upon acceptance of goods, not to exceed 90 days from shipment

Payment terms offered are subject to final credit approval.

**SUBMITTALS:**

Eight (8) to ten (10) weeks after receipt of approved order. Two (2) copies shall be provided.

**DELIVERY:**

Equipment shall be delivered twenty-four (24) to thirty-two (32) weeks after submittals are approved.

**OPERATION & MAINTENANCE MANUALS:**

Two (2) final hard copies and electronic copy shall be furnished with the equipment. O&M Manuals will be delivered four (4) weeks after equipment delivery.

**EQUIPMENT AND SERVICES TO BE PROVIDED BY OTHERS**

1. Installation, offloading, field assembly, and erection of the Schwing Bioset, Inc. (SBI) supplied equipment.
2. Storage of equipment and/or costs for long term storage (longer than 3 months).
3. Racks, trays or supports for hydraulic lines, sludge lines, or control wiring.
4. Miscellaneous metal.

5. Field painting of any of the SBI supplied equipment. All touch up painting required due to normal wear and tear during shipping shall the responsibility of others.
6. Field-routed grease tubing
7. Supports for grease tubing, conduit or control wiring.
8. Field wiring of any kind.
9. Labor and material (e.g., polymer flocculant) for preliminary, final field, system performance and system integrity tests.
10. **Anchor bolts**, nuts, and washers for the SBI supplied equipment unless otherwise stated. Anchor design and embedment by others.
11. Cost for Engineer, Owner, or Contractor to witness any shop test.
12. Additional costs to supply alternate products other than specifically mentioned in this scope.
13. Networking, hardware, communication modules, or power supplies not specifically mentioned in this scope.
14. PLC programming software or software licenses not specifically mentioned in this scope.
15. It is the contractor's responsibility to field verify building dimensions, equipment access and that equipment layout /dimensions are suitable to accommodate the Schwing Bioset supplied equipment.
16. Field service technicians or special tools not specifically mentioned in this scope.
17. Water and drain piping of any kind.
18. Motor starters or variable frequency drives not specifically mentioned in this scope.
19. Spare parts not specifically mentioned in this scope.
20. **<u>Screw press supports, discharge cake conveyors, cake discharge chutes, and local disconnects</u>** not specifically mentioned in this scope.

If you have any questions, please don't hesitate to contact me by phone 612-867-4429, fax 715-247-3438, or email jdivalentino@Schwingbioset.com.

Yours very truly,
**Schwing Bioset, Inc.**

Joshua DiValentino, MS, MBA
Senior Sales Manager - Western Regions

**Schwing Bioset, Inc. New Equipment Sales Terms and Conditions**

**1. Acceptance and Prices.** These terms and conditions are an integral part of Schwing Bioset,Inc ("Schwing Bioset")'s firm offer and form the basis of any agreement resulting from Schwing Bioset's proposal. The proposal is subject to acceptance within thirty days from its date, and the prices are subject to change without notice prior to acceptance by the party to whom this offer is made, or its authorized agent ("Buyer"). Following acceptance without addition of any other terms and conditions of sale or any other modification by Buyer, the prices stated are firm provided that notification of release for immediate production and shipment is received at Schwing Bioset's factory not later than five months from Schwing Bioset's submittals. If through no fault of Schwing Bioset, the order is not released for manufacture within 5 months from Schwing Bioset's submittals, Schwing Bioset reserves the right to increase the price of the order. Any delay in shipment caused by Buyer's actions will subject prices to increase equal to the percentage increase in list prices during that period of delay. In no event will prices be decreased.

Acceptance will have occurred if Buyer: signs Schwing Bioset's proposal; issues written order pursuant to submission of proposal; or permits or accepts performance; or other commercially reasonable manner. If Buyer's order is an acceptance of Schwing Bioset's proposal, Schwing Bioset's return of such order with these terms and conditions attached serves as an acknowledgement and confirmation of receipt of order. If order is expressly conditioned upon Schwing Bioset's acceptance or assent to terms other than those expressed herein, return of order by Schwing Bioset with these terms and conditions attached serves as notice of objection to such terms and a counter-offer to provide equipment in accordance with scope and terms of the original proposal. If Buyer does not reject or object within ten days, counter-offer will be deemed accepted. If Buyer permits or accepts performance, such terms will be deemed accepted. In order for Schwing Bioset's acknowledgement of order to be valid it must be made at the corporate level.

**2. Performance.** Schwing Bioset shall be obligated to furnish only the goods described in Schwing Bioset's proposal, and submittal data (if such data is issued in connection with this order), and Schwing Bioset may rely on the acceptance of proposal and submittal data as acceptance of the suitability of the equipment for the particular project. Schwing Bioset's duty to perform under any order and the price thereof is dependent upon Schwing Bioset's corporate approval of the order and Schwing Bioset shall not be responsible for delays in contract formation caused by inclusion of new or different terms by Buyer, or delays in credit approval due to delayed or incomplete credit information by Buyer. Schwing Bioset's duty to perform is contingent upon the non-occurrence of an Event of Force Majeure. If the order is not approved at the corporate level, Schwing Bioset may elect to delay performance or to renegotiate with Buyer. If Schwing Bioset and Buyer are unable to agree on revised prices or terms, the order may be canceled without any liability. If Schwing Bioset shall be unable to carry out any material obligation under this Agreement due to an Event of Force Majeure, this Agreement shall at Schwing Bioset's election (i) remain in effect but Schwing Bioset's obligations shall be suspended until the uncontrollable event terminates or (ii) be terminated upon ten (10) days' notice to Buyer, in which event Buyer shall pay Schwing Bioset for all parts of the Work furnished to the date of termination. An "Event of Force Majeure" shall mean any cause or event beyond the control of Schwing Bioset. Without limiting the foregoing, "Event of Force Majeure" includes: acts of God; acts of terrorism, war or the public enemy; flood; earthquake; tornado; storm; fire; civil disobedience; pandemic insurrections; riots; labor disputes; labor or material shortages; sabotage; restraint by court order or public authority (whether valid or invalid); and action or non-action by or inability to obtain or keep in force the necessary governmental authorizations, permits, licenses, certificates or approvals if not caused by Schwing Bioset; and the requirements of the United States Government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the Government.

**3. Taxes.** No taxes are included in this quote/order. The amount of any applicable present or future state/local sales/use tax or other government charge upon the production, sale, shipment, and/or use of the goods covered by this quotation shall be paid directly to the taxing authorities by purchaser, and paid tax receipts will be furnished to Schwing Bioset upon request, unless purchaser provides us with an exemption certificate acceptable to the taxing authorities.

**4. Warranty and Liability.** Schwing Bioset warrants its new parts and service work against defects in material and workmanship under normal use and service, and which shall not have been subject to misuse, negligence, or accident, for a period of one (1) year that shall commence upon startup or ninety (90) days from delivery, whichever occurs first. Schwing Bioset will replace or repair free of charge, F.O.B. SBI factory, such part or parts thereof as in its sole judgment shall be deemed defective. Due to the specialized nature of Schwing Bioset material handling equipment, Schwing Bioset field service technicians shall not be restricted in adjusting or repairing Schwing Bioset furnished equipment, regardless of collective bargaining agreements entered into by other parties. This warranty shall not apply to any equipment manufactured by us which shall have been loaded or operated beyond its rated capacity as specified by Schwing Bioset. Damage resulting from improper installations or alterations outside our plant will be considered as misuse and not as a defect. Certain parts of the equipment provided by Schwing Bioset such as the pumping cylinders, valves, pumping rams, screw flights, sliding frame components, trough liners for screws etc. that are in contact with material, are subject to normal wear. This normal wear is not covered under this warranty. Schwing Bioset shall not be liable for consequential damages or injuries of any kind, or for expenses, losses, or delays incidental to any failure. Schwing Bioset reserves the right to make changes and improvements in its product without incurring any obligation to install any such changes or improvements in its products previously manufactured. All warranty is void if equipment is not serviced by a Schwing Bioset certified technician and if replacement parts utilized are anything other than Schwing Bioset supplied and authorized parts, from delivery through termination of warranty period. In the event of a defect or issue with Schwing Bioset supplied equipment, buyer shall notify Schwing Bioset in writing of said defect and offer Schwing Bioset reasonable opportunity to cure. This warranty is in lieu of any other warranty expressed or implied or any other obligation or liability on the part of Schwing Bioset, and no other person is authorized to make any representations or warranties beyond those herein expressed. Without limiting the generalities of the foregoing, **THERE IS NO IMPLIED WARRANTY OF MARKETABILITY AND NO IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

**5. Indemnity**. Schwing Bioset agrees to indemnify and hold Buyer harmless from the amount of any final judgment entered against Buyer for injury or death to any person (including employees of Buyer and Schwing Bioset) or damage to tangible property of Buyer and based solely upon: (a) Schwing Bioset's defective manufacture of equipment sold to Buyer; (b) Schwing Bioset's violation of any applicable laws, rules or regulations in connection with the manufacture of said equipment, or (c) Schwing Bioset's gross negligence or intentional misconduct. The duty to indemnify will continue in full force and effect, notwithstanding the expiration or early termination hereof, with respect to any claims based on facts or conditions that occurred prior to expiration or termination.

**6. Insurance.** Schwing Bioset agrees to maintain the following insurance during the term of the contract with limits not less than shown below and will, upon request from Buyer, provide a Certificate of Insurance evidencing this coverage:

| | |
|---|---|
| Commercial General Liability | $2,000,000 per occurrence |
| Automobile Liability | $2,000,000 CSL |
| Workers Compensation | Statutory Limits |

In the event Schwing Bioset agrees to name Buyer or others as an additional insured, Schwing Bioset will do so but only under its primary Commercial General Liability policies to the extent of the indemnity obligation assumed herein. In no event does Schwing Bioset waive its right of subrogation.

**7. Liability Disclaimer. NOTWITHSTANDING ANY PROVISION TO THE CONTRARY, IN NO EVENT SHALL SCHWING BIOSET BE LIABLE FOR ANY SPECIAL, INCIDENTAL, LIQUIDATED, CONSEQUENTIAL (INCLUDING WITHOUT LIMITATION LOST REVENUE OR PROFITS), OR PUNITIVE DAMAGES.** This exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory. Should Schwing Bioset nevertheless be found liable for any damages they shall be limited to the purchase price of the equipment under the order. **SCHWING BIOSET DISCLAIMS ANY LIABILITY FOR DAMAGES OF ANY KIND (WHETHER DIRECT OR INDIRECT) ARISING FROM MOLD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES OR AIRBORNE BIOLOGICAL AGENTS.**

**8. Patent Indemnity.** The Schwing Bioset shall protect and indemnify the Buyer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the articles or material delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Schwing Bioset shall promptly be notified and given full opportunity to negotiate a settlement. Schwing Bioset does not warrant against infringement by reason of Buyer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation Buyer agrees to reasonably cooperate with Schwing Bioset. In connection with any proceeding under the provisions of this Article all parties concerned shall be entitled to be represented by counsel at their own expense.

**9. Shipment Dates.** Shipment dates are estimates only. No valid contract may be made to ship within or at a specified time unless in writing, signed by an authorized signatory of Schwing Bioset. Shipments shall be f.o.b. factory or warehouse at named shipping point with title and risk of loss passing to Buyer upon delivery to the carrier unless quoted otherwise and stated as such in our formal written offer. Schwing Bioset shall not be liable for damages of any kind including Liquidated, Consequential, and/or Incidental.

**10. Cancellation.** If, following acceptance of proposal by Buyer, all or any portion of the resulting order is canceled by Buyer without default on the part of Schwing Bioset or without Schwing Bioset's written consent, Buyer shall be liable to Schwing Bioset for cancellation charges including but not limited to Schwing Bioset's incurred costs and such profit as would have been realized by Schwing Bioset from the transaction had the agreement not been breached by Buyer.

**11. Payment**. Pending Credit approval, Payment terms are 20% due at time of order, 20% due at time of submittal approval, 55% due at time goods are shipped, and 5% due upon acceptance of goods, not to exceed 90 days from shipment, unless otherwise expressly agreed to in writing by Schwing Bioset. Schwing Bioset reserves the right to add to any account outstanding for more than 30 days a service charge the lesser of 1-1/2% of the principal amount due at the end of each month, or the maximum allowable legal interest rate. Buyer shall be liable to Schwing Bioset for all collection expenses, including reasonable attorney's fees and court costs, incurred by Schwing Bioset in attempting to collect any amounts due from Buyer. If requested, Schwing Bioset will provide appropriate lien waivers upon receipt of payment. Schwing Bioset reserves the right to suspend or terminate performance in the event of Buyer's non-payment.

**12. Returns.** Products may be returned only with permission of Schwing Bioset and shall be subject to a 25% restocking fee.

**13. Applicable Law**. Any agreement resulting from Schwing Bioset's proposal will be governed and construed according to Minnesota law.

**14. U.S. Government Work. This provision applies only to indirect sales by Schwing Bioset to the US Government.** If the Work is in connection with a U.S. Government contract, Buyer certifies that it has provided and will provide current, accurate, and complete information, representations and certifications to all government officials, including but not limited to the contracting officer and officials of the Small Business Administration, on all matters related to the prime contract, including but not limited to all aspects of its ownership, eligibility, and performance. Anything herein notwithstanding, Schwing Bioset will have no obligations to Buyer unless and until Buyer provides Schwing Bioset with a true, correct and complete executed copy of the prime contract. Upon request, Buyer will provide copies to Schwing Bioset of all requested written communications with any government official related to the prime contract prior to or concurrent with the execution thereof, including but not limited to any communications related to Buyer's ownership, eligibility or performance of the prime contract. Buyer will obtain written authorization and approval from Schwing Bioset prior to providing any government official any information about Schwing Bioset's performance of the work that is the subject of this offer or agreement, other than this written offer or agreement.

**15. Storage at Schwing Bioset**. Should the customer desire to store the equipment purchased at Schwing Bioset's facilities, these services can be completed at a rate of $250.00 per week, or $1,000 per calendar month. Customer shall issue the original equipment purchase order with a contingency of 12 months storage that can be drawn from if required. These funds will not be utilized unless written approval from customer is offered. Terms for Storage Fees are 100% N30 from invoice date. Retainages and/or offsets do not apply.

Palmer, AK

Preliminary Design Proposal

December 13, 2021

| | | | |
|---|---|---|---|
| **To:** | | **Date:** | **12/13/2021** |
| **Company:** | | **From:** | **Robert Rolette** |
| **Tel.:** | | **Tel.:** | **913-745-1234** |
| **cc:** | **Marty Unger, Brad Linsey, Kevin Bunting – Parkson**<br>**Bill Reilly - WHReilly** | | |
| **Subject:** | **Parkson Biolac® Treatment System, Preliminary Design Proposal for Palmer, AK** | | |

Thank you for your interest in Parkson's Biolac® Treatment System. Based upon the data provided for this project, we developed the Biolac® design described in this proposal. We believe that this Biolac® design not only meets effluent quality requirements, but also provides the most cost effective solution for this municipality.

We look forward to working with you on this project. Should you have any questions or need clarifications, please do not hesitate to contact me at (913)745-1234. Thanks.

Sincerely,

PARKSON CORPORATION

An Axel Johnson, Inc. Company

Robert Rolette

Application Engineer

rrolette@parkson.com

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# 1. Design Basis

## 1.1. Influent and Effluent Specifications

The proposed system design is based on wastewater influent with the following characteristics:

**Table 1.1 – Design Influent flow requirements**

| PARAMETER | UNITS | AVERAGE |
|---|---|---|
| **Ave Daily Flow** | MGD | 1.06 |
| **Peak Hourly Flow** | MGD | 1.638 |
| **Maximum RAS Flow** | MGD | 1.5X design flow |

Note: Customer must confirm these final design flows to assure accuracy of the hydraulic calculations.

**Table 1.2 - Influent Water Quality**

| PARAMETER | UNITS | AVERAGE |
|---|---|---|
| **Design Temperature** | Deg C | 20 |
| **Minimum Temperature** | Deg C | 2 |
| **$BOD_5$** | lbs/d | 5721 |
| **Total Suspended Solids** | lbs/d | 5763 |
| **$NH_3$-N** | lbs/d | 657 |
| **TKN** | lbs/d | 1033 |
| **Total Phosphorous (TP)** | lbs/d | 114 |
| **pH** | - | 6 to 8 |
| **Alkalinity** | mg/L as $CaCO_3$ | 350 |

Note: Customer must confirm Influent loading conditions for any associated process warranty.

In order to offer this proposal, Parkson Corporation must make the following assumptions. Deviations from these assumptions should be brought to the attention of the designer of this system as modifications maybe required:

a. The wastewater will be pretreated to remove debris and grit using a fine influent screen.

b. Sufficient alkalinity is present or will be added to allow nitrification to proceed uninhibited.

c. The incoming oil, grease, chemical and metals concentrations are within biologically treatable levels.

d. Sufficient nutrients (P, N, etc.) are present in the influent for biomass growth or will be added by the plant operating staff.

e. A qualified operator will supervise plant activities and performance.

Based on the specified influent water quality, Parkson anticipates that the proposed Biolac® system will provide the following effluent quality:

**Table 1.3 - Effluent Water Quality**

| PARAMETER | UNITS | QUALITY |
|---|---|---|
| **$BOD_5$** | mg/L | 185 |
| **Total Suspended Solids** | mg/L | 200 |
| **$NH_3$-N** | mg/L | 21 |
| **Total Nitrogen** | mg/L | 31 |
| **Total Phosphorus** | mg/L | NR |

## 1.2. Selected Design Parameters

Based on the design loading information described above, the proposed Biolac® System will be derived as follows:

| | | | |
|---|---|---|---|
| **F/M Ratio** | **0.06** | **MLSS** | 3,000 mg/l |
| **HRT** | 3.41 days | **SRT** | 30-45 days |

# 2. System Description

The Biolac® Biological Nutrient Removal System is an innovative complete mix activated sludge process using extended retention of biological solids to create an extremely stable and easily operated system. The Biolac® process can be applied to a wide range of wastewater treatment applications, whether for municipal application or industrial application. Biolac® has over 800 installations in North American and over 1000 installations globally.

Some of the advantages of the Biolac® BNR process include:

a. Economical construction: Most biolac® systems are installed in earthen basins which reduces construction cost tremendously by eliminating the need for sophisticated concrete structures and complex piping systems for recycling.

b. Biolac® BNR systems are typically designed with a sludge age greater than 30 days. The extended sludge age provides stable operation, low sludge production, low production of well stabilized biosolids, and high effluent quality.

c. Economical process in terms of operation and maintenance cost.

d. Comprehensive electrical control system to optimize air delivery and provide peace of mind to plant operator.

e. Utilization of fine bubble aeration using extremely high mixing efficiency of 4 CFM per 1000 $ft^3$ which is over 50% improvement in comparison to the mixing efficiency achieved by stationary fine bubble diffusers.

f. Ease of aeration expansion capability simply by adding additional Biofuser® tubes to modules.

g. Easily upgradable to achieve ENR limits by implementing the Wave-Oxidation design by Parkson's process experts. The Wave-Oxidation process is designed to achieve sequential nitrification / denitrification which results in oxygen and alkalinity recovery and translates into an energy efficient and stable operation.

h. Integral clarifier design using common walls with the Biolac® basin, designed to make the most efficient use of the available footprint.

i. Elimination of the need to drain the aeration and the clarification basin(s) with the Biolac® system since all components can be cleaned and maintained from the surface.

The Biolac® process is characterized by excellent BOD removal, complete nitrification and enhanced denitrification, and biosolids stabilization. It uses fine bubble membrane diffusers attached to floating aeration chains, which are moved across the basin propelled by the air release from the diffusers. The moving aeration chains equipped with the Biofuser® diffuser assemblies provide efficient mixing of the basin contents as well as high oxygen transfer at low energy usage.

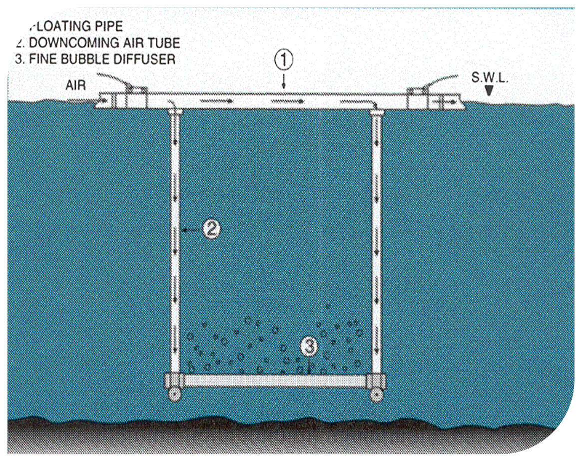
The Biofuser® system does not have submerged aeration piping or any other components to be installed, leveled, or secured on the basin floor. The BioFlex® chains with BioFusers do not contact or harm the basin liner. Each BioFlex® chain can be individually controlled by independent air valve providing excellent flexibility in fine-tuning the system to meet the oxygen demand. The individual control capability of the BioFlex chains is used to create alternating oxic and anoxic zones (Wave Oxidation) to allow denitrification in a single basin without internal mixed liquor recycle or complex controls. The moving aeration chain design is not mixing limited so the horsepower required for mixing is typically half of that required for aeration. A turndown capability of 50-70% during low loaded periods is typical without sacrificing mixing due to the movement of the BioFlex aeration chains. Inspection and service of the BioFusers is done quickly and easily without dewatering the basin, keeping maintenance costs low and eliminating the need for redundant aeration basins. In case of cold climates, the fine bubble diffusion beneath the water surface eliminates icing and minimizes wastewater cooling.

Earthen basins can be used rather than expensive concrete tanks making this extended aeration/activated sludge design the lowest cost alternative available on the market. Integral clarifier(s) are installed using common-wall construction with the extended aeration basin to settle and recycle the stable extended aeration solids.

# 3. System Components

The Biolac® aeration system consists mainly of suspended aeration chains, fine bubble diffusers, motorized and controlled air valves, clarification equipment, blowers and automatic electrical control system.

## 3.1. Moving Aeration Chain System




The moving aeration chain suspends fine bubble diffusers near the bottom of the basin. The aeration system is designed so that there are no points of attachment to the bottom of the basin. The aeration system is completely suspended above the basin bottom and is not supported or rested on the bottom. This arrangement allows for ease of access for service and maintenance without dewatering the basin or having a complete aeration system shut down.

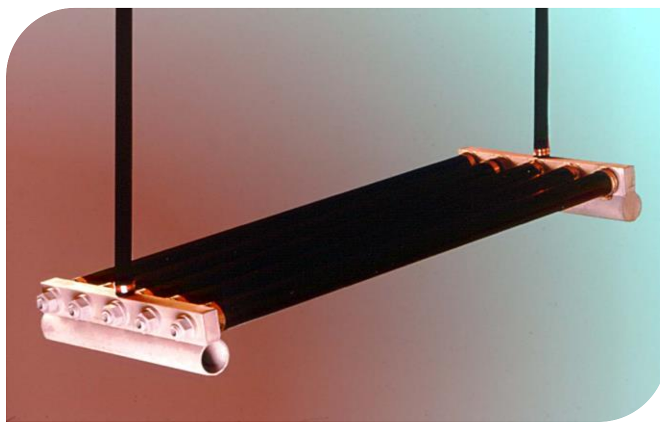
The aeration chain system is designed to be self-propelled and to move back and forth systematically in the wastewater to provide high mixing efficiency of the basin's content. This capability is critical to allow turndown flexibility in the aeration system while maintaining a completely mixed environment.

Air is delivered to each aeration chain from one side and connects to the air main through individual branches with butterfly valves. The butterfly valve provides individual control or isolation of the airflow to each chain.

The moving aeration chain is constructed of a single continuous polyethylene header. The moving aeration chain is connected to the Biofuser® by EPDM hose.

## 3.2. Diffuser Frame

The diffuser frame is formed from an extruded polypropylene compound with sufficient strength to prevent warping or deflection. The end connections of each frame shall be sealed using mechanical welding procedures providing a connection stronger than the unwelded tube.



The suspended air diffuser assembly consists of a fully functioning unit capable of housing up to five (5) diffuser tubes total.

## 3.3. System Integral Clarifier

The Biolac® system includes an integral clarifier basin(s) with a hopper zone. The integral clarifier is located downstream of the Biolac® system. All metal components of the clarifier are generally fabricated using 304SS. The clarifier is typically designed using conventional solids and hydraulic loading rates.

Each clarifier has a flocculating rake mechanism which consists of a drive assembly and non-drive / pulley assembly.

The sludge removal system includes an airlift pump and a sludge suction pipe and the Return Sludge will flow by gravity upstream of the Biolac® basin. The sludge suction piping for removing the settled solids from the clarifier is located along the length of the clarifier hopper bottom. Holes are placed along the length of the suction pipe for uniformal removal of the sludge.

Each integral clarifier includes a fixed overflow weir to control the liquid level in the clarifier and Biolac® basin as well as control the flow to the effluent pipe.

A scum baffle is included in the integral clarifier as well to prevent floating objects from passing over the overflow weir.

## 3.4. Aeration Design

a. The estimated air and energy requirements and the number of BioFlex© moving aeration headers and Biofuser® units estimated are given in Table 1. A typical BioFlex aeration header and Biofuser® assembly is shown in Drawing SD-36.

b. The required air for Biolac® basin(s) will be supplied by a total of two (2), 125 Hp positive displacement blowers. One (1) additional blower is provided as an installed spare. Only one (1) blower is necessary for mixing. Therefore, it is possible to operate one blower and cut energy usage substantially during periods of low load, such as nighttime operation. The blowers are expected to be located on a concrete pad next to the aeration basins or in a blower building as dictated by local requirements.

## 3.5. Clarifier Design

a. The biomass is separated from the mixed liquor in the clarifiers. A floating flocculating rake mechanism travels back and forth through the length of the clarifiers to aid in solids settling and distribution. Settled biomass is collected in the bottom of the clarifier by a stationary suction pipe and pumped by an airlift pump discharging to a channel and then the RAS piping. The biomass is returned to the influent zone of the activated sludge aeration basin via gravity flow. Biomass is wasted using an automated valve or pump system as dictated by the wasting method. The effluent leaves through a fixed v-notch overflow weir. Floating materials and debris are removed using a rotating scum removal system.

b. The clarifier dimensions and design criteria can be found in Table 1.

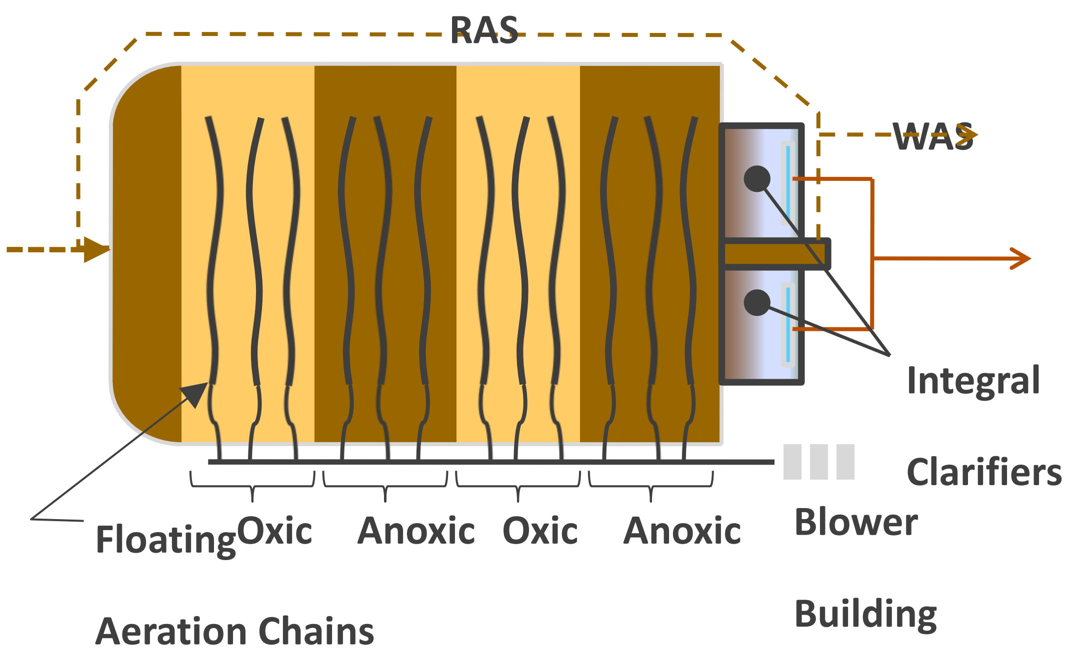
# 4. Wave-Oxidation® (WaveOx) Biological Nutrient Removal

Biological Nutrient Removal (BNR) is simplified and affordable with the Biolac® Wave Oxidation process. Simple control of the air flow distribution to the Biolac's moving aeration chains varies the basin dissolved oxygen content by creating a unique moving wave of multiple oxic and anoxic zones. This repeated cycling of environments nitrifies and denitrifies the wastewater without recycle pumping or additional external basins.

Biological phosphorus removal can also be accomplished by incorporating an upstream anaerobic zone.

The Biolac WaveOx process not only produces BNR effluent quality with low effluent total nitrogen and total phosphorus, but also includes main features such as

- Single basin BNR process resulting in major construction costs savings by eliminating the need for baffle walls to create independent zones.
- Reduced energy consumption by eliminating the need for internal recycle pumps and mixers for anoxic zones
- Optimized process operation by using simple and smart electrical controls achieving up to 80% denitrification .


RAS
WAS
Integral
Clarifiers
Floating
Oxic
Anoxic
Oxic
Anoxic
Blower
Building
Aeration Chains

# 5. Biolac® Treatment System Preliminary Design Information

| Biolac Extended Aeration Basin | |
|---|---|
| Number of Biolac® Basin(s) | 1 |
| Approximate Dimensions at Grade (ft) | 426 x 180 |
| Approximate Bottom Dimensions (ft) | 384 x 96 |
| Side Slope | 3:1 |
| Side Water Depth (ft) | 9.7 |
| Basin Volume (MG) | 3.62 |
| Clarifier Design Hydraulic Loading Rate (gpd/ft$^2$) | 356 |
| Integral Clarifier Size (ft) | 65 x 23 ea. |
| Number of Clarifiers per basin | 2 |
| Estimated SOR (lbs/hr)<br>Oxidation-only<br>Wave Oxidation (including denite credit) | <br>930<br>643 |
| Estimated SCFM (excluding airlift requirements)<br>Oxidation-only<br>Wave Oxidation (including denite credit) | <br>6026<br>4264 |
| Estimated Brake HP (excluding airlift requirements)<br>Oxidation-only<br>Wave Oxidation (including denite credit) | <br>203<br>144 |
| # Diffusers | 975 |
| # Biofuser® Assemblies | 325 |
| # BioFlex© Headers | 25 |

# 6. Equipment and Services Supplied

Parkson will supply the following equipment and services for the Biolac® treatment system described above:

Complete BioFlex® moving chains with BioFuser® aeration units including, reinforced hi-temperature connecting hose, HDPE piping, restraining cable system and required hardware.

Electric motor actuated butterfly valves for individual control of each BioFlex aeration chain.

Qty three (3) complete, 125 Hp, blower assemblies (PD blowers) including motor and required backflow prevention valves, pressure gauges and accessories (includes one installed spare blower for redundancy).

All Integral clarifier equipment required including biosolids removal piping, airlift pump, flocculating mechanism, rotating scum removal pipe and overflow weir.

One dissolved oxygen probe and analyzer per basin.

Remote-mounted control system for operation of the Biolac® Treatment System including control enclosure, VFDs, timers, relays and control switches for all motors, and components in the system. Dissolved oxygen monitoring and blower control are also provided.

Final installation inspection, start-up supervision and operator training.

# 7. Cost Estimate and Term

a. The budget price for the equipment and services supplied is $ FOB Factory, Freight Allowed.

b. Terms are 10% on Order, 15% on Submittal issuance, 75% on Shipment. Net 30 days.

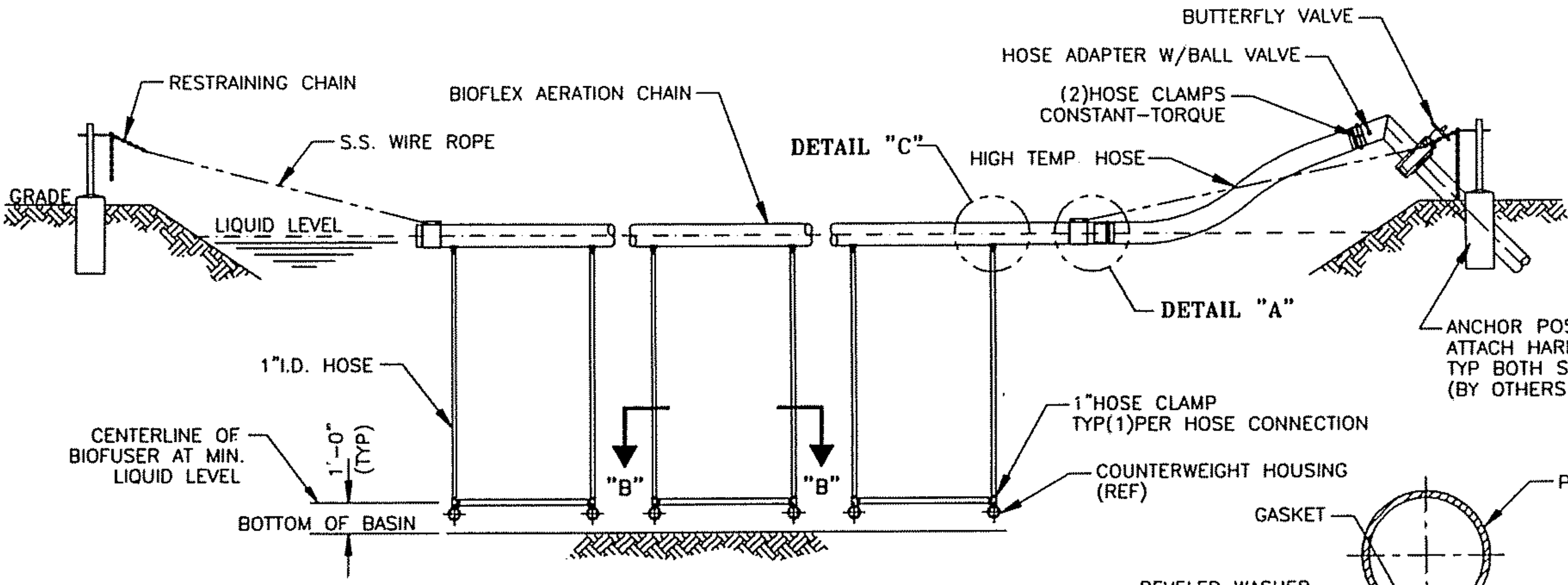
c. Approval drawings-typically 8-12 weeks after receipt of written order.

d. Equipment Shipment - typically 16-20 weeks after complete release for manufacture.

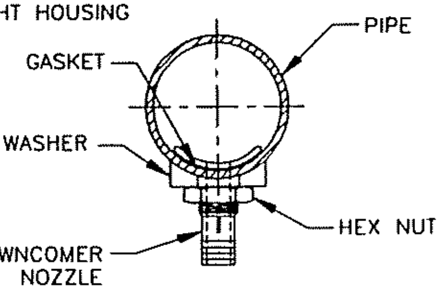
# 8. Supplemental Information and References

a. Typical Drawings

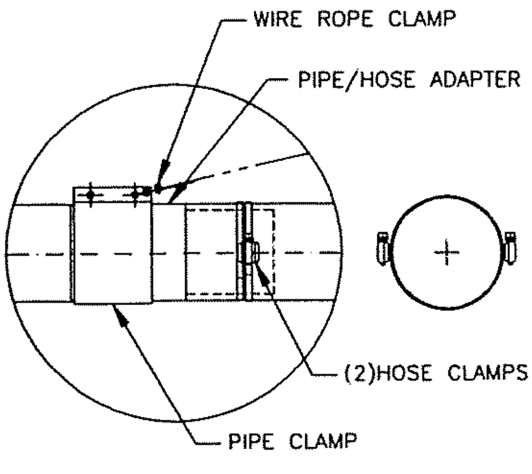
- SD-36 "BioFlex Moving Aeration Chain with Biofuser® Series 2203"
- SD-6 "Typical Moving Aeration Chain Connection"
- SD-7 "Anchor Post with Hook Detail"
- SD-8 "Positive Displacement Aeration Blower Assembly"
- SD-23 "Waste Valve Assembly"



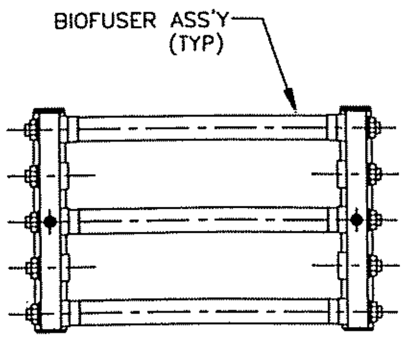

ELEVATION (BIOFLEX/BIOFUSER ASS'Y)




DETAIL "C"




DETAIL "A"




VIEW "B-B"

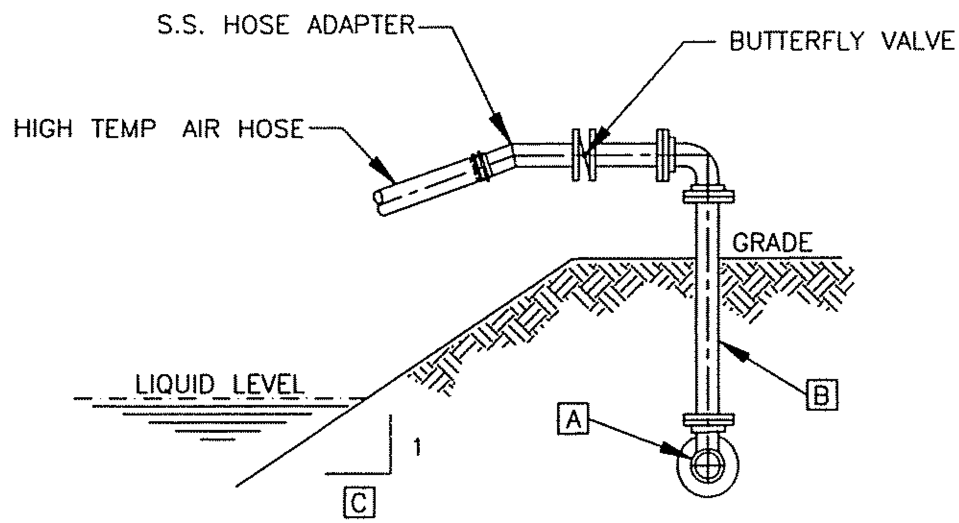
NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP.
2. TWO(2)HOSE CLAMPS TO BE INSTALLED AT EACH HOSE CONNECTION. WHEN TIGHTENED, WORM GEARS SHOULD BE 180° FROM EACH OTHER.
3. BIOFLEX WILL BE PROVIDED IN STANDARD LENGTHS. FUSION WELDING & DRILLING DOWNCOMER HOLE IN FIELD WILL BE REQUIRED BY CONTRACTOR.

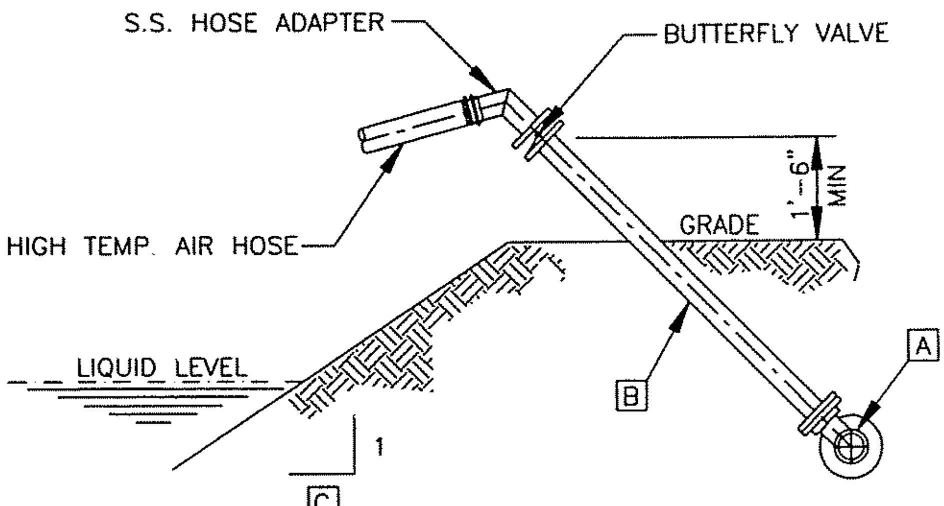
PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2003

| | | | | | |
|---|---|---|---|---|---|
| Drawn By G.C. | Checked By | Approved By | Micro Rev. | CAD No. SD-33 | Loc status LS |
| Date 2/1/96 | Date | Date | Date | DWG Scale NONE | CAD int scale 64 |
| Location | | | Dwg No. SD-36 | | Rev A |




OPTION #1



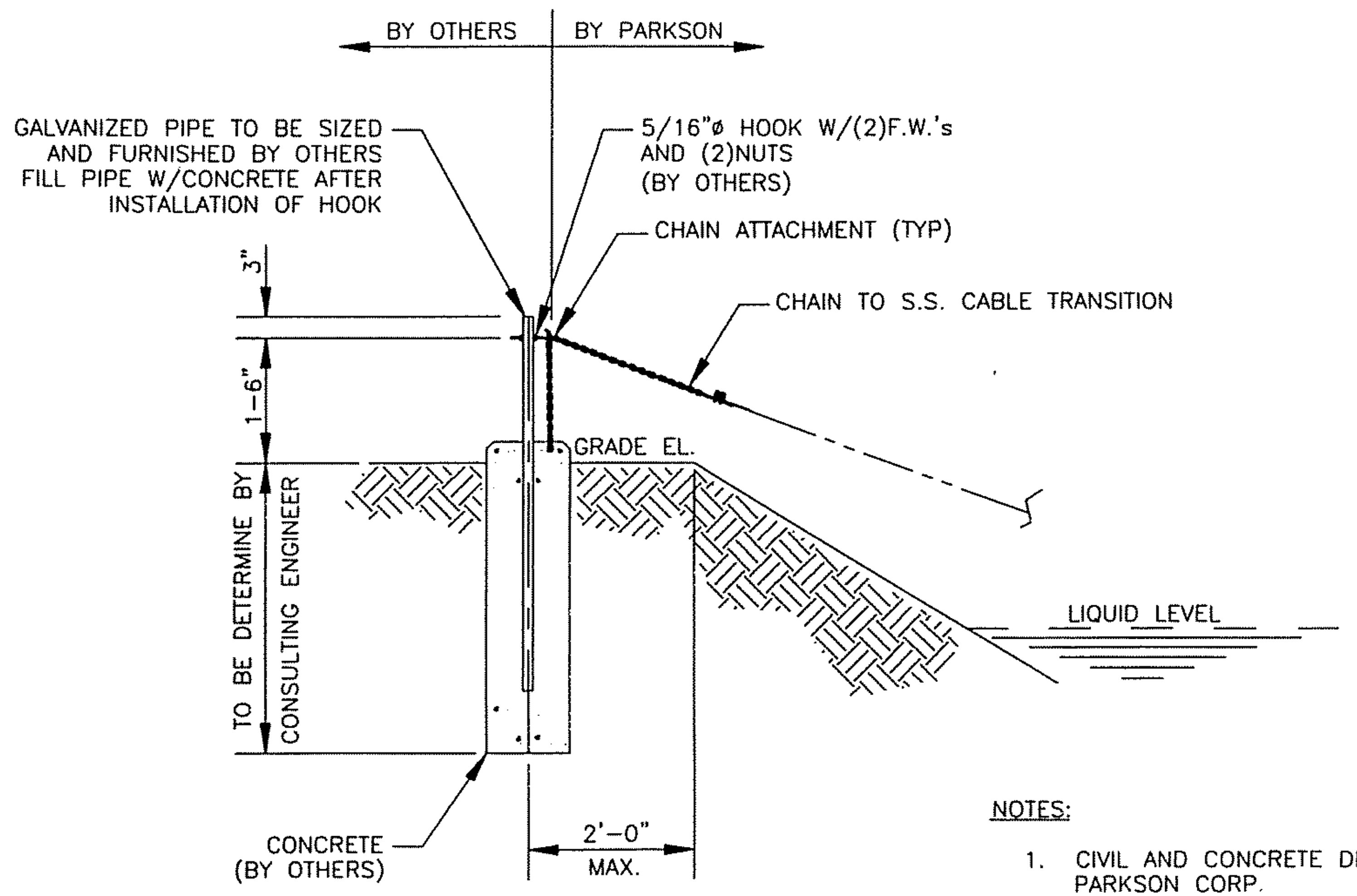

OPTION #2

| ITEM | DESCRIPTION | DIM |
|---|---|---|
| A | AIR HEADER DIAMETER | |
| B | AIR FEED PIPE DIAMETER | |
| C | WALL SLOPE | |

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
TYPICAL MOVING AERATION CHAIN CONNECTION

| Drawn By G.C. | Checked By | Approved By | Micro Rev. | CAD No. SD6 | Loc. status LS |
|---|---|---|---|---|---|
| Date 2/1/96 | Date | Date | Date | DWG Scale NONE | CAD inl scale 32 |
| Location | | | Dwg. No SD-6 | | Rev A |



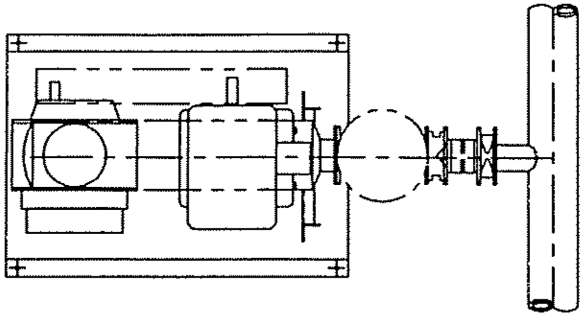

NOTES:

1. CIVIL AND CONCRETE DESIGN NOT BY PARKSON CORP.
2. PRELIMINARY DWG., NOT FOR CONSTRUCTION.

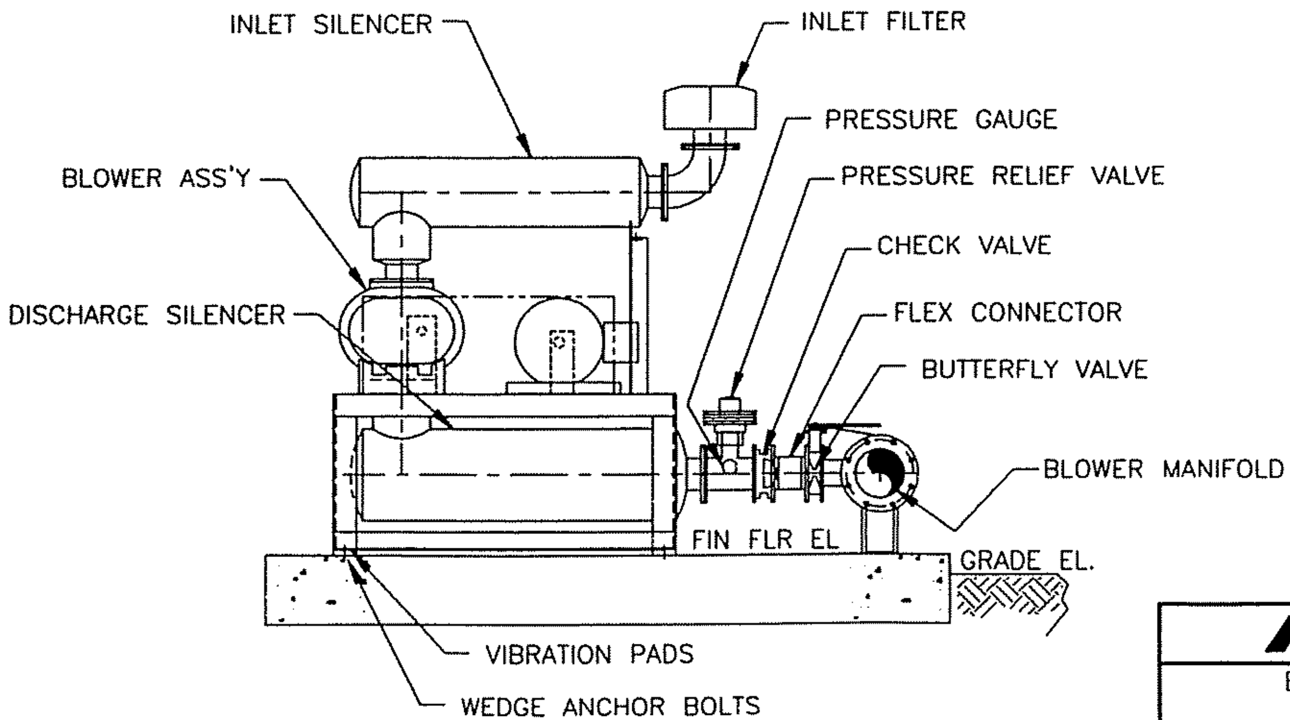
**PARKSON CORPORATION**

BIOLAC LONG SLUDGE AGE SYSTEM
ANCHOR POST W/HOOK DETAIL

| Drawn By G.C. | Checked By | Approved By | Micro Rev. | CAD No SD7 | Loc. status LS |
|---|---|---|---|---|---|
| Date 2/1/96 | Date | Date | Date | DWG Scale NONE | CAD ini scale 24 |
| Location | | | Dwg No. SD-7 | | Rev A |

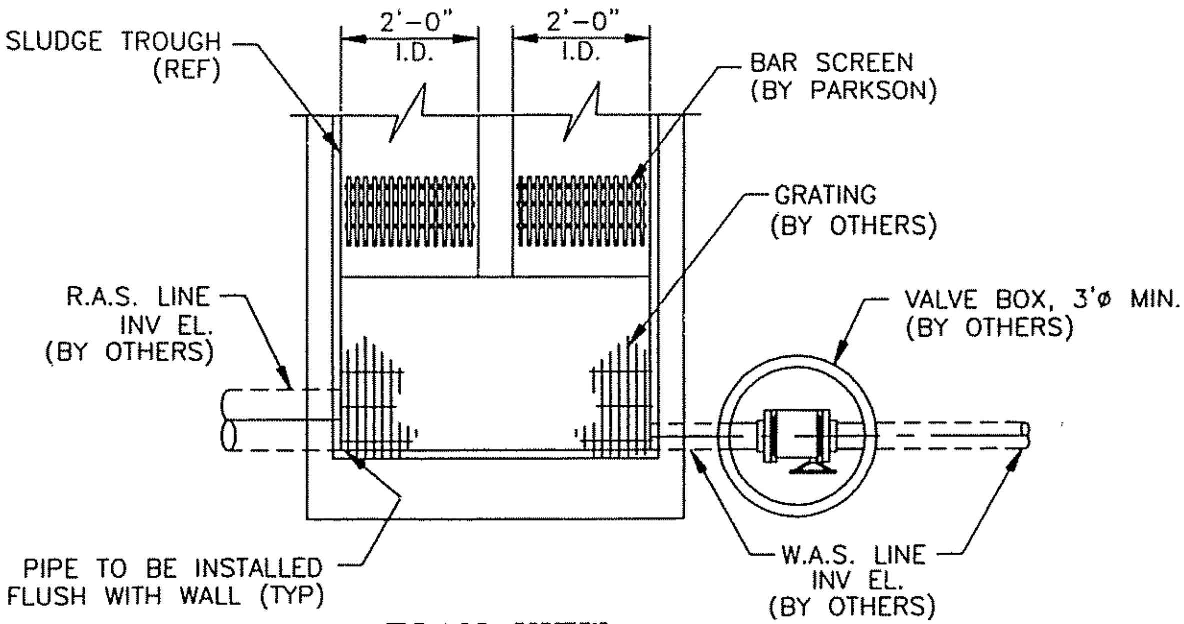


PLAN

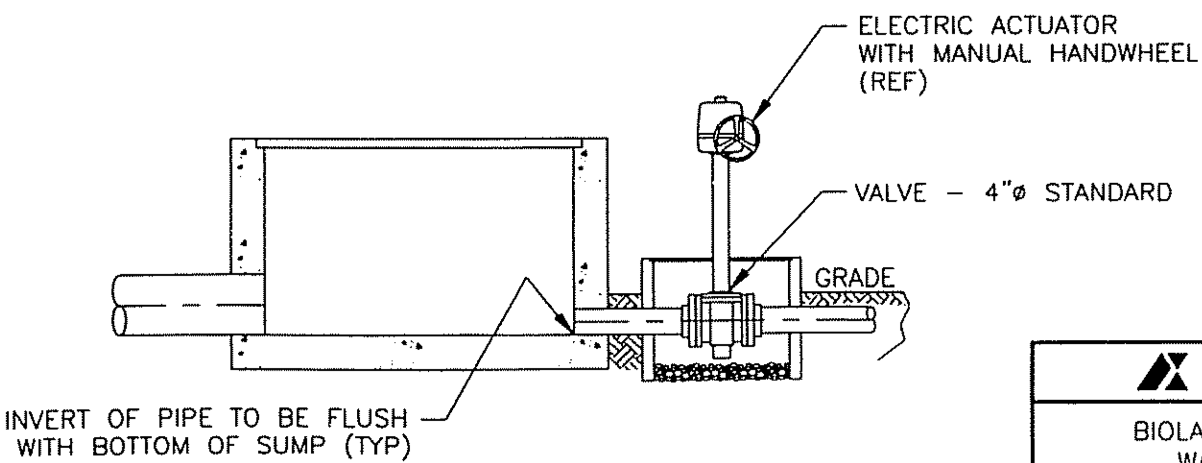



ELEVATION

| PARKSON CORPORATION | | | | | |
|---|---|---|---|---|---|
| BIOLAC LONG SLUDGE AGE SYSTEM<br>POSITIVE DISPLACEMENT<br>AERATION BLOWER ASS'Y | | | | | |
| Drawn By G.C. | Checked By | Approved By | Micro Rev. | CAD No. SD8 | Loc. status |
| Date 2/1/96 | Date | Date | Date | DWG Scale NONE | CAD int scale 32 |
| Location | | | Dwg. No. SD-8 | | Rev A |




PLAN VIEW




ELEVATION
(WALL OMITTED FOR CLARITY)

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
WASTE SLUDGE VALVE ASS'Y

| | | | | | |
|---|---|---|---|---|---|
| Drawn By G.C. | Checked By | Approved By | Micro Rev. | CAD No 5023 | Loc status |
| Date 2/1/96 | Date | Date | Date | DWG Scale | CAD inl scale 32 |
| Location | | | Dwg. No SD-23 | | Rev A |

# APPENDIX B

## Capital Cost Estimate

## O&M Cost Estimate

## Tipping Fee Calculations

| ITEM | QTY | UNIT | 2009 UNIT PRICE ($) | 2021 UNIT PRICE ($) | TOTAL | |
|---|---|---|---|---|---|---|
| ***Septage Reciving Equipment*** | | | | | | |
| Septage Receiving Screening System (Honeymonster) | 2 | EA | | $ 137,100 | $ 274,200 | |
| Equalization Tank (254,000 gal) | 1 | EA | | $ 912,000 | $ 912,000 | |
| Screw Press (FKC) | 1 | EA | | $ 414,200 | $ 414,200 | |
| Effluent Pumps (lift station pumps) | 2 | EA | $ 6,500 | $ 8,742 | $ 17,484 | |
| Booster Pump for Hot Wash Water | 2 | EA | $ 3,000 | $ 4,035 | $ 8,069 | |
| Odor Control Towers and Fans | 1 | LS | $ 200,000 | $ 268,978 | $ 268,978 | |
| Truck Scale and Heated Pad | 1 | EA | | $ 770,000 | $ 770,000 | |
| Mechanical Equipment (Hot water heater/boiler) | 1 | LS | | $ 10,000 | $ 10,000 | |
| Solids Hauling Truck | 1 | EA | | $ 150,000 | $ 150,000 | |
| | | | | | | $ 2,824,931 |
| ***Equipment Allowances - Septage Receiving Facility*** | | | | | | |
| Shipping Allowance | 6% | OF | | $ 2,824,931 | $ 169,496 | |
| Installation Labor | 6% | OF | | $ 2,824,931 | $ 169,496 | |
| Instrumentation Equipment Allowance | 6% | OF | | $ 2,824,931 | $ 169,496 | |
| Instrumentation Labor | 3% | OF | | $ 2,824,931 | $ 84,748 | |
| Process Piping Allowance | 6% | OF | | $ 2,824,931 | $ 169,496 | |
| Process Piping Labor | 3% | OF | | $ 2,824,931 | $ 84,748 | |
| Electrical Equipment Allowance | 20% | OF | | $ 2,824,931 | $ 564,986 | |
| Electrical Labor | 15% | OF | | $ 2,824,931 | $ 423,740 | |
| | | | | | | $ 1,836,205 |
| ***Septage Receiving Buildings*** | | | | | | |
| F&I Septage Receiving Building (50'x40') | 2000 | SF | $ 190 | $ 256 | $ 511,058 | |
| F&I Screw Press Building (60'x20') | 1200 | SF | $ 190 | $ 256 | $ 306,635 | |
| Misc Metals Allowance (Stairs, Handrails, Platforms) | 5% | OF | | $ 817,692 | $ 40,885 | |
| | | | | | | $ 858,577 |
| ***Septage Receiving Civil and Foundations*** | | | | | | |
| Land Cost | 5.5 | Acre | | $ 20,000 | $ 110,000 | |
| Construction Surveying | 1 | LS | | $ 5,000 | $ 5,000 | |
| Site Work | 1 | LS | | $ 551,879 | $ 551,879 | |
| Dewatering | 1 | LS | | $ 100,000 | $ 100,000 | |
| SWPPP | 1 | LS | | $ 10,000 | $ 10,000 | |
| Effluent Force Main | 800 | LF | | $ 100 | $ 80,000 | |
| Water Service | 800 | LF | | $ 100 | $ 80,000 | |
| Electrical Service | 1 | EA | | $ 150,000 | $ 150,000 | |
| Natural Gas Service | 1 | EA | $ 60,000 | $ 80,693 | $ 80,693 | |
| Landscaping | 1 | LS | | $ 10,857 | $ 10,857 | |
| | | | | | | $ 1,178,430 |
| ***Palmer WWTF Capital Improvements*** | | | | | | |
| Lagoon 1 Aeration Upgrades | 1 | LS | | $ 800,000 | $ 800,000 | |
| Lagoon Reduction and Site Preparation | 14560 | CY | | $ 30 | $ 436,806 | |
| Blower Building Expansion (40'x20') | 800 | SF | | $ 256 | $ 204,423 | |
| Sludge Settling Clarifier Tanks | 500 | CY | | $ 2,500 | $ 1,250,000 | |
| Cover Panels for Clarifiers | 1 | LS | | $ 300,000 | $ 300,000 | |
| WAS and RAS Vault | 1 | EA | | $ 250,000 | $ 250,000 | |
| WAS and RAS Piping | 800 | LF | | $ 100 | $ 80,000 | |
| Effluent Manholes | 2 | EA | | $ 15,000 | $ 30,000 | |
| Effluent Piping | 900 | LF | | $ 100 | $ 90,000 | |
| Alkalinity Feed System | 1 | LS | | $ 75,000 | $ 75,000 | |
| Additional MBBR Media | 1 | LS | | $ 700,000 | $ 700,000 | |
| | | | | | | $ 4,216,229 |
| ***Equipment Allowances - Palmer WWTF Improvements*** | | | | | | |
| Shipping Allowance | 6% | OF | | $ 2,325,000 | $ 139,500 | |
| Installation Labor | 6% | OF | | $ 2,325,000 | $ 139,500 | |
| Instrumentation Equipment Allowance | 6% | OF | | $ 2,325,000 | $ 139,500 | |
| Instrumentation Labor | 3% | OF | | $ 2,325,000 | $ 69,750 | |
| Process Piping Allowance | 6% | OF | | $ 2,325,000 | $ 139,500 | |
| Process Piping Labor | 3% | OF | | $ 2,325,000 | $ 69,750 | |
| Electrical Equipment Allowance | 20% | OF | | $ 2,325,000 | $ 465,000 | |
| Electrical Labor | 15% | OF | | $ 2,325,000 | $ 348,750 | |
| | | | | | | $ 1,511,250 |

| | |
|---|---|
| SUBTOTAL CONSTRUCTION | $ 12,425,621 |
| City Administration @ 2% | $ 248,512 |
| Design @ 10% | $ 1,242,562 |
| Construction Management @ 12% | $ 1,491,074 |
| Project Contingency @ 20% | $ 2,485,124 |
| 5 Years Inflation @ 2.5% | $ 1,632,829 |
| Subtotal Design, Admin, and Construction | $ 7,100,102 |
| **PROJECT TOTAL** | **$ 19,525,723** |

| | | | |
|---|---|---|---|
| Cost Inflation | | 2.5% | |
| 2009 - 2021 Rate | | 1.34 | |
| | | | |
| ***Septage Receiving Civil Costs - Site Work*** | $ | 551,879 | |
| Paved surface area | | 55,627 | SF |
| | | | |
| **3" Asphalt** | | 13,907 | CF |
| density | | 0.0755 | ton/CF |
| | | 1050 | ton |
| unit cost | $ | 150 | /ton |
| total cost | $ | 157,494 | |
| | | | |
| **3" Aggregate base course** | | 13,907 | CF |
| density | | 0.072 | ton/CF |
| | | 1001 | ton |
| unit cost | $ | 40 | /ton |
| total cost | $ | 40,051 | |
| | | | |
| **30" borrow** | | 199,910 | CF |
| density | | 0.072 | ton/CF |
| | | 14393 | ton |
| unit cost | $ | 16 | /ton |
| total cost | $ | 230,296 | |
| | | | |
| **Excavation** | | 4038 | CY |
| unit cost | $ | 5.00 | /CY |
| total cost | $ | 20,188 | |
| | | | |
| **Fencing** | | 1177 | LF |
| unit cost | $ | 50 | /ft |
| total cost | $ | 58,850 | |
| | | | |
| **Gates** | | 3 | EA |
| unit cost | $ | 15,000 | |
| total cost | $ | 45,000 | |
| | | | |
| ***Septage Receiving Civil Costs - Landscaping*** | $ | 10,857 | |
| Topsoil | | 2,333 | SY |
| unit cost | $ | 3.00 | /SY |
| total cost | $ | 7,000 | |
| | | | |
| Seeding | | 0.48 | Acre |
| unit cost | $ | 8,000 | /acre |
| total cost | $ | 3,857 | |

O&M Cost Estimate
Summary

| | | Total Annual O&M |
|---|---|---|
| O&M - Septage Facility | $ | 303,512 |
| O&M - Palmer WWTF | $ | 355,849 |
| TOTAL (2022 Dollars) | $ | 659,361 |
| 5 Years Inflation @ 2.5% | $ | 86,645 |
| **TOTAL (2027 Dollars)** | **$** | **746,007** |

| ITEM | QTY | UNIT | 2009 UNIT PRICE ($) | 2021 UNIT PRICE ($) | ANNUAL COST ($) | |
|---|---|---|---|---|---|---|
| ***Labor - Receving station operation*** | | | | | | |
| Truck hauler clean up | 183 | hr/yr | $ 30 | $ 40 | $ 7,363 | |
| Receiving station solids cleaning | 91 | hr/yr | $ 30 | $ 40 | $ 3,682 | |
| Screw press and screenings waste disposal | 312 | hr/yr | $ 30 | $ 40 | $ 12,588 | |
| Dumper reporting | 91 | hr/yr | $ 30 | $ 40 | $ 3,682 | |
| Spot check lab tests (BOD, COD, TSS, TKN) | 245 | hr/yr | $ 30 | $ 40 | $ 9,867 | |
| Septage hauler billing | 96 | hr/yr | $ 30 | $ 40 | $ 3,873 | |
| | | | | | | $ 41,055 |
| ***Labor - Receiving station maintenance*** | | | | | | |
| Drain, clean and inspect equalization tank | 29 | hr/yr | $ 30 | $ 40 | $ 1,178 | |
| Receiving station preventative maintenance | 11 | hr/yr | $ 30 | $ 40 | $ 442 | |
| Odor control equipment maintenance | 11 | hr/yr | $ 30 | $ 40 | $ 442 | |
| Repair and upgrades | 110 | hr/yr | $ 30 | $ 40 | $ 4,418 | |
| | | | | | | $ 6,480 |
| ***Power*** | | | | | | |
| Receiving facility gates | 21 | kWh/month | | $ 0.15 | $ 38 | |
| Receiving facility scale operation | 203 | kWh/month | | $ 0.15 | $ 365 | |
| Receiving facility heat trace - scale and pads | 180 | kWh/month | | $ 0.15 | $ 324 | |
| Screening/grit removal | 7,632 | kWh/month | | $ 0.15 | $ 13,738 | |
| Screw press assembly | 22,320 | kWh/month | | $ 0.15 | $ 40,176 | |
| Wet well pumps | 2,880 | kWh/month | | $ 0.15 | $ 5,184 | |
| Ventilation system | 2,716 | kWh/month | | $ 0.15 | $ 4,889 | |
| Odor control system | 5,209 | kWh/month | | $ 0.15 | $ 9,376 | |
| Lighting | 3,089 | kWh/month | | $ 0.15 | $ 5,560 | |
| Existing lift station pump operation | 2,880 | kWh/month | | $ 0.15 | $ 5,184 | |
| Facility Charge | 1 | ea/month | | $ 30.00 | $ 360 | |
| Facility Demand Charge | 54 | kW/month | | $ 7.70 | $ 4,989 | |
| | | | | | | $ 90,182 |
| ***Heating*** | | | | | | |
| Truck/screening washdown water | 62,175 | scf-NG/yr | $ 0.009 | $ 0.012 | $ 753 | |
| Building | 3,274,994 | scf-NG/yr | $ 0.009 | $ 0.012 | $ 39,641 | |
| | | | | | | $ 40,393 |
| ***Miscellaneous supplies*** | | | | | | |
| Screen drive lube | 4 | ea/yr | $ 240 | $ 323 | $ 1,291 | |
| Pump seals and bearings | 1 | ea/yr | $ 960 | $ 1,291 | $ 1,291 | |
| Valve maintenance | 1 | ea/yr | $ 700 | $ 941 | $ 941 | |
| Heat and ventilation equipment maintenance | 1 | ea/yr | $ 240 | $ 323 | $ 323 | |
| Odor control media | 1 | /yr | $ 230 | $ 309 | $ 309 | |
| Building lighting replacement | 1 | ea/yr | $ 400 | $ 538 | $ 269 | |
| | | | | | | $ 4,425 |
| ***Miscellaneous Services and Equipment*** | | | | | | |
| Vehicle gas | 250 | gal/yr | $ 3.40 | $ 3.60 | $ 900 | |
| Vehicle oil | 16 | quarts/yr | $ 4.00 | $ 5.38 | $ 86 | |
| Vehicle insurance and license | 1 | yr | $ 1,200 | $ 1,614 | $ 1,614 | |
| Screenings and solids disposal fee at LF | 130,389 | lb/yr | | $ 0.080 | $ 10,431 | |
| Polymer | 2,608 | lb/yr | $ 3.000 | $ 4.035 | $ 10,522 | |
| | | | | | | $ 23,553 |
| ***Major Equipment Amortization*** | | | | | | |
| Septage screening system | 1 | LS/yr | | $ 18,333 | $ 18,333 | |
| Solids hauling truck | 1 | LS/yr | | $ 10,000 | $ 10,000 | |
| Screw Press | 1 | LS/yr | | $ 41,500 | $ 41,500 | |
| | | | | | | $ 69,833 |
| | | | | SUBTOTAL ANNUAL O&M | | $ 275,920 |
| | | | | Contingency @ | 10% | $ 27,592 |
| | | | | TOTAL ANNUAL O&M | | $ 303,512 |

| | | |
|---|---|---|
| Cost Inflation | 2.5% | |
| 2009 - 2021 Rate Factor | 1.34 | |

***Septage Bldg Dimensions***

| | | |
|---|---|---|
| Bldg Width | 30 | ft |
| Bldg Length | 110 | ft |
| Eave Height | 16 | ft |
| Septage Receiving Building SF | 3300 | SF |

***Lighting***

| | | |
|---|---|---|
| Lighting intensity | 1.3 | W/sf |
| kWh | 3089 | kWh/year |

***Gate Power***

| | | |
|---|---|---|
| Qty | 3 | gates |
| Electrical demand | 700 | watts |
| Average use | 0.2 | hr/day |
| Monthly demand | 21 | kWh/month |

***Scale Power***

| | | |
|---|---|---|
| Qty | 1 | scale |
| Electrical demand | 750 | watts |
| Average use | 9.0 | hr/day |
| Monthly demand | 203 | kWh/month |

***Pad and Scale Heating Power***

| | | |
|---|---|---|
| Pad qty | 100 | LF heat trace |
| Scale qty | 100 | LF heat trace |
| Electrical demand | 5 | watts/LF |
| Average use | 6.0 | hr/day |
| Monthly demand | 180 | kWh/month |

***Power Cost***

| | | |
|---|---|---|
| Facility maximum demand | 53.99 | kW/billing cycle |

***Conductive Heat Loss***

| | |
|---|---|
| Building Wall SF | 5440 |
| Building Ceiling SF | 3300 |
| Heating degree days | 10501 |
| Delta T | 29 |
| R value | 25 |
| Hrs/day | 24 |
| Efficiency | 60% |
| BTU/yr | 146845984 |
| BTU*10^6/yr | 146.85 |

***Ventilation Heat Loss***

| AC per Hour | | hr/day | CFM | BTU/yr | BTU*10^6/yr |
|---|---|---|---|---|---|
| | 12 | 8 | 10560 | 1596824064 | 1596.82 |
| | 6 | 16 | 5280 | 1596824064 | 1596.82 |
| | | | | TOTAL | 3193.65 |

| | | |
|---|---|---|
| Gas heating value | 1020 | BTU/scf-NG |
| Total annual heating | 3274994 | scf-NG/yr |

***Screenings and Grit Disposal***

| | | |
|---|---|---|
| Annual Septage Volume | 34.80 | MG/yr |
| Solids removed | 90% | Vendor data |
| Raw septage TSS | 7,138 | mg/L |
| | 0.0042 | lb/gal |
| Total solids removed | 130,389 | lb/yr |

***Polymer Use***

| | | |
|---|---|---|
| Polymer Dose | 40 | lb/dry ton of sludge |
| Polymer Qty | 2,607.78 | lb/year |

| ITEM | QTY | UNIT | 2009 UNIT PRICE ($) | 2021 UNIT PRICE ($) | ANNUAL COST ($) | |
|---|---|---|---|---|---|---|
| ***Labor - WWTF operation*** | | | | | | |
| Alkalinity system batching | 20 | hr/yr | $ 30 | $ 40 | $ 807 | |
| Spot check lab tests (BOD, COD, TSS, TKN) | 91 | hr/yr | $ 30 | $ 40 | $ 3,682 | |
| | | | | | | $ 4,489 |
| ***Labor -WWWTF maintenance*** | | | | | | |
| Drain, clean and inspect clarifiers | 50 | hr/yr | $ 30 | $ 40 | $ 2,017 | |
| Lagoon aeration maintenance | 50 | hr/yr | $ 30 | $ 40 | $ 2,017 | |
| Blower maintenance | 10 | hr/yr | $ 30 | $ 40 | $ 403 | |
| WAS and RAS facility maintenance | 10 | hr/yr | $ 30 | $ 40 | $ 403 | |
| Alkalinity feed system maintenance | 10 | hr/yr | $ 30 | $ 40 | $ 403 | |
| Headworks screenings waste disposal | 50 | hr/yr | $ 30 | $ 40 | $ 2,017 | |
| Lagoon #2 sludge removal | 300 | hr/yr | $ 30 | $ 40 | $ 12,104 | |
| Headworks cleaning | 50 | hr/yr | $ 30 | $ 40 | $ 2,017 | |
| Lift station cleaning | 50 | hr/yr | $ 30 | $ 40 | $ 2,017 | |
| | | | | | | $ 23,401 |
| ***Power*** | | | | | | |
| Existing headworks screw press operation | 2,880 | kWh/month | | $ 0.15 | $ 5,184 | |
| Lagoon aeration blowers | 81,000 | kWh/month | | $ 0.15 | $ 145,800 | |
| WAS and RAS lift station pumps | 5,850 | kWh/month | | $ 0.15 | $ 10,530 | |
| Blower Building ventilation system | 2,716 | kWh/month | | $ 0.15 | $ 4,889 | |
| Blower Building lighting | 749 | kWh/month | | $ 0.15 | $ 1,348 | |
| Existing wastewater treatment process | 1,000 | kWh/month | | $ 0.15 | $ 1,800 | |
| Facility Demand Charge | 203 | kW/month | | $ 7.70 | $ 18,711 | |
| | | | | | | $ 188,262 |
| ***Heating*** | | | | | | |
| Blower Building | 803,841 | scf-NG/yr | $ 0.009 | $ 0.012 | $ 9,730 | |
| | | | | | | $ 9,730 |
| ***Miscellaneous Supplies and Equipment*** | | | | | | |
| Blower and pump maintenance | 1 | LS | $ 960 | $ 1,291 | $ 1,291 | |
| Valve maintenance | 1 | LS | $ 700 | $ 941 | $ 941 | |
| Heat and ventilation equipment maintenance | 1 | LS | $ 240 | $ 323 | $ 323 | |
| Blower Building lighting replacement | 1 | LS | $ 400 | $ 538 | $ 269 | |
| Dredge and Haul Truck for Lagoon # 2 Sludge Cleaning | 10 | days | | $ 1,500 | $ 15,000 | |
| | | | | | | $ 17,824 |
| ***Miscellaneous services*** | | | | | | |
| Vehicle gas | 1,000 | gal/yr | $ 3.40 | $ 3.60 | $ 3,600 | |
| Vehicle oil | 36 | quarts/yr | $ 4.00 | $ 5.38 | $ 194 | |
| Vehicle insurance and license | 3 | vehicle-yr | $ 1,200 | $ 1,614 | $ 4,842 | |
| Screenings and grit disposal | 14,484 | lb/yr | | $ 0.080 | $ 1,159 | |
| Alkalinity (NaOH) | 7,500 | gal/yr | | $ 4.000 | $ 30,000 | |
| | | | | | | $ 39,794 |
| ***Major Equipment Amortization*** | | | | | | |
| Blowers | 1 | /yr | | $ 20,000 | $ 20,000 | |
| WAS and RAS Pumps | 1 | /yr | | $ 5,000 | $ 5,000 | |
| Aeration System | 1 | /yr | | $ 15,000 | $ 15,000 | |
| | | | | | | $ 40,000 |
| | | | | SUBTOTAL ANNUAL O&M | | $ 323,499 |
| | | | | Contingency @ | 10% | $ 32,350 |
| | | | | TOTAL ANNUAL O&M | | $ 355,849 |

***Power Calculations***

| | | | |
|---|---|---|---|
| Blower pump size | 250 | hp | |
| Blower operation | 14.4 | hr/day | |
| Blower power | 81000 | kWh/month | 972000 |
| | | | |
| WAS pump size | 10 | hp | |
| WAS operation | 2 | hr/day | |
| WAS power | 450 | kWh/month | |
| | | | |
| RAS pump size | 10 | hp | |
| RAS operation | 24 | hr/day | |
| RAS power | 5400 | kWh/month | |

***Power Cost***

| | | |
|---|---|---|
| Facility max demand | 202.50 | kW/billing cycle |

***Blower Bldg Expansion Dimensions***

| | | |
|---|---|---|
| Bldg Length | 40 | ft |
| Bldg Width | 20 | ft |
| Eave Height | 16 | ft |
| Blower Building Expansion SF | 800 | SF |

***Lighting***

| | | |
|---|---|---|
| Lighting intensity | 1.3 | W/sf |
| kWh | 749 | kWh/month |

***Conductive Heat Loss***

| | |
|---|---|
| Building Wall SF | 1920 |
| Building Ceiling SF | 800 |
| Heating degree days | 10501 |
| Delta T | 29 |
| R value | 25 |
| Hrs/day | 24 |
| Efficiency | 60% |
| BTU/yr | 45700352 |
| BTU*10^6/yr | 45.70 |

***Ventilation Heat Loss***

| AC per Hour | hr/day | CFM | BTU/yr | BTU*10^6/yr |
|---|---|---|---|---|
| 12 | 8 | 2560 | 387108864 | 387.11 |
| 6 | 16 | 1280 | 387108864 | 387.11 |
| | | | TOTAL | 774.22 |

| | | |
|---|---|---|
| Gas heating value | 1020 | BTU/scf-NG |
| Total annual heating | 803841 | scf-NG/yr |

***Screenings and Grit Disposal at Headworks***

| | | |
|---|---|---|
| Annual Septage Volume | 34.79 | MG/yr |
| Solids removed | 10% | |
| Raw septage TSS | 7,138 | mg/L |
| | 0.0042 | lb/gal |
| Total solids removed | 14,484 | lb/yr |

**Financing Assumptions - USDA-RD Loan**

| | |
|---|---|
| 1.750% | interest rate |
| 30 | year loan life |
| 30% | grant-funding |

**Estimated Tipping Fees and Total Trip Costs[1]**

| | Tipping Fee /1,000 gal | Tipping Fee[3] | Total Hauling Expenses/trip[4] | Total Trip Cost |
|---|---|---|---|---|
| **Year 2027 MSB** | $78.04 | $234.11 | $26.10 | $260.21 |
| **Year 2057 MSB** | $38.38 | $115.13 | $26.10 | $141.23 |
| **Flat-Rate MSB** | $58.21 | $174.62 | $26.10 | $200.72 |
| **Year 2027 AWWU[2]** | $30.21 | $90.63 | $182.67 | $273.30 |

Notes:

1. Costs and fees shown on a per trip basis.
2. 5 years inflation @ 2.5% applied to AWWU 2022 tipping fee of $26.10/1,000 gal
3. Assumes a 3,000-gal hauling volume.
4. Refer to Appendix B for itemized hauling expenses. A 70-mile round trip distance used for AWWU, and 10-mile round trip distance used for MSB, both measured from a common point located at the Parks-Glenn Hwy interchange. Hauling costs do not include expenses for time spent at location of septage collection nor travel from septage collection to the Parks-Glenn Hwy interchange.

Tipping Fee Trip Costs
Proposed Costs - First Year

| | | | |
|---|---|---|---|
| Facility Flow - 2022 | | 15.2 | MG/yr |
| Facility Flow - 2027 | | 17.1 | MG/yr |
| ***Total Annual Cost*** | | | |
| Total O&M Cost | $ | 746,007 | |
| Total Capital Cost | $ | 19,525,723 | |
| Grant funding | | 30% | |
| Remaining cost | $ | 13,668,006 | |
| Loan interest rate | | 1.750% | |
| Loan life | | 30 | years |
| Yearly debt service | $ | 589,498 | |
| Total Annual Cost | $ | 1,335,505 | |
| ***Septage Dumping Unit Cost*** | | | |
| Cost per gallon | $ | 0.08 | /gal |
| | $ | 78.04 | /1000 gal |
| Cost per pound | $ | 0.65 | /lb |
| ***Average total trip cost*** | | | |
| Hauler volume | | 3,000 | gal |
| RT Mileage | | 10 | miles |
| Total cost | $ | 260.21 | /roundtrip |

Tipping Fee Trip Costs
Proposed Costs - Year 2057

| | | | |
|---|---|---|---|
| Facility Flow - 2057 | | 34.8 | MG/yr |
| ***Total Annual Cost*** | | | |
| Total O&M Cost | $ | 746,007 | |
| Total Capital Cost | $ | 19,525,723 | |
| Grant funding | | 30% | |
| Remaining cost | $ | 13,668,006 | |
| Loan interest rate | | 1.750% | |
| Loan life | | 30 | years |
| Yearly debt service | $ | 589,498 | |
| Total Annual Cost | $ | 1,335,505 | |
| ***Septage Dumping Unit Cost*** | | | |
| Cost per gallon | $ | 0.04 | /gal |
| | $ | 38.38 | /1000 gal |
| Cost per pound | $ | 0.32 | /lb |
| ***Average total trip cost*** | | | |
| Hauler volume | | 3,000 | gal |
| RT Mileage | | 10 | miles |
| Total cost | $ | 141.23 | /roundtrip |

Tipping Fee Trip Costs
Proposed Costs - Break Even Year

| | | | |
|---|---|---|---|
| Facility Flow | | 16.21 | MG/yr |
| Associated Year | | 2025 | |

***Total Annual Cost***

| | | | |
|---|---|---|---|
| Total O&M Cost | $ | 746,007 | |
| Total Capital Cost | $ | 19,525,723 | |
| Grant funding | | 30% | |
| Remaining cost | $ | 13,668,006 | |
| Loan interest rate | | 1.750% | |
| Loan life | | 30 | years |
| Yearly debt service | $ | 589,498 | |
| Total Annual Cost | $ | 1,335,505 | |

***Septage Dumping Unit Cost***

| | | | |
|---|---|---|---|
| Cost per gallon | $ | 0.08 | /gal |
| | $ | 82.40 | /1000 gal |
| Cost per pound | $ | 0.69 | /lb |

***Average total trip cost***

| | | | |
|---|---|---|---|
| Hauler volume | | 3,000 | gal |
| RT Mileage | | 10 | miles |
| Total cost | $ | 273.30 | /roundtrip |

Tipping Fee
2027 AWWU Costs

| | | |
|---|---|---|
| AWWU Septage Tipping Fee | 30.21 | /1,000 gal |
| Hauler Volume | 3,000 | gal |
| RT Mileage | 70 | miles |
| Total cost | $ 273.30 | /roundtrip |

Tipping Fee
Hauler Expenses

| | 2007 Cost | | 2027 Cost (2.5% inflation) | |
|---|---|---|---|---|
| **Tires** | $ 0.15 | /mile | $ 0.24 | /mile |
| **Fuel** | | | $ 0.89 | /mile |
| **Oil** | $ 0.02 | /mile | $ 0.04 | /mile |
| **Tanker maintenance** | $ 0.08 | /mile | $ 0.14 | /mile |
| **Truck maintenance** | $ 0.22 | /mile | $ 0.36 | /mile |
| **Engine life** | $ 0.04 | /mile | $ 0.07 | /mile |
| **Transmission** | $ 0.02 | /mile | $ 0.03 | /mile |
| **Labor** | $ 0.63 | /mile | $ 0.84 | /mile |
| | | **Total** | $ 2.61 | /mile |

# APPENDIX C

## Wastewater Design Flows and Loading Calculations

**Phase 1 Design Flows and Loading**

*Estimated PWWTP Design Loadings with Septage - 2-28-22*

| **Combined Loading** | | **Avg Daily** | **Peak Day** | **"Low Day"** |
|---|---|---|---|---|
| Summer Flow | GPD | 1,217,500 | 1,717,500 | 867,500 |
| Winter Flow | GPD | 1,072,500 | 1,572,500 | 722,500 |
| BOD | mg/L | 334 | 438 | 567 |
| BOD | lb/day | 3,392 | 6,278 | 4,099 |
| TSS | mg/L | 328 | 435 | 549 |
| TSS | lb/day | 3,330 | 6,236 | 3,971 |
| TKN | mg/L | 66 | 81 | 109 |
| TKN | lb/day | 672 | 1,162 | 792 |
| Ammonia-N | mg/L | 39 | 51 | 66 |
| Ammonia-N | lb/day | 396 | 724 | 476 |
| Alkalinity | mg/L | 320 | 285 | 369 |

"Low Day" Flow is assumed to equal current max month flow rate.

"Low Day" loadings are assumed to equal current peak day loadings.

**Existing MBBR Design**

**Phase 1 Avg Daily Design Flows and Loading (PWWTP Engineer's Report-Dec 2016)**

| | Flow | BOD | | | TSS | | | TKN | | | Ammonia-N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MGD | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor |
| Annual Average | 1 | 224 | 1868 | 1.00 | 244 | 2035 | 1.00 | 38 | 318 | 1.00 | 26 | 213 | 1.00 |
| Max. Month | 1.2 | 282 | 2818 | 1.26 | 310 | 3102 | 1.27 | 48 | 479 | 1.26 | 32 | 321 | 1.26 |
| Peak Day | 1.5 | 380 | 4754 | 1.70 | 395 | 4941 | 1.62 | 65 | 808 | 1.69 | 43 | 541 | 1.69 |

**Estimated Design Loadings with Septage - Avg Daily Flow (future)**

| **Septage Flows** | | **Raw Septage** | **Pre-Treated Septage** |
|---|---|---|---|
| Winter | GPD | 72,500 | 72,500 |
| Summer (Peak) | GPD | 217,500 | 217,500 |
| Total | GPY | 34,800,000 | 34,800,000 |

| **Summer Septage Loading** | | | | Pre-Trmt Performance |
|---|---|---|---|---|
| BOD | mg/L | 2,800 | 840 | 70% Removal |
| BOD | lb/day | 5,079 | 1,524 | |
| TSS | mg/L | 7,138 | 714 | 90% Removal |
| TSS | lb/day | 12,948 | 1,295 | |
| TKN | mg/L | 217 | 195 | 10% Removal |
| TKN | lb/day | 394 | 354 | |
| Ammonia-N | mg/L | 112 | 101 | 10% Removal |
| Ammonia-N | lb/day | 203 | 183 | |
| Alkalinity | mg/L | 970 | 873 | 10% Removal |

| **City Wastewater Flows** | | | |
|---|---|---|---|
| Winter | GPD | 1,000,000 | Phase 1 Avg Day Flow Rate (from 2016 Engineer's Report) |
| Summer | GPD | 1,000,000 | |
| Total | GPY | 365,000,000 | |

| **Average Septage Loadings** | | **2007 Report** | **2010 Report** | **Clark Report** |
|---|---|---|---|---|
| BOD | mg/L | 1,053 | 2,800 | 1,850 |
| BOD | lb/day | 1,910 | 5,079 | 3,356 |
| TSS | mg/L | 7,138 | 6,450 | 2,380 |
| TSS | lb/day | 12,948 | 11,700 | 4,317 |
| TKN | mg/L | --- | --- | 217 |
| TKN | lb/day | --- | --- | 394 |
| Ammonia-N | mg/L | --- | --- | 112 |
| Ammonia-N | lb/day | --- | --- | 203 |

**Existing MBBR Design**

**Phase 1 Avg Daily Design Flows and Loading (PWWTP Engineer's Report-Dec 2016)**

Phase 1 Avg Day Loading (from 2016 Engineer's Report)

| **City Wastewater Loading** | | |
|---|---|---|
| BOD | mg/L | 224 |
| BOD | lb/day | 1868 |
| TSS | mg/L | 244 |
| TSS | lb/day | 2035 |
| TKN | mg/L | 38 |
| TKN | lb/day | 318 |
| Ammonia-N | mg/L | 26 |
| Ammonia-N | lb/day | 213 |
| Alkalinity | mg/L | 200 |

| **Combined Loading** | | |
|---|---|---|
| Summer Flow | GPD | **1,217,500** |
| Winter Flow | GPD | **1,072,500** |
| BOD | mg/L | **334** |
| BOD | lb/day | **3392** |
| TSS | mg/L | **328** |
| TSS | lb/day | **3330** |
| TKN | mg/L | **66** |
| TKN | lb/day | **672** |
| Ammonia-N | mg/L | **39** |
| Ammonia-N | lb/day | **396** |
| Alkalinity | mg/L | **320** |

**Existing MBBR Design**

**Phase 1 Peak Daily Design Flows and Loading (PWWTP Engineer's Report-Dec 2016)**

| | Flow | BOD | | | TSS | | | TKN | | | Ammonia-N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MGD | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor |
| Annual Average | 1 | 224 | 1868 | 1.00 | 244 | 2035 | 1.00 | 38 | 318 | 1.00 | 26 | 213 | 1.00 |
| Max. Month | 1.2 | 282 | 2818 | 1.26 | 310 | 3102 | 1.27 | 48 | 479 | 1.26 | 32 | 321 | 1.26 |
| Peak Day | 1.5 | 380 | 4754 | 1.70 | 395 | 4941 | 1.62 | 65 | 808 | 1.69 | 43 | 541 | 1.69 |

**Estimated Design Loadings with Septage - Peak Daily Flow (future)**

| Septage Flows | | Raw Septage | Pre-Treated Septage |
|---|---|---|---|
| Winter | GPD | 72,500 | 72,500 |
| Summer (Peak) | GPD | 217,500 | 217,500 |
| Total | GPY | 34,800,000 | 34,800,000 |

| Summer Septage Loading | | | | Pre-Trmt Performance |
|---|---|---|---|---|
| BOD | mg/L | 2,800 | 840 | 70% Removal |
| BOD | lb/day | 5,079 | 1,524 | |
| TSS | mg/L | 7,138 | 714 | 90% Removal |
| TSS | lb/day | 12,948 | 1,295 | |
| TKN | mg/L | 217 | 195 | 10% Removal |
| TKN | lb/day | 394 | 354 | |
| Ammonia-N | mg/L | 112 | 101 | 10% Removal |
| Ammonia-N | lb/day | 203 | 183 | |
| Alkalinity | mg/L | 970 | 873 | 10% Removal |

| Average Septage Loadings | | 2007 Report | 2010 Report | Clark Report |
|---|---|---|---|---|
| BOD | mg/L | 1,053 | 2,800 | 1,850 |
| BOD | lb/day | 1,910 | 5,079 | 3,356 |
| TSS | mg/L | 7,138 | 6,450 | 2,380 |
| TSS | lb/day | 12,948 | 11,700 | 4,317 |
| TKN | mg/L | --- | --- | 217 |
| TKN | lb/day | --- | --- | 394 |
| Ammonia-N | mg/L | --- | --- | 112 |
| Ammonia-N | lb/day | --- | --- | 203 |

| City Wastewater Flows | | |
|---|---|---|
| Winter | GPD | 1,500,000 |
| Summer | GPD | 1,500,000 |
| Total | GPY | 547,500,000 |

Phase 1 Current Peak Day Flow Rate (from 2016 Engineer's Report)

**Existing MBBR Design**

**Phase 1 Peak Daily Design Flows and Loading (PWWTP Engineer's Report-Dec 2016)**

Phase 1 Peak Day Loading (from 2016 Engineer's Report)

| **City Wastewater Loading** | | |
|---|---|---|
| BOD | mg/L | 380 |
| BOD | lb/day | 4754 |
| TSS | mg/L | 395 |
| TSS | lb/day | 4941 |
| TKN | mg/L | 65 |
| TKN | lb/day | 808 |
| Ammonia-N | mg/L | 43 |
| Ammonia-N | lb/day | 541 |
| Alkalinity | mg/L | 200 |

| **Combined Loading** | | |
|---|---|---|
| Summer Flow | GPD | **1,717,500** |
| Winter Flow | GPD | **1,572,500** |
| BOD | mg/L | **438** |
| BOD | lb/day | **6278** |
| TSS | mg/L | **435** |
| TSS | lb/day | **6236** |
| TKN | mg/L | **81** |
| TKN | lb/day | **1162** |
| Ammonia-N | mg/L | **51** |
| Ammonia-N | lb/day | **724** |
| Alkalinity | mg/L | **285** |

4085.57835

**Existing MBBR Design**

**Phase 1 Current Max Month Design Flows with Current Peak Day Loading (PWWTP Engineer's Report-Dec 2016)**

| | Flow | BOD | | | TSS | | | TKN | | | Ammonia-N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MGD | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor | mg/L | lb/day | Loading Factor |
| Annual Average | 1 | 224 | 1868 | 1.00 | 244 | 2035 | 1.00 | 38 | 318 | 1.00 | 26 | 213 | 1.00 |
| Max. Month | 1.2 | 282 | 2818 | 1.26 | 310 | 3102 | 1.27 | 48 | 479 | 1.26 | 32 | 321 | 1.26 |
| Peak Day | 1.5 | 380 | 4754 | 1.70 | 395 | 4941 | 1.62 | 65 | 808 | 1.69 | 43 | 541 | 1.69 |

**Estimated Design Loadings with Septage-Current Peakd Day Flow ("Low Day" for future)**

| **Septage Flows** | | **Raw Septage** | **Pre-Treated Septage** |
|---|---|---|---|
| Winter | GPD | 72,500 | 72,500 |
| Summer (Peak) | GPD | 217,500 | 217,500 |
| Total | GPY | 34,800,000 | 34,800,000 |

| **Summer Septage Loading** | | | | Pre-Trmt Performance |
|---|---|---|---|---|
| BOD | mg/L | 2,800 | 840 | 70% Removal |
| BOD | lb/day | 5,079 | 1,524 | |
| TSS | mg/L | 7,138 | 714 | 90% Removal |
| TSS | lb/day | 12,948 | 1,295 | |
| TKN | mg/L | 217 | 195 | 10% Removal |
| TKN | lb/day | 394 | 354 | |
| Ammonia-N | mg/L | 112 | 101 | 10% Removal |
| Ammonia-N | lb/day | 203 | 183 | |
| Alkalinity | mg/L | 970 | 873 | 10% Removal |

| **City Wastewater Flows** | | |
|---|---|---|
| Winter | GPD | 650,000 |
| Summer | GPD | 650,000 |
| Total | GPY | 237,250,000 |

Phase 1 Current Max Month Flow Rate (from 2016 Engineer's Report)

| **Average Septage Loadings** | | **2007 Report** | **2010 Report** | **Clark Report** |
|---|---|---|---|---|
| BOD | mg/L | 1,053 | 2,800 | 1,850 |
| BOD | lb/day | 1,910 | 5,079 | 3,356 |
| TSS | mg/L | 7,138 | 6,450 | 2,380 |
| TSS | lb/day | 12,948 | 11,700 | 4,317 |
| TKN | mg/L | --- | --- | 217 |
| TKN | lb/day | --- | --- | 394 |
| Ammonia-N | mg/L | --- | --- | 112 |
| Ammonia-N | lb/day | --- | --- | 203 |

**Existing MBBR Design**

**Phase 1 Current Max Month Design Flows with Current Peak Day Loading (PWWTP Engineer's Report-Dec 2016)**

Phase 1 Current Peak Day Loadings (from 2016 Engineer's Report)

| **City Wastewater Loading** | | |
|---|---|---|
| BOD | mg/L | 475 |
| BOD | lb/day | 2575 |
| TSS | mg/L | 494 |
| TSS | lb/day | 2676 |
| TKN | mg/L | 81 |
| TKN | lb/day | 438 |
| Ammonia-N | mg/L | 54 |
| Ammonia-N | lb/day | 293 |
| Alkalinity | mg/L | 200 |

| **Combined Loading** | | |
|---|---|---|
| Summer Flow | GPD | **867,500** |
| Winter Flow | GPD | **722,500** |
| BOD | mg/L | **567** |
| BOD | lb/day | **4099** |
| TSS | mg/L | **549** |
| TSS | lb/day | **3971** |
| TKN | mg/L | **109** |
| TKN | lb/day | **792** |
| Ammonia-N | mg/L | **66** |
| Ammonia-N | lb/day | **476** |
| Alkalinity | mg/L | **369** |