HAULED WASTE DISPOSAL STATION

DESIGN STUDY REPORT

SPRING 2017

Prepared for:

Anchorage Water & Wastewater Utility
Client/Mentor: Willie O'Malley
3000 Arctic Boulevard
Anchorage, AK 99503

Prepared by:

CWolf Engineers, LLC
Project Manager: Andrea Moreno
2900 Spirit Drive
Anchorage, Alaska 99508

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LIST OF ACRONYMS

ADA – Alaska Disabilities
ADEC – Alaska Department of Environmental Conservation
ARL – Anchorage Regional Landfill
AWWU – Anchorage Water and Wastewater Utility
EPA – Environmental Protection Agency
FSE – Food Service Establishment
FOG – Fat, Oil, and Grease
GPM – Gallons per Minute
MASS – Municipality of Anchorage Standard Specifications
MCC – Motor Control Center
MGD – Million Gallons per Day
MOA – Municipality of Anchorage
MOU – Memorandum of Understanding
MSB – Mat-Su Borough
O&M – Operations and Maintenance
RACS – Raptor Acceptance Control System
SCADA – Supervisory Control and Data Acquisition
SSO – Sanitary Sewer Overflow
WWMP – Wastewater Master Plan

EXECUTIVE SUMMARY

CWolf Engineering 2017 has been contracted to deliver a 35% design to upgrade the King Street hauled waste disposal station for Anchorage Water and Wastewater Utility (AWWU). This station was upgraded in 2010 but is in need of another upgrade considering the increase in operation and maintenance (O&M) costs. Unauthorized materials which include screenings, sediments, and fats, oils, and grease (FOG) are the main cause of the issues, which include sanitary sewer overflows (SSO) and the hindering of existing monitoring equipment. ADEC works closely with the Environmental Protection Agency (EPA) to manage reduction of SSOs.

CWolf Engineering 2017 designed a recommendation for the upgrade of the King Street hauled wastewater disposal station with a 20-year outlook. This upgrade will be able to support the projected flow and population increase for the Municipality of Anchorage (MOA) for 2037. With the upgrade, the station will be able to properly handle the intake of FOGs, screenings, and sediments.

The selected equipment for the upgrade is the Raptor Septage Complete Plant (Model 40SCP) manufactured by Lakeside. This prefabricated septage receiving station includes grit and screening removal equipment that dumps the waste into trash bins that will be picked up by Alaska Waste. The equipment will also clean and dewater the waste prior to dumping. A barrel of lime will also be included with the final design. A layer of lime will be sprinkled on top of the waste to help with dewatering and odor control. A hot water injection point at the influent end of the septage receiving station will also be implemented before the magnetic flow meter. This will degrease and remove particles to ensure accurate flow meter readings, as well as increasing the lifespan of the equipment.

The King Street location does not currently have a supply of water to the building. It is necessary for the process in removing screenings, grit and providing water to wash down any spills. The receiving station will receive its water supply by tapping into the nearby existing water main. The available flow of the water main is 250 GPM at 58 PSI. Approximately 200 feet of 12” diameter pipe would be required. During the construction of the new King Street septage receiving station the Turpin Street location will be used.

A total of 1.4 cubic yards of screenings removal and 1.7 cubic yards of grit removal are anticipated using the Raptor Septage Complete Plant. Roughly 0 cubic yards of screenings should pass into the sewer interceptor but 2.6 cubic yards of grit should. FOG received will be accepted on-site and treated at the AWWTF. Collection of screenings and grit into 6 cubic yard dumpster bins should be picked up one a week from the west facing wall of the station. The construction upgrade cost of the King Street septage receiving station is estimated at $12.25 million.

1.0 INTRODUCTION

AWWU solicited for engineering services to upgrade the hauled wastewater disposal station for the Municipality of Anchorage area with a 20-year outlook. CWolf Engineering won the bid to provide AWWU with a pre-design recommendation for Project A: Hauled Wastewater Disposal Station located in Anchorage, Alaska.

Anchorage currently has two hauled wastewater disposal stations: one located on King Street and the other located on Turpin Street. These stations currently serve the entire Municipality of Anchorage from Eklutna to Girdwood, and the Mat-Su Borough (MSB). The waste accepted from these stations includes domestic septage, landfill leachate, commercial tank and portable toilet wastes, sludge from non-municipal treatment operations, and other waste materials.

Currently, the Turpin Street location accepts the MSB's wastewater. However, in 2019 the MSB plans to construct a wastewater disposal station. Leachate is currently hauled to both wastewater stations, but in 2019 the Anchorage Regional Landfill (ARL) will construct a segment of pipe that will send leachate directly into the AWWU sewer collection system. The municipality also plans to mandate food service establishments to collect grease and have it hauled to a receiving station. With the MSB's wastewater and all leachate disposed in other means, AWWU plans to upgrade the King Street location. It will be Anchorage's main disposal station for septage and FOG while keeping the Turpin location close and used only as a backup. This design study report prepared for AWWU addresses the existing conditions, projected flows, building plans, permitting, and cost estimations for the King Street station upgrade.

2.0 BACKGROUND/EXISTING CONDITIONS

Currently both the King Street and Turpin Street locations operate without continuous supervision from AWWU. Wastewater received from these stations is carried by public sanitary sewer system to the main Asplund Wastewater Treatment Facility at Point Woronzof. The Turpin Street location, along with another station on 94th Street, was constructed in 1988. The King Street location was constructed later in 2002, and is located approximately 500 feet from the 94th Street location. The King Street Septage Receiving Station is approximately 10' x 10', 100 sq. ft., and received an upgrade in 2010.

One of the key issues is that the King Street septage station is being used for more than just septage disposal. Current operation and maintenance costs have increased due greatly to trunk and clogged interceptor pipe caused by the discharging of unauthorized materials. These unauthorized materials include FOG, large sediments, and screenings. These discharges, especially FOG in particular, hinder the operations of existing monitoring equipment, including sampling and flow monitoring as well as cause sanitary sewer overflows. Currently AWWU is spending a significant amount of time cleaning the

receiving stations and handling an increasing volume of material. A large amount of money is also spent cleaning downstream sewers due to the amount of debris in the lines.

2.1 Project Location

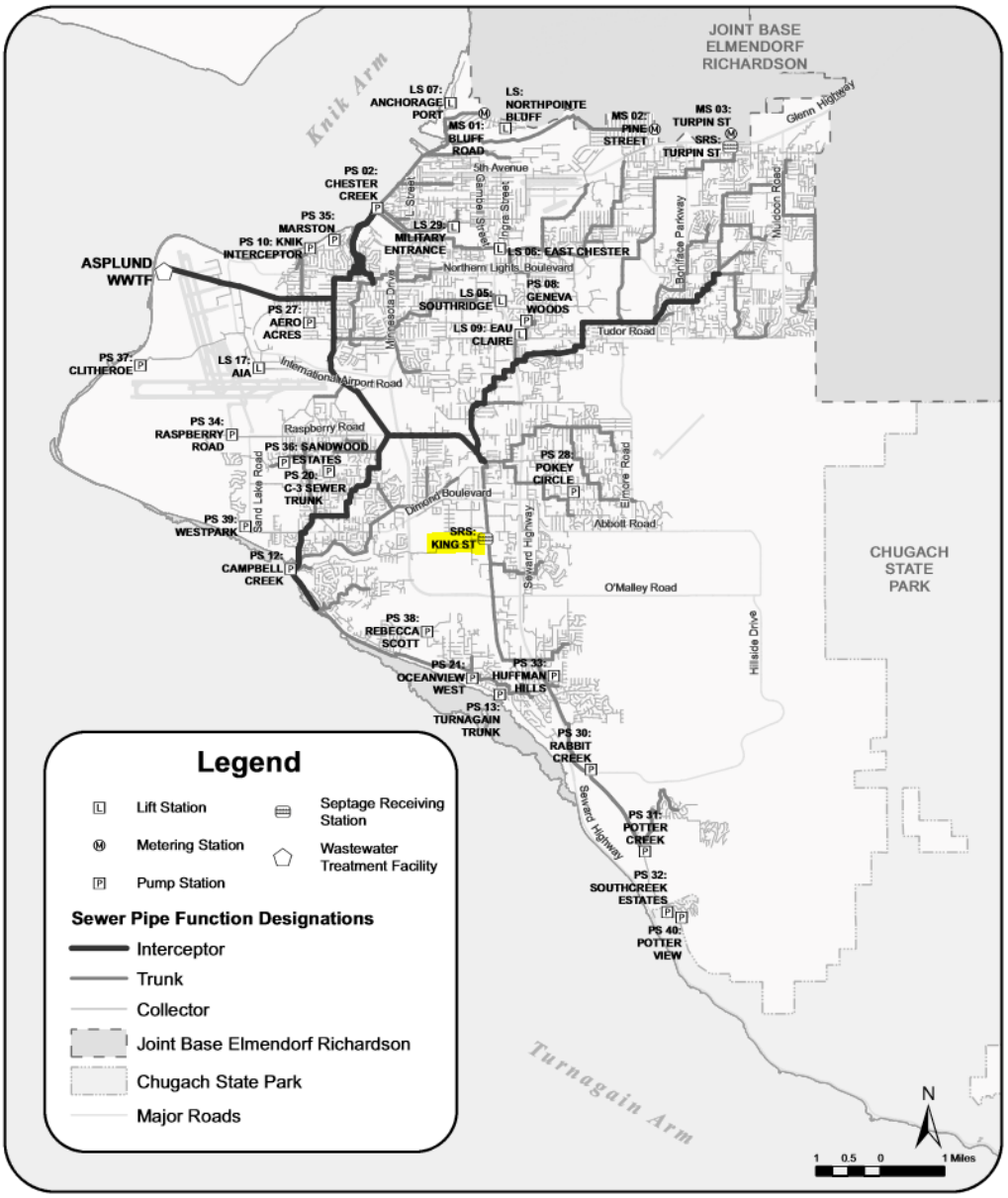


Figure 1: Project Location. Courtesy of AWWU GIS Report

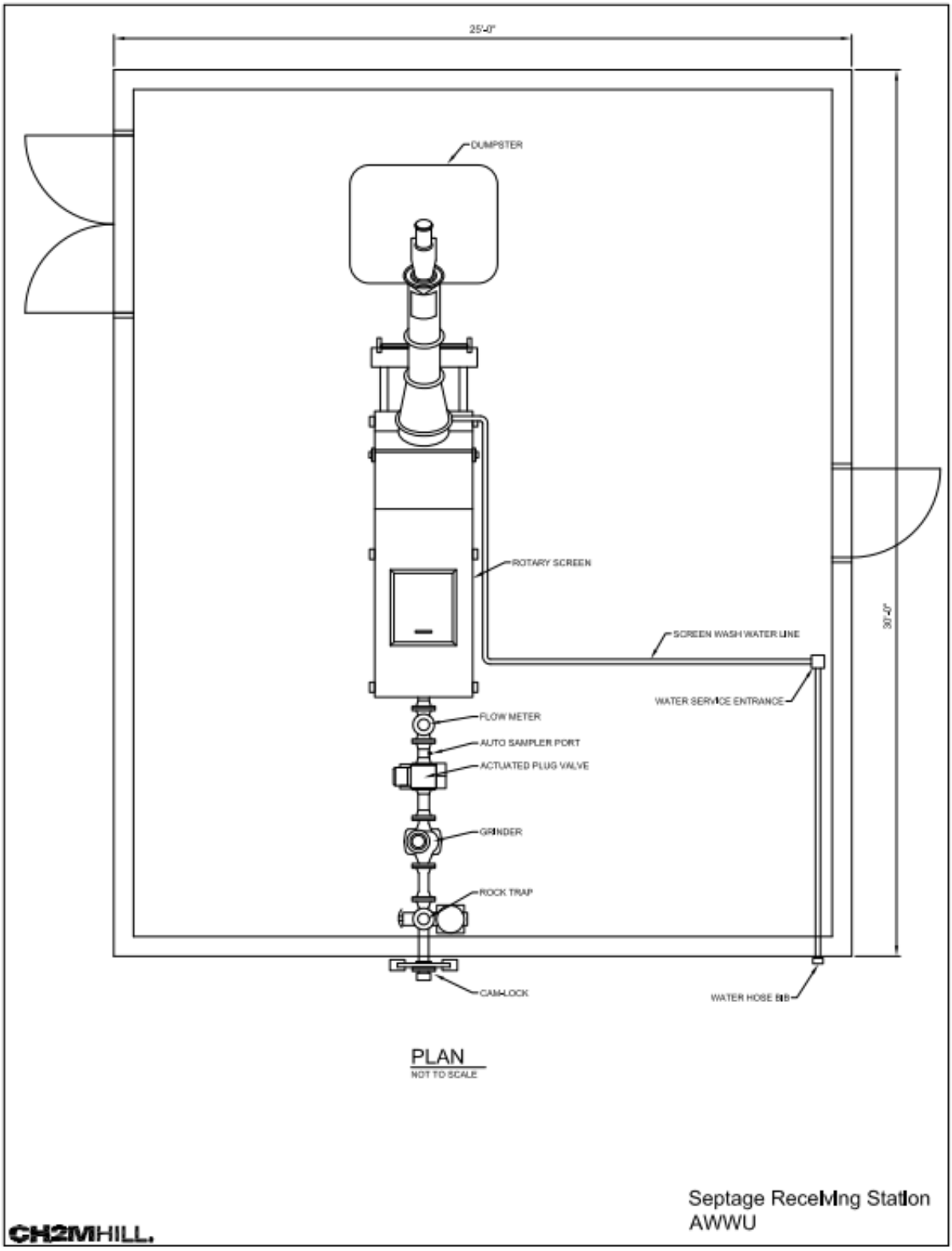


Figure 2: Concept Drawing of Septage Station Floor Plan

3.0 HYDRAULIC DESIGN

3.1 Population

AWWU septage receiving stations service the Municipality of Anchorage and the Matanuska-Susitna Borough. The population of interest is only the Municipality of Anchorage. The projected population was used to determine the septage flow projection. A 20-year design life was used to determine projected values.

The population projections for year 2037 were determined from the 2014 Anchorage Wastewater Master Plan. The master plan was utilized in this report because their population projections were developed using the year 2000 Census data. Between years 2010 and 2033, the MOA recorded population with sewer served by AWWU and the total population. The difference between the served by AWWU and not served reflected the number of people with hauled truck service. The hauled service population was required to calculate septage volume hauled to the receiving stations. A best-fit line between the two years provided 2037's projected population to have hauled service. Please see Appendix A for more details.

Table A. MOA and AWWU Served Populations

Population	Municipality of Anchorage	Anchorage Bowl	Northern Communities	Girdwood
2010				
Total	291,826[1]	240,343	34,982	2,245
Served by AWWU Sewer	**233,271**	**213,471**	**17,716**	**2,084**
2033				
Total	351,003[1]	287,827	45,282	3,540
Served by AWWU Sewer	**287,490**	**258,776**	**25,353**	**3,361**

Note:
1. The MOA total exceeds the sum of the Anchorage Bowl, Northern Communities, and Girdwood because utilities other than AWWU provide sewer service within MOA boundaries and areas are served by on-site wastewater systems.

Figure 3: Table of MOA and AWWU Served Populations

3.2 Flow Projections

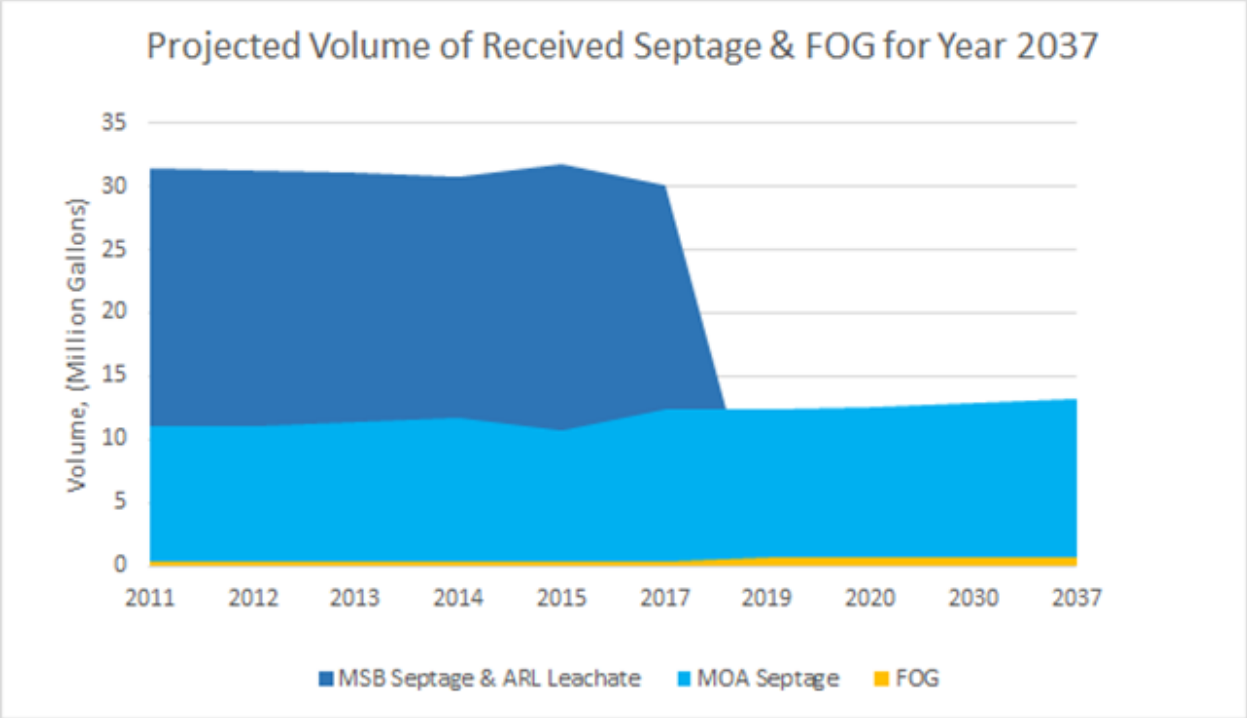


Figure 4: Graph of Projected Volume Received in 2037

Both of the receiving stations have flow meters that do not accurately track the truck's discharge. PortALogic Order Query receives the measured flow volumes. These volume calculations were utilized for the flow projections. The volumes from the flow meters are inaccurate but are the most reliable source to determine total yearly volumetric discharge of the MOA and MSB.

Considering the MSB is planning to build a septage receiving station by 2019, the total projected flow had to exclude their volumetric discharge. MSB's septage truck accumulation sources are uncertain so the yearly discharge volume quantity was extracted from HDR Alaska's study. The remaining quantity was used to determine year 2037's flow volume projection.

In table 1, each month's septage volume was extracted from the King Street location. The numbers were then factored equally to have a combined volume to approximately 13.27 million gallons annually. The month of July should have similar level of volume. This chart shows a lower volume likely due to small sample size of one year.

Table 1: Projected Flows for 2037

2037 Receiving quantity	Septage	Septage FOG	FSE FOG	Total FOG
	Gal.	Gal. per day		Gal.
January	676,859	196	1,795	61,700
February	626,474	182	1,795	55,300
March	784,050	227	1,795	62,700
April	1,141,632	331	1,795	63,800
May	1,382,175	401	1,795	68,100
June	1,400,995	406	1,795	66,000
July	1,141,929	331	1,795	65,900
August	1,575,272	457	1,795	69,800
September	1,475,474	428	1,795	66,700
October	1,413,074	410	1,795	68,300
November	940,189	273	1,795	62,000
December	699,663	203	1,795	61,900
Yearly	13,257,800	**117,100**	**655,200**	**772,000**

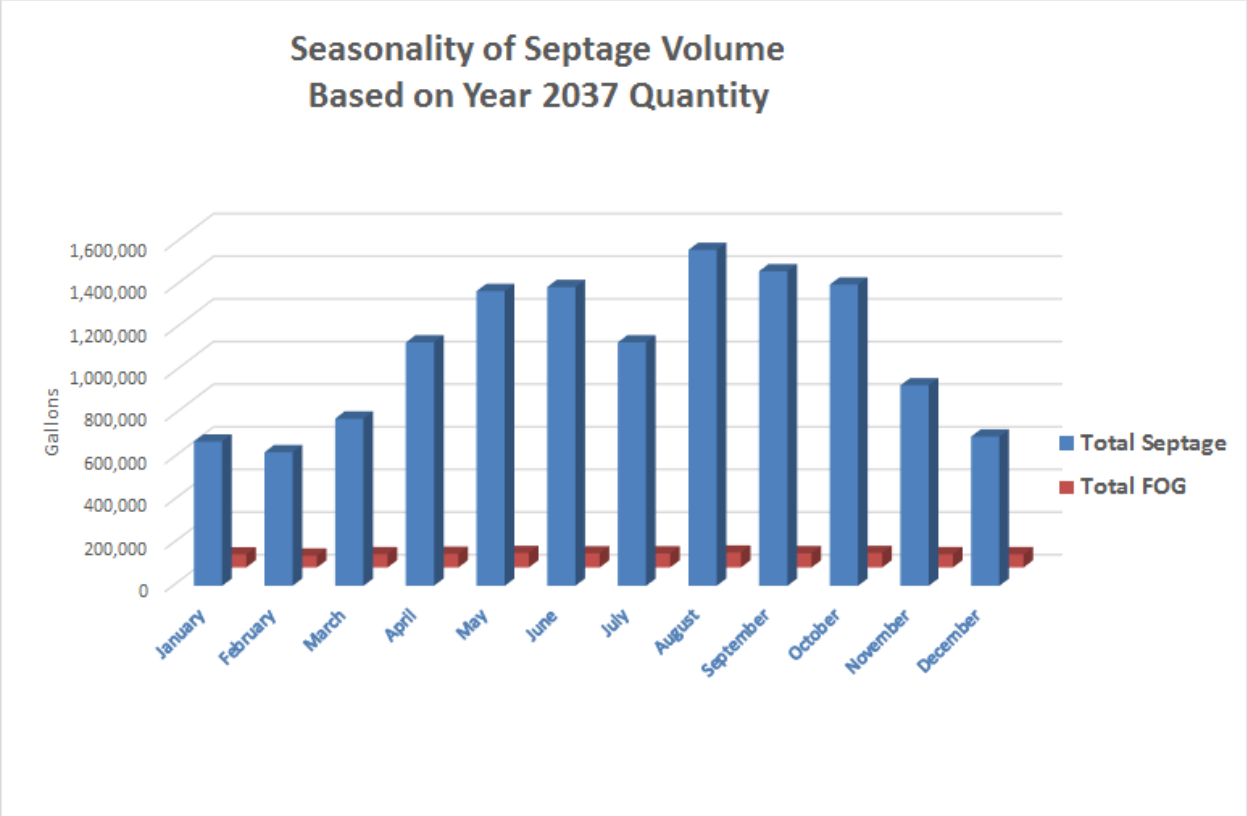


Figure 5: Graph of King Street Septage and FOG for 2037

3.3 Hydraulic Capacity of Influent Pipe

Hydraulic capacity of the sewer line must be capable of handling projected flow for 2037. The Manning Equation will be used to determine the cross sectional area that is filled during peak flow disposal from the receiving station. With an anticipated peak daily flow of 101 GPM, the existing 12 inch diameter pipe will fill up to a fifth of the diameter. Hence, there it is not necessary to replace the existing pipe up to the interceptor.

3.4 Process Design

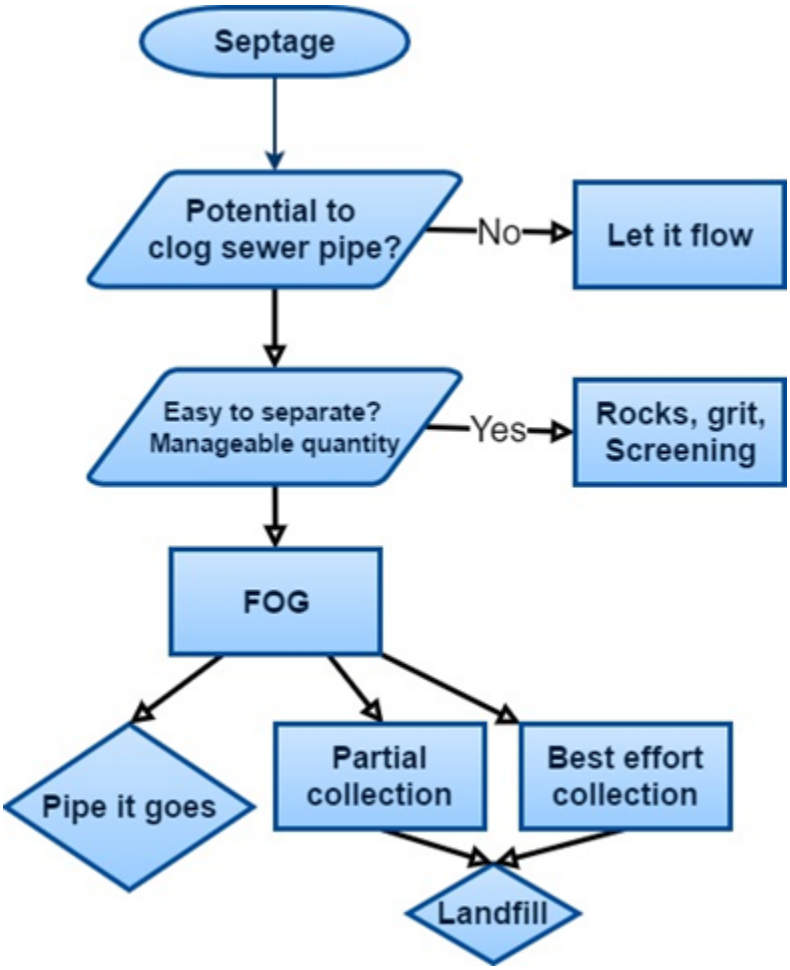


Figure 6: Procedure of Septage Handling

3.4.1 Fat, Oil, and Grease

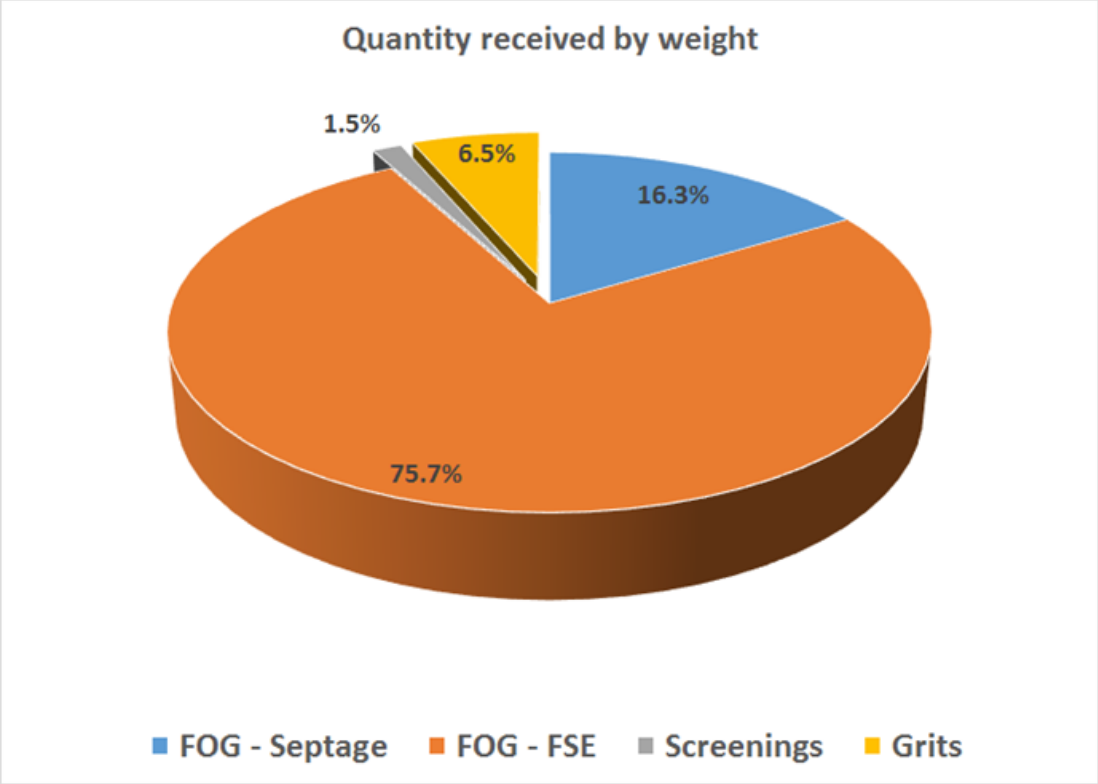


Figure 7: Quantitative Comparison of Problematic Factors

A. Characteristics
There are two types of FOG buildup that causes issues in sanitary sewer pipes. The following segment reviews the two types, and feasible options, which doesn't necessarily require removal.

From the study report, *Biodegradation of Fat, Oil, and Grease in Wet Wells*, the following excerpt is directly from the research study report:

> "For most of metal ions, the two pump stations had a similar metal profile and there was no obvious seasonal change in metal concentrations. The calcium by several studies that calcium can help the buildup of FOG layers (He et al., 2011; Keener et al., 2008) although there is no specific concentration level that is supposed to be beneficial for FOG layer formation. He et al. (2011) and Keener et al. (2008) proposed that the excess calcium present in FOG deposits might be partly caused by concrete corrosion. He et al. (2011) tried to form FOG deposit with calcium concentration of 50 mg/L to 750 mg/L and found that the resulting FOG deposit weight also increased. They also found that increasing levels of calcium led to higher calcium levels in FOG deposits, which could support the important role of calcium in FOG formation. Thus, methods to reduce calcium

concentration or restrict corrosion of concrete might mitigate FOG build-up in pump stations."

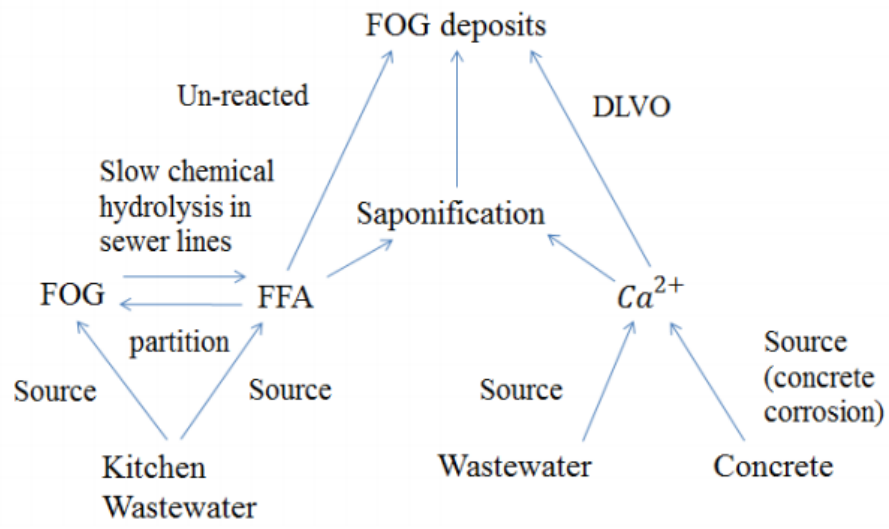


Figure 8: FOG Calcification

Based on this study report, the general idea is that FOG buildup has a yield strength range of 4 kPa to 34 kPa, depending on whether it is soft non-reacted or hard-calcified buildup. Hard calcification of FOG in the sewer system is partly to blame for SSOs.

B. Mechanical Separation
For design concepts 2 and 3 FOG will be mechanically removed, placed in garbage bins with 20-55% water content, and disposed directly at the landfill. This will bypass the pipe network completely offering least impact on the system and FOG loading at AWWTF. The main concern with this option is that it increases fire hazard rating.

C. Mutually Exclusive Options
Pipe Insulation Heating
Non-reacted FOG still contribute to the issue, the collector pipe sections between King street and AWWTF has a few vulnerabilities such as poor heating and insulation, according to the CRW study report, this causes temperature drops that narrows FOG collection in concentrated segments. The solution to this would be heat-trace the pipe network to find vulnerabilities and improve heating/insulation of such segments, oils such as corn oil and canola oil each solidifies at 12 and 14 degrees Fahrenheit, which would not be a concern. Peanut oil has a freezing temperature of 37 degrees Fahrenheit, mixed animal fat has freezing temperature range of around 40 degrees Fahrenheit, both are primary causes and the buildup of each can be sharply decreased if the pipe network is better protected.

Concrete Corrosion
A small grease removal chamber in the pre-fabricated receiving station could not

remove a high enough percentage of the FOG to make FOG the limiting factor in causing calcified build-up. Calcium metal ions flowing in the pipes are primarily a result of concrete pipe corrosion and soap containing calcium, the better way to reduce the amount of calcified buildup would be to avoid installing concrete sanitary sewer pipes, or even replace old concrete pipes, as the table below shows that cement pipes and various types of concrete pipes make up for more than half of the total pipes in service, and that the average age of service is about 45 years.

Table 3.2: Summary of Sewer Pipe Material Statistics[1]

Pipe Material	Pipe Diameter					Total Length (miles)	Average Age (years)
	less than 8"	8" - 10"	12" - 16"	18" - 24"	greater than 24"		
Acrylonitrile-Butadiene-Styrene (ABS)	0.00	0.53	0.00	0.00	0.00	0.53	40
Asbestos Cement (AC)	0.86	215.43	21.22	6.45	0.00	243.96	44
Concrete (CC)	0.00	0.01	0.00	1.66	1.18	2.84	45
Cast Iron (CI)	0.13	5.88	0.92	0.57	0.00	7.50	46
Cured in Place Pipe (CIPP)	0.00	2.22	1.44	1.43	0.07	5.16	4
Corrugated Metal (CMP)	0.00	0.01	0.36	1.34	2.78	4.49	40
Concrete (CN)	0.29	40.85	7.57	2.33	0.95	51.99	50
Ductile Iron (DI)	2.66	219.47	43.31	12.80	11.37	289.61	25
Concrete (FC)	0.00	0.00	0.00	0.00	0.88	0.88	42
Fiberglass Reinforced Pipe (FRP)	0.00	0.00	0.00	0.00	0.60	0.60	2
High Density Polyethylene (HDPE)	1.65	1.73	0.63	1.10	0.54	5.66	19
Polyvinyl Chloride (PVC)	0.03	0.01	0.10	0.00	0.00	0.14	9
Reinforced Concrete (RC)	0.00	0.00	0.01	11.23	22.90	34.14	40
Steel (ST)	0.00	0.00	0.00	0.22	0.04	0.27	37
Techite (TC)	0.00	0.15	0.00	0.00	0.00	0.15	42
Unknown	0.27	2.86	0.44	0.05	0.00	3.62	26
Vitrified Clay (VC)	0.01	1.50	0.98	0.00	0.01	2.50	63
Wood Stave	0.00	1.30	0.28	0.00	0.00	1.58	61

[1] Data from AWWU geographic information system (GIS) inventory

Figure 9: Table of Sewer Pipe Material Statistics

Bio Bricks.

However if both types of pipe network upgrade seem too costly, there is another alternative mutually exclusive solution involving biodegradation. There is a line of products on the market called bio bricks, a bio brick is a slow-dissolving block that contains high concentration of microorganisms that will latch onto the pipe walls and start digesting FOG particles. The same research study above had looked into bio bricks and had concluded that it works better the more FOG buildup there is. Nill effect is observed before FOG build-up reaches a certain thickness. See appendix for details on bio bricks and the study report.

3.4.2 Hot Water Injection

The current system has a magnetic flow meter, however it faces the issue of clogging up over time, which makes it less accurate than desired. The solution for this issue will be to implement a hot water injection point at the influent end of the septage receiving station before the magnetic flow meter. Pump and high pressure spray nozzle will also be installed inside the hot water will degrease and remove other particles that would collect in the system, to ensure the flow meter is accurate, and increase lifespan of the equipment.

3.4.3 Management & Accounting System

Of the alternatives, the top pick is to utilize a pre-fabricated septage receiving station. The top option for pre-fabricated septage receiving stations is Lakeside Raptor Septage Complete Plant (Model 40 SCP), which comes with an optional Raptor Acceptance Control System (RACS). The RACS has multiple functionalities including ground level septage hauler support, software that enables automatic data extraction at any discrete location on a PC as well as automatic accounting system and customer tracking, invoicing and report generation. The software would record date, gallons and waste type for each transaction, and it allows up to 5 different types of wastes each with different cost per gallon. Lastly, the RACS includes a magnetic flow meter of its own, which would be compatible with the software. There won't be a need to install a magnetic flow meter separately.

3.4.4 Grit Removal Component

The grit collection is done by an auger located along the bottom gutter of the main chamber of the Raptor septage receiving plant. The auger with its increased shaft diameter then dewaters the solids against a perforated stainless steel screen. Grit removal is estimated at 40% at 600 GPM, though it may vary.

3.4.5 Screening Removal Component

The screening removal component consists of a self cleaning bar rack with options for opening sizes, this design decided to go with 0.25 inch opening for optimal removal efficiency. Similar to grit removal, the collected screening is then dewatered and discharged by an auger into a separate bin.

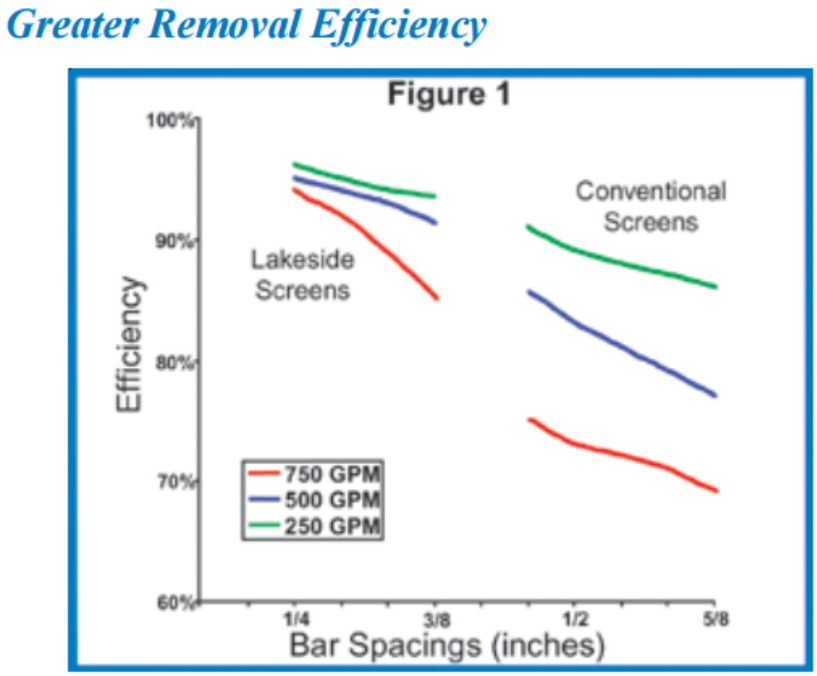


Figure 10: Lakeside Screens Removal Efficiency

3.4.6 Rock Trap

A rock trap will be attached to the system externally before the Raptor septage receiving plant, after flow meter, for the sake of protecting the equipment. The rock trap will have to be periodically manually emptied, to empty the rock trap no power tools will be involved.

3.5 Concept Design

3.5.1 Concept 1

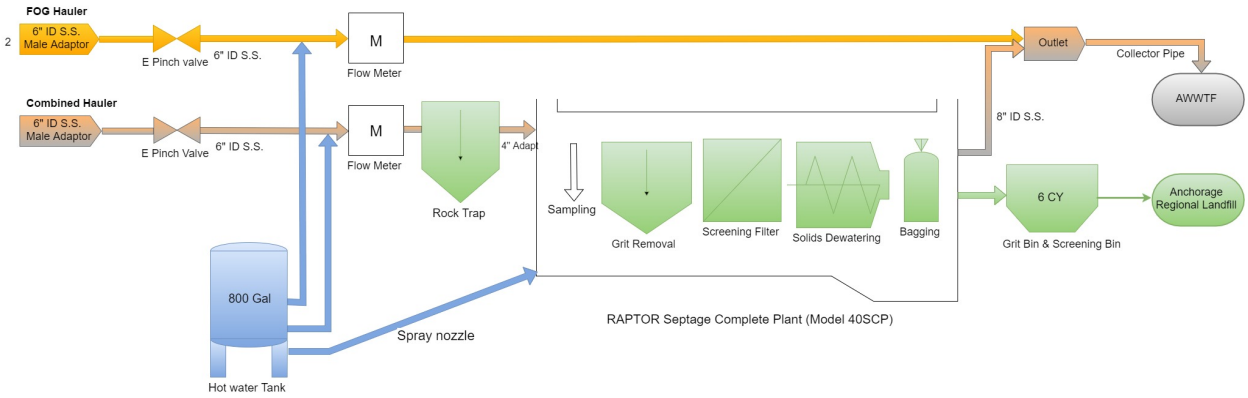


Figure 11: Concept 1 - FOG Dedicated Hauler Option

Concept 1 utilizes a Lakeside Raptor Septage Complete Plant Model 40SCP, which would come in pre-fabricated in a shipping container, complete with additional components on top of the base model. The station will have the following components: rock trap, grit removal, external flow meter, screening removing, solids dewatering and bagging, sampling, all electronics up to date to today's standard, for more details please see Appendix.

There will be two 6 cubic yard solid waste collection bins placed underneath the grit and screening drop-off chutes. The bins are to collect approximately 3.4 CY of combined solids during a typical peak week, and near 2 CY per week on average, and to be picked up by Waste Management weekly, at the rate of $500 per month combined.

A hot water tank of 800 gallon capacity will be installed to do have 3 duties, first it will be available for spray down station, in case there is a spill or a need to use hot water to maintain a clean septage receiving pad, a second purpose would be to periodically inject a fast stream of hot water to clean the flow meter, and lastly it would supply a spray nozzle system to clear out grease build-up inside the Raptor septage receiving plant.

In this design alternative, FOG would not be collected at the receiving station, it will be passed downstream and be taken care of at Asplund Wastewater Treatment Facility, since there is approximately five miles of large diameter collector pipe in between it should not cause a shock to the system at AWWTF.

3.5.2 Concept 2

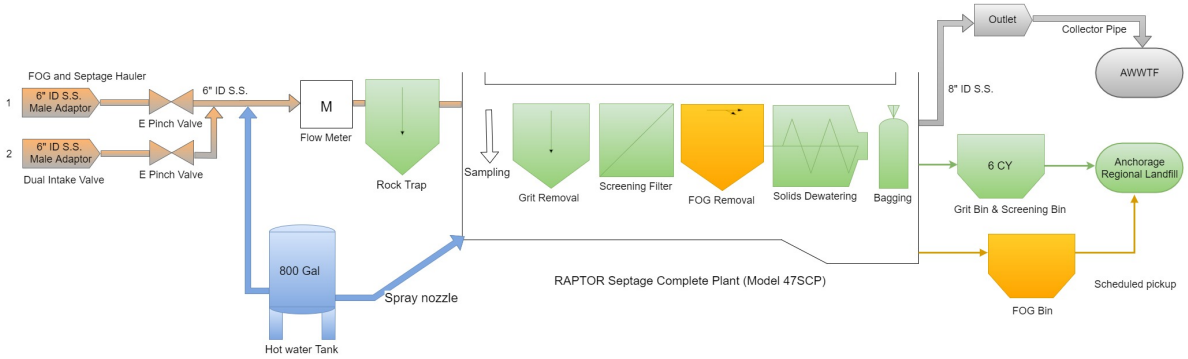


Figure 12: Concept 2 - Partial FOG Collection

This design concept is similar to concept 1, many processes are the same except that a higher capacity septage receiving station would be installed, and with more capabilities. The duplicate procedures will not be discussed here.

The main difference is that a FOG removal add-on would be included in the plant model 47SCP, and that approximately less than a half of the FOG received would be extracted, collected, stored, hauled, and disposed at the Anchorage Regional Landfill. The quantity of FOG is much greater than that of the grit and the screenings, which adds significantly to M&O cost. The storing of grease also increases the level of fire hazard requirement, which means non-combustible material should be used however the design concept 1 preferred material was already non-combustible, and that higher air changes per hour should be used, thus the design ACH is bumped up to 6, which also added to heating cost.

3.5.3 Concept 3

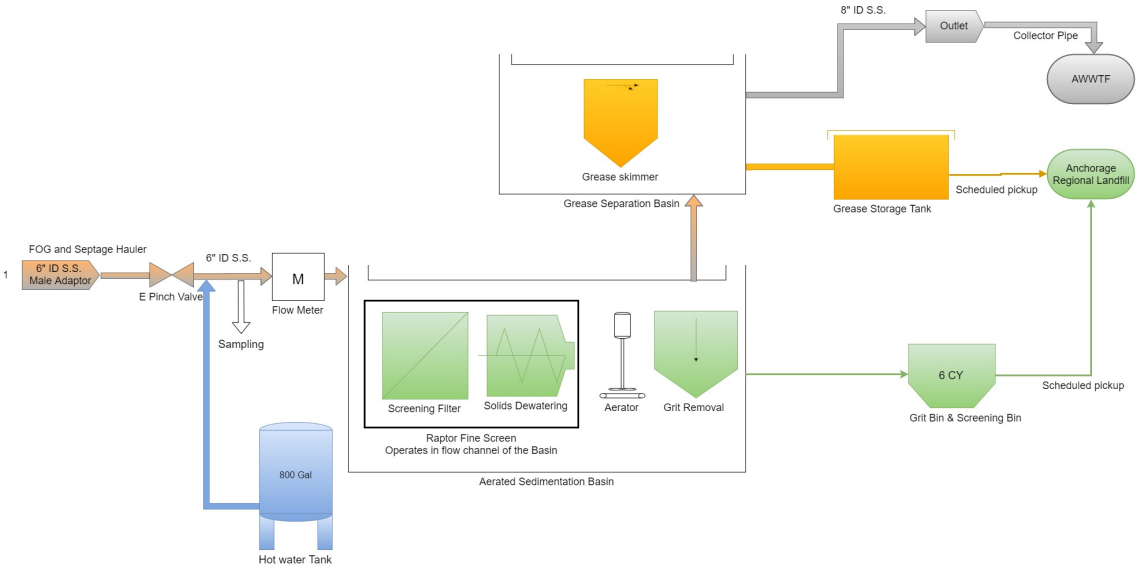


Figure 13: Concept 3 - Aerated Lagoon

Design concept 3 is aimed to improve on the shortcomings of concept 2. While concept 2 is space efficient, it does not have a desirable FOG removal efficiency. At 600 GPM and approximately 2700 Gallon volume, it would remove less than half of the FOG content in the stream. In a waste treatment facility, FOG removal efficiency is typically around 70%, lower bound at 50% and upper bound as high as 92%-95%. Therefore this design concept would include two treatment basins, connected in series. The first basin would have a Raptor Fine Screen that sits in an open channel at the start of the basin to catch screenings. It is a 5 foot diameter rotating drum self cleaning screenings filter with 0.25 inch openings, this is in place to make sure that equipment processes down the line do not get tangled with rags. The removal efficiency of the 0.25-inch opening screening filter is 95% at 600 GPM flow rate. The Fine Screen also has dewatering capabilities, then drop off the dewatered into a 6CY bin.

4.0 WASTE MANAGEMENT

4.1 FOG Projection

FOG projections for year 2037 were based on 13.27 million gallons (M-gal) annual receiving quantity. This estimate accounts for the restaurants in Anchorage that will be following regulation to collect their own grease and have it hauled to the King Street septage receiving station.

The number of restaurants and drinking places in the state of Alaska was 1383 in 2015 according to Restaurant.org. The number of food service establishments (FSEs) that will be served by the King Street septage receiving station is estimated to be 700. FOG production per restaurant varies significantly, at between 2.5 to 47 gallons per FSE per day per EPA journal. Due to the lack of actual data on average FOG production per FSE in Anchorage, the number of 20 gallons per day per FSE was used for the estimate, since most restaurants in Anchorage does not operate at the same capacity as for example a popular diner in Los Angeles.

After adjusting to an estimated 80% compliance and 23% growth in restaurants by 2037 based on direct proportionality to population projection, the amount of FOG received by this septage receiving station by 2037 should be similar to the following table.

Table 2: Projected Volumes of FOG, screenings, and grit

2037 Projected Quantity	Concentration	Average Day	Peak day	Peak week
	mg/L	Gal.		
Septage	-	36400	145600	458600
FOG total	-	2120	8480	26700
*Dry weight	mg/L	lbs		
FOG Non-FSE	-	2950	11800	37200
FOG total	-	16600	66600	209600
Screenings	903	270	1080	3400
Grits	3860	1170	4680	14700

4.2 Solids Holding and Disposal

The grit and screenings projections are derived by using the recommended design concentrations per EPA, based on the belief that the numbers are reliable and that it does not change over time. The concentrations in mg/L are then applied to the projected annual septage volume of 13.27 M-gal shown in earlier section, which in turn yielded the annual expected screenings and grit quantity in unit of pounds per year, per average day, peak day and peak week. The weights shown in the table below does not reflect percent removal nor include moisture content, it is only the quantity to be received by the station.

Based on a 95% removal rate at 750 GPM and 0.25-inch screen opening size (see Appendix B for efficiency chart offered by Lakeside).

Alaska Waste Management will be scheduled to pick up the collection of grit and screening on a weekly basis. The dumpster chosen to service the collection can hold up to 6 cubic yards worth of solids. It is anticipated that it will fill up to 5.8 cubic yards by 2037. Once full, the maintenance worker will apply a layer of lime to the top of the solids before driving the forklift through the bay door and replacing the filled dumpster with the empty one located on the west facing exterior wall of the building. Alaska Waste Management requires a service agreement from AWWU to handle the solid waste.

Water Content

High water content is undesirable in solids wastes, it adds to transport and disposal costs, as well as adding stress to the landfill making compaction difficult.

The screenings would generally require a solid content of 15% or more to pass the paint filter test, the Raptor septage receiving stations are rated to dewater to produce a 35% solids screening product, The grit will have a higher solids ratio of 90% solids by weight. The two types should be dewatered well above minimum requirement. If there is any trouble of meeting dewatering requirement within first year, then the manufacturers are responsible for failing to meet specs.

Vector Control

The municipal landfill would require practice of vector control on both septage receiving station end and their end. A 40 lb. bag of lime is to be dumped on top of the screenings and grit collections bin prior to hauling. It would be negotiated then to see if the prefabricated Raptor station's bagging attachment that automatically bags the solids can act as a replacement to using lime, as in many places in the lower 48s have already accepted the latter option. This is the only vector control to be performed on AWWU's end. The process utilizes chemicals to increase the pH of the wastes to a high level such that it kills rodents and microbes alike. The landfill after disposing of the wastes will be responsible for covering the wastes with dirt material at the end of each day, which is an act of attraction reduction vector control.

Table 3: Summary of Solid Wastes for 2037

Weekly pickup quantity	Lbs.	% Solid by mass	Sp. G	C-FT	CY
FOG Non-FSE	37,200	55	0.944	6312	23
FOG total	209,600	55	0.944	3558	132
Screenings	3400	65	1.4	39	1.4
Grits	14,700	90	2	118	4.4

5.0 BUILDING DESIGN

5.1 Floor Plan

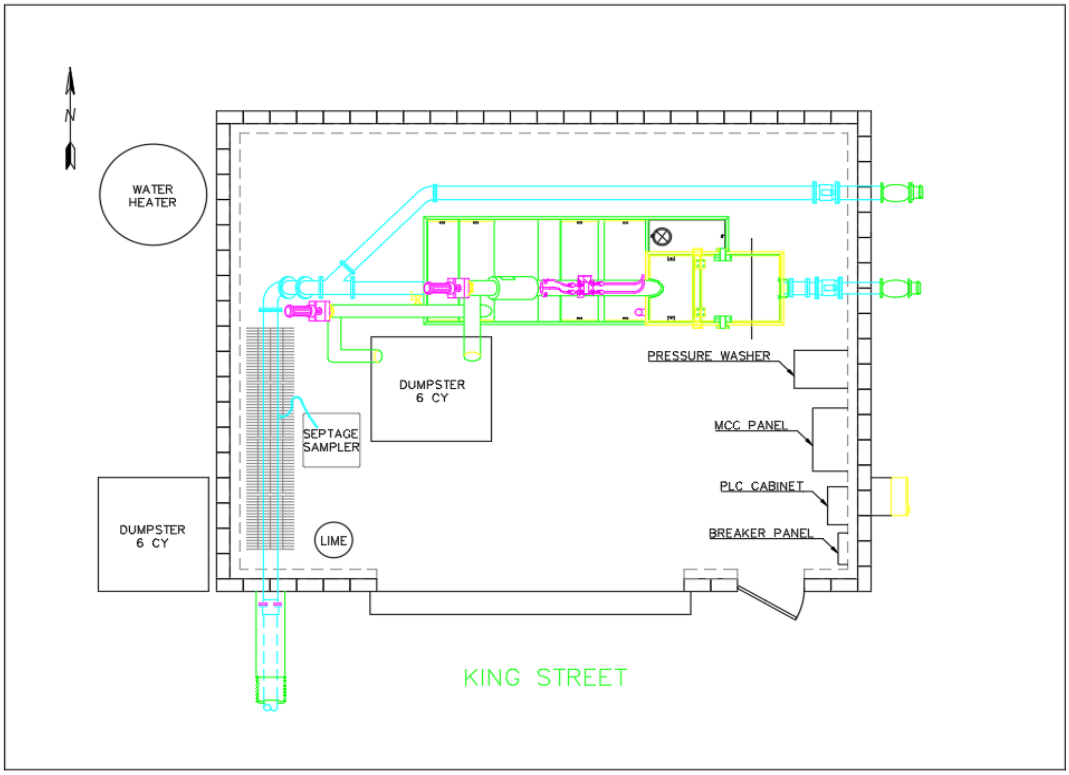


Figure 14: Proposed Floor Plan of King Street Septage Receiving Station Upgrade

The equipment space requirement determined the size of the building while also keeping the maximum space-efficiency in mind. Due to the spacing of the grit and screenings chute discharges, one of the chutes needs to be reconfigured so that they both dump into the 6 CY dumpsters. The Lakeside Raptor has an option for bagging the contents straight from the chute so that could be an alternative option. As shown in Figure 11 above, one of the chutes has been rotated so that the solids can be disposed into the dumpsters properly.

5.2 Roof

A recommended roof design would be a monoslope roof considering the entrance for the bay door would be on the south facing wall. The Raptor septage receiving plant, while partially in a trench, wills that still stand 17 feet above ground level.

5.3 Walls

The walls are recommended to be pre-fabricated 1” insulated panels, which are to be supported by steel frames. Since the building should be constructed out of anything but

timber, preferably non-combustible material over low combustible material, for the sake of one building design for all design alternative. A comparison between heating costs made metal frame building with 1” insulation a clear winner over typical masonry choices, since the inside of the building must be maintained at above freezing temperature to ensure the grits and screening bins which are stored for a solid week remain thawed, as well as making sure that components of the Raptor septage receiving plant does not freeze and clog due to freezing.

5.4 Bay Doors

The bay doors are recommended to be insulated and approximately 16’-5’’ wide, 11’ tall, and 3” wall thickness. The selected bay door requires a 14.5” head plate attached to the wall that hangs over the wall opening height. The purpose of the bay door is to allow a small forklift to come in and out to transfer 6CY garbage bins loaded and empty. For alternatives 2 and 3, which generate vastly larger volume of solids, thus requiring higher frequency of operator maintenance, this is even more essential.

5.5 Floors

The floor is recommended to be 6” reinforced concrete slabs. There is a longitudinal drain along the effluent pipe shown on the floor layout drawing.

5.6 Tap Into Water Line

The plan is to supply the receiving station with water by tapping into the existing water main. There is roughly 200’ of 12” diameter pipe required. Per detail provided.
Fire Hazard
In the National Fire Protection Association manual 820 on wastewater treatment facilities, the King Street septage receiving station design concept 1 would fall under unclassified building with reasonable distance away from other buildings. Design concept 1 is a waste stream processing location, with grit and screening collected and stored in the enclosed space, and FOG bypasses the station. This classification warrants for non-combustible material, low combustible material, and low flame spread material to be used for the building material, as well as basic accessible gadgets such as a fire extinguisher on site, as well as flame detector.
Being an unclassified category fire hazard building, it means that there are no air changes per hour requirement for design concept 1. The cost and heating estimate still is estimated for a 3 air changes per hour design, since AWWU would like to have odor control on site and that 3 ACH is typical for most buildings. For design concepts 2 and 3, with grease collected in the open the design calls for 6 air changes per hour, which explains the increased heating cost in the cost estimate section. However keep in mind that septage stream extracted FOG would still have a minimum of 20%-55% moisture content.

Figure 15: Aerial View of Existing Water Main

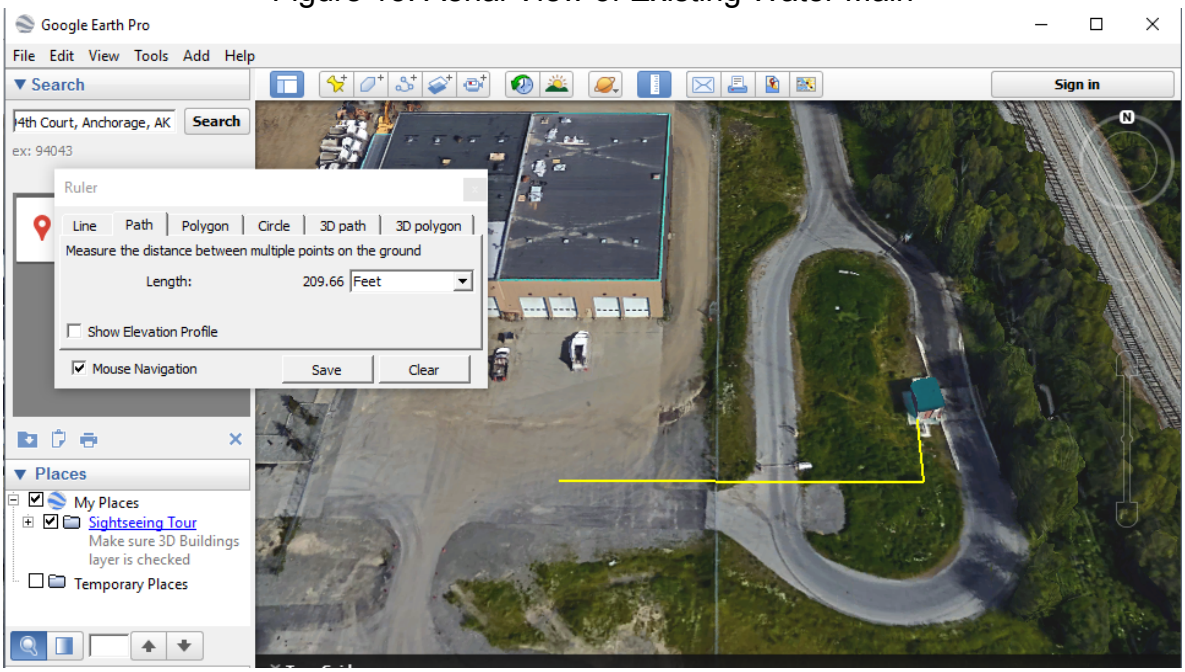


Figure 16: Estimated Tap Length Requirement

5.7 Additions to Existing

Along with the new Lakeside Raptor equipment, several other pieces of equipment will be added to the receiving station.

A pressure washer will be included to clean any spills. An indoor small pressure washer, such as the Landa EHW pressure washer, is recommended. The Landa EHW is 32" x 24" x 52", with a standard hose length of 50 feet, allowing for both indoor and outdoor washing. Refer to Appendix B for more information.

A water heater will be required to provide hot water for the hot water injection point at the end of the influent pipe. A large 1750-gallon water heater will be stored outside the building to give enough space inside the building for operation. An electrically powered water heater is recommended to avoid having to include a gas line.

A barrel of lime will include to the recommended design. A layer of lime will be sprinkled on top of the solid wastes in the dumpsters to help with stabilization, dewatering, and odor control. A standard barrel for containing lime will be used.
Refer to Figure 11 for recommended placement of these additional pieces of equipment.

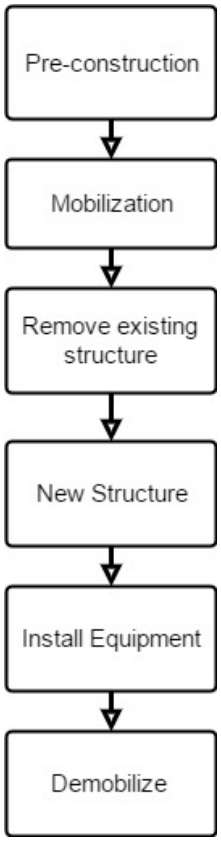
6.0 SITE PLAN

6.1 Building Location

The septage receiving station is located on King Street and 94th Ave in Anchorage, Alaska. It is located inside of AWWU maintenance and operations yard that makes it convenient in case there's an emergency, since personnel and equipment is no shortage. The location of King street septage receiving station is also close to the trunk collector pipe that transports sewage to AWWTF, for the next approximately 5 miles.

6.2 Walkway

A simple concrete walkway is recommended for transporting the solid waste to the dumpster for pick up. It will begin from the entrance of the bay door to the drive path where the dump truck will come to pick up the waste. The path will be 4 feet wide by 45 feet long. The walkway will be compliant with the ADA for safety and the concrete will meet MASS requirements.



6.3 Construction Plan

For the most part, the construction procedure of this project would be relatively simple. The major components are demolition, building a typical steel frame insulated building, then assemble the prefabricated equipment inside the building once it is complete. The individual components of the Raptor complete plant 40SCP and 47SCP models both would be able to be fit through the steel bay door, which is 11 foot tall. For the sake of simplicity, utilities upgrade section is under new structure, and that the prefabricated plant has electronics and SCADA included which saves a hassle when it comes to installation.

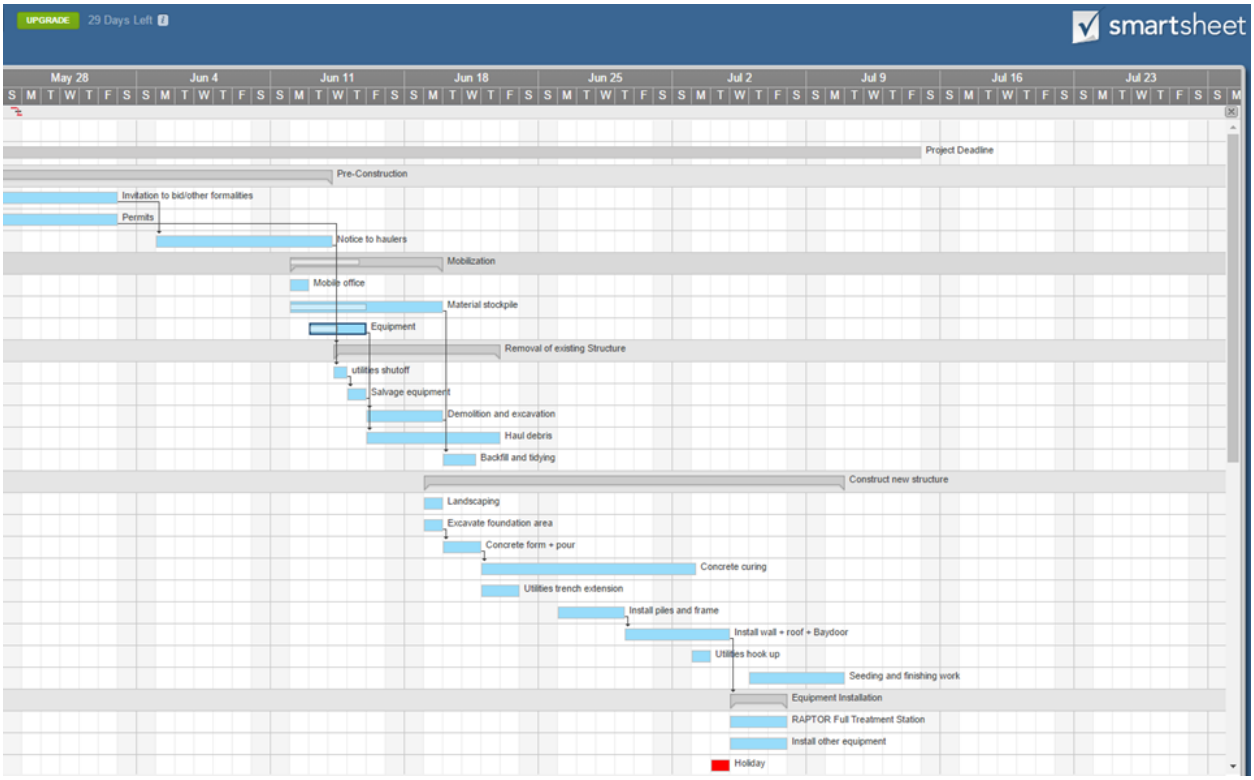


Figure 17: Gantt Critical Path Method Schedule

This cropped image is from a working Gantt critical path method schedule using Smartsheet.com, which goes into further detail of each phase of the construction process and how it should play out if the project was to be produced the way it is currently designed. The few critical paths to be noted are notice to haulers, equipment mobilization, utilities shutdown, demolition and hauling of debris, concrete pour and curing, structure construction, to finally equipment installation. The estimated time it takes from start of mobilization to project completion is 29 days, and pre-construction formalities and permitting would be much longer.

6.3.1 Station Operation During Construction

During the construction of the King Street septage receiving station, all septage haulers will be directed to use the Turpin Street location.

6.3.2 Excavation

Excavation area includes the footprint of existing building, the footprint of the new building, and utilities trench of 210 feet. The new building would require extra depth of excavation, since the Raptor complete septage receiving plant is designed to have its supports and part of its main body underneath floor level, to decrease building height requirement.

6.3.3 Construction

Construction material has to be composed of Non-combustible material; limited combustible material, and low flame spread material only for design concept 1, and non-combustible material for concept 2 and concept 3. The proposed material for the wall is prefab steel panel with 1" insulation.

7.0 PERMITS

A memorandum of understanding (MOU) will need to be established by and between the Anchorage Regional Landfill (ARL) and AWWU for the MOA.

An approval to construct must be obtained from Alaska Department of Environmental Conservation (ADEC). Plans must be submitted to an ADEC engineer for review for compliance with ADEC 18 AAC 72 wastewater regulations. Approval to Construct is granted once the plan is found to meet regulation requirements. The following documents are required to be submitted:

- Plan Intake Form
- A Plan Review Invoice with payment
- A completed Owner's Statement form
- Engineering plans sealed in accordance with 12 AAC 36. 185-26.245
    - Cover letter and/or engineer's report describing project, seal
    - Other supporting documents

A building safety permit must be obtained by the MOA, which will cover the following:

- Building code
- Plumbing code
- Mechanical code
- Electrical code

- Concrete code
- Fire code
- International building code

The following will be submitted to obtain the building permit:

- Full legal description of property
- Two copies of Soil Engineers reports and recommendations for new building and additions
- Three sets of complete construction plans
- Code study, including building construction type, occupancy, existing, and applicable code
- One set of engineering calculations and specifications for all commercial buildings
- Two copies of any previous agreements, clarifications, etc., when applicable
- Three certified plot plans stamped and signed by a professional land surveyor registered in the State of Alaska

For more details on permits please refer to Appendix E.

8.0 COST ESTIMATION

8.1 Direct Cost

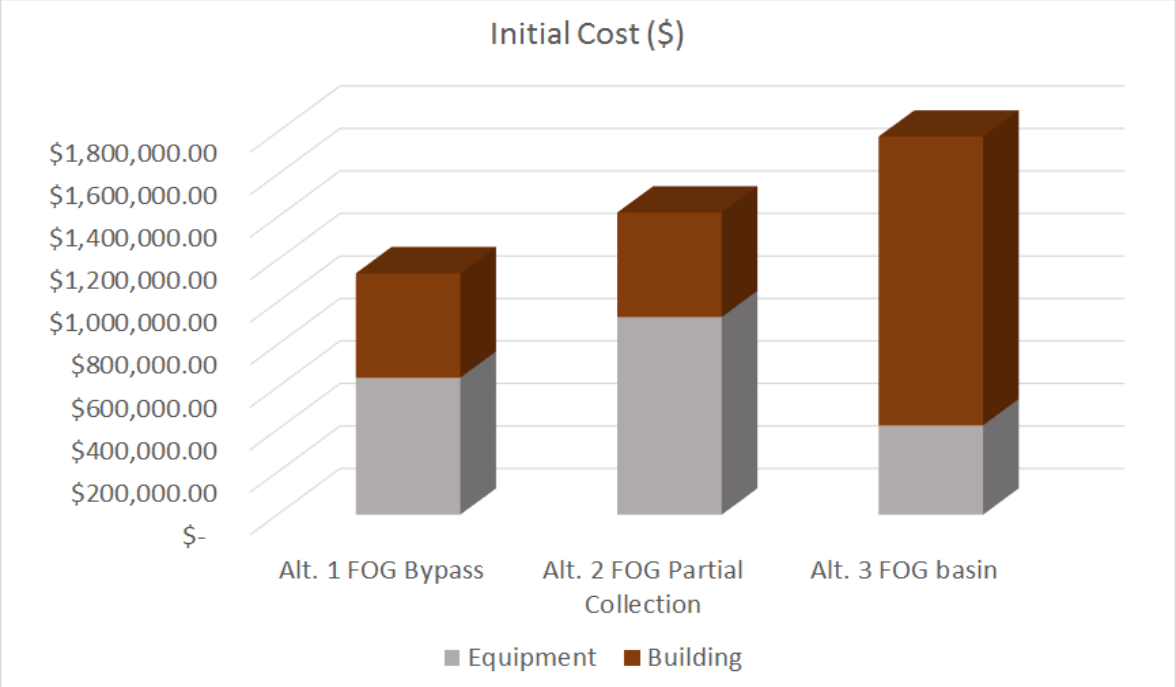


Figure 18: Graph of Initial Cost Comparisons

8.2 O&M Annual Cost

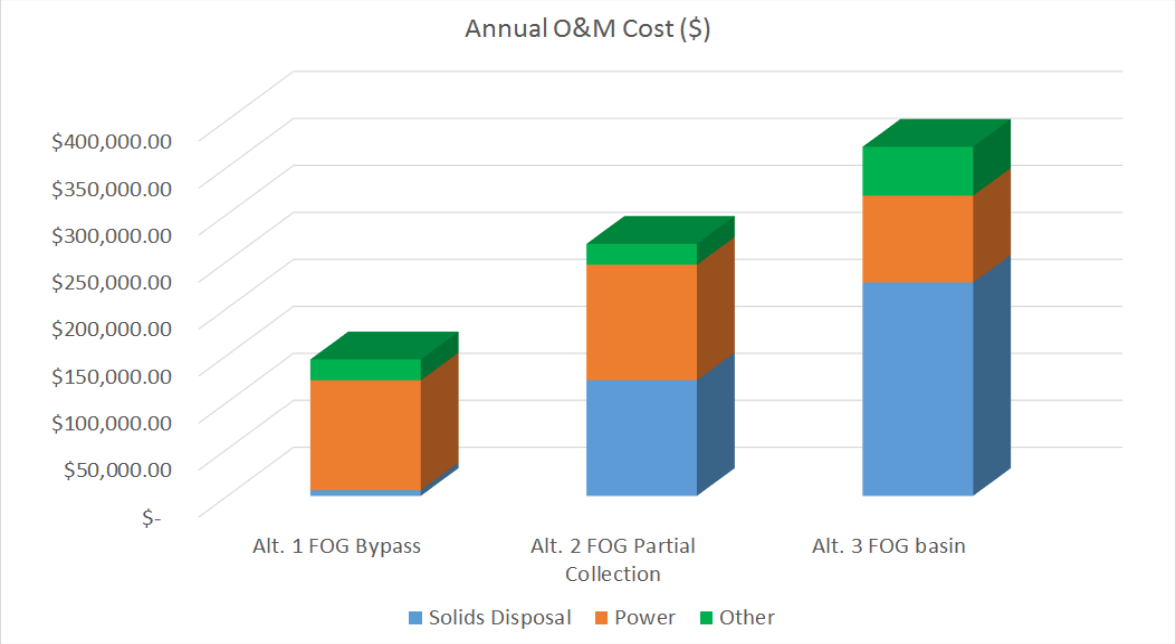


Figure 19: Graph of O&M Annual Cost Comparison

8.2.1 Heating

Above is an estimate on heat loss, which is based on the area of the components of the building, each with a different R/U value. The building is designed to maintain a temperature of 55 degrees Fahrenheit, which is adequate for keeping everything non-frozen, and makes it simple for maintenance crew and operator to make routine stops. A table of building heat loss values can be found in Appendix C.

8.2.2 Electricity

Since there was a lack of information on pre-made septage receiving stations, as well as industrial sized water heater for septage receiving station, the method used to derive cost of electricity was estimation of daily usage of each equipment and then applying the Anchorage electricity rate of 16.8 cents per kilowatt-hour. Further breakdown for each concept can be found in Appendix C.

8.2.3 Solids Removal

The DEC has requirements for solids disposal in municipal landfills, three categories of regulations particularly affects the King Street design project. First of all no PCB is allowed to be dumped, which are generally heat exchange fluids, this station will not have the capabilities to extract PCBs from its stream. PCB should not cause a direct issue for disposal, however it would not be recommended for septage haulers to accept

industrial chemical wastes. The second and third categories of concern are the water content and vector control of solid wastes. Total costs for solids removal can be found in Appendix C.

8.2.4 Levelized Cost, 20-year Design Life with Factored Time Value

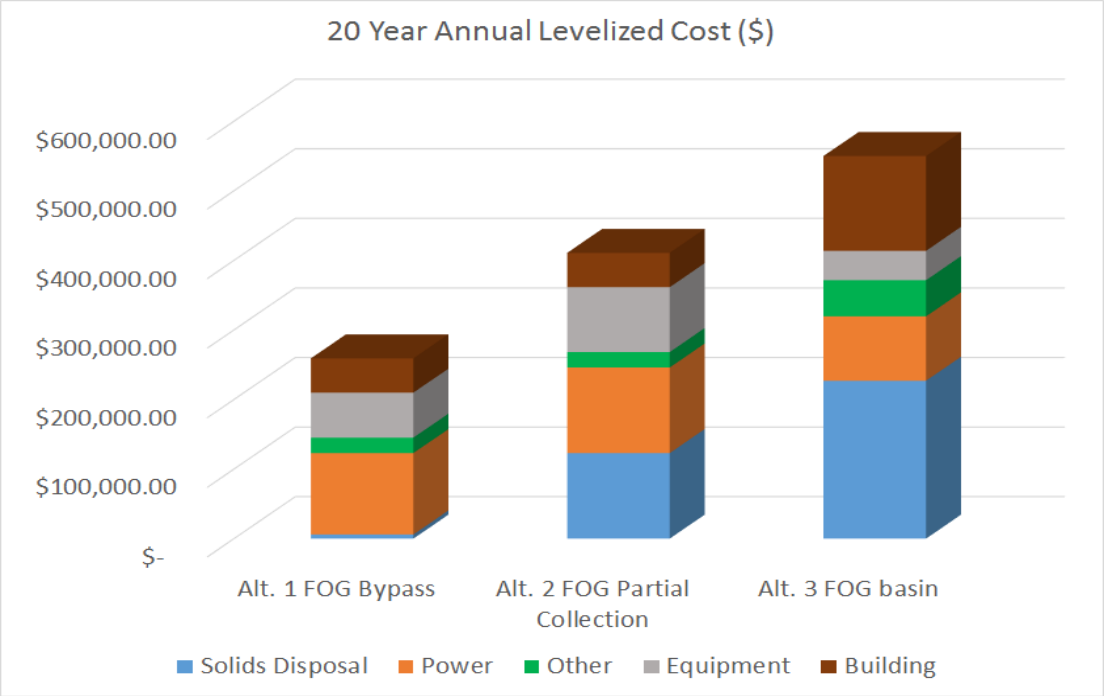


Figure 20: Graph of 20 Year Annual Levelized Cost

8.2.5 Comparison Including Emergency Cleaning Cost

The combined cost between Emergency SSO response cleaning and EPA fines amounts to approximately $920,000 a year, with restaurants discharging directly to a larger diameter pipe, a drastic drop in emergency cleaning cost is to be expected regardless of mechanical removal, since it takes much more to clog a large diameter pipe than it does a small diameter pipe. The further removal subsequently would reduce emergency cleaning costs, however all estimated percent reduction in cleaning cost with each alternative design concepts is highly speculative, and should only be taken as an interesting comparison rather than solid grounds to make decision off of.

The following graph shows that with an estimated 23%, 32%, 50%, and 20% (order from left to right) reduction in emergency cleaning cost shown in green, the status quo would likely be the cheapest option, however it does not account for other factors such as public health, possible reputation hindrance, and also damage to equipment by grits, rocks, screenings that are otherwise sent down the pipe.

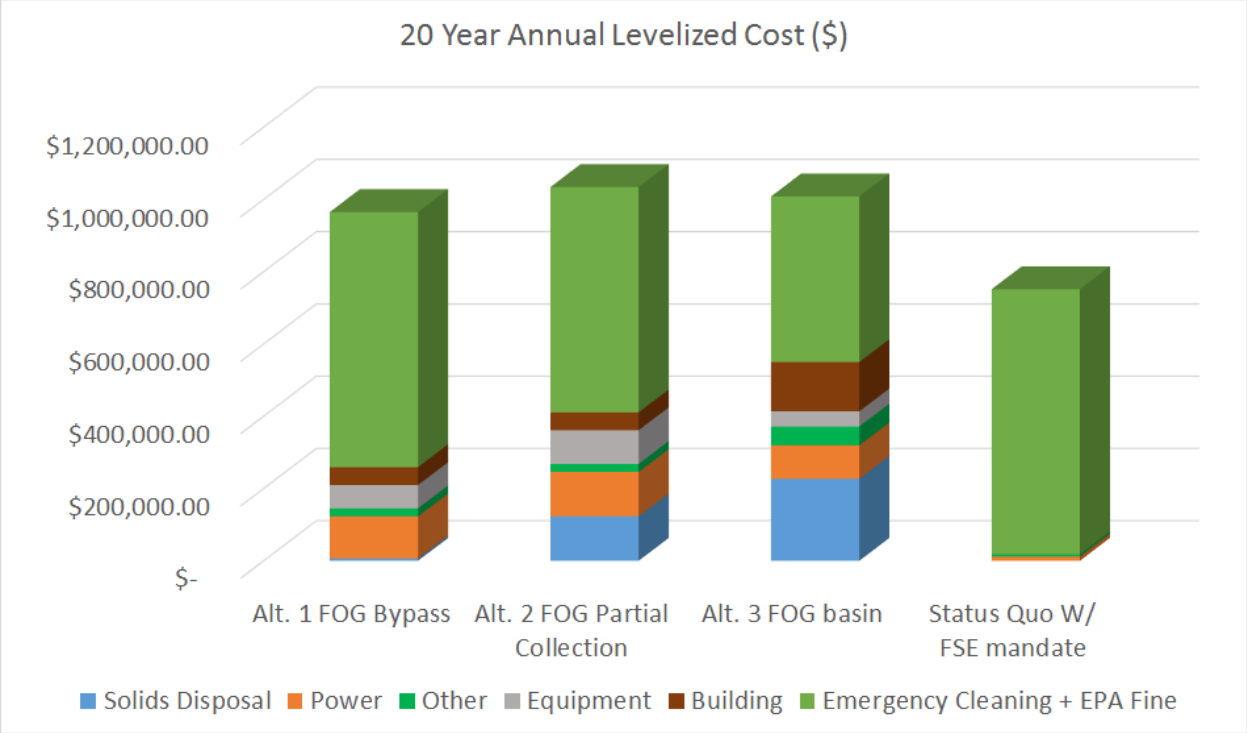


Figure 21: Graph of 20 Year Annual Levelized Cost vs. Status Quo

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Dehghani, M., Sadatjo, H., Maleknia, H., & Shamsedini, N. (2014). A Survey on the Removal Efficiency of Fat, Oil and Grease in Shiraz Municipal Wastewater Treatment Plant. *Jentashapir Journal of Health Research, 5(6). doi:10.17795/jjhr-26651*

APPENDIX A

Drawings and Diagrams

AWWU PLAN SET
No. N.A.

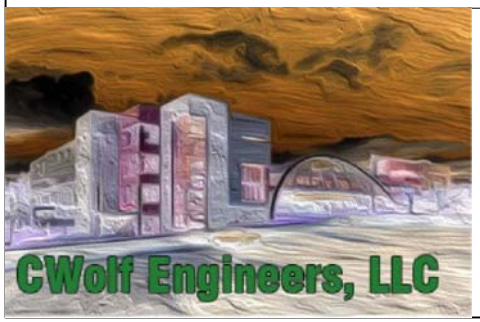
[INSERT VICINITY MAP]

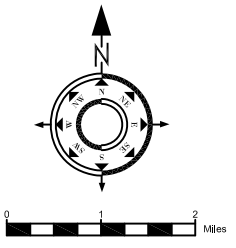
MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

HAULED WASTE DISPOSAL STATION

PROJECT IDENTIFICATION No. N/A

04/04/2017

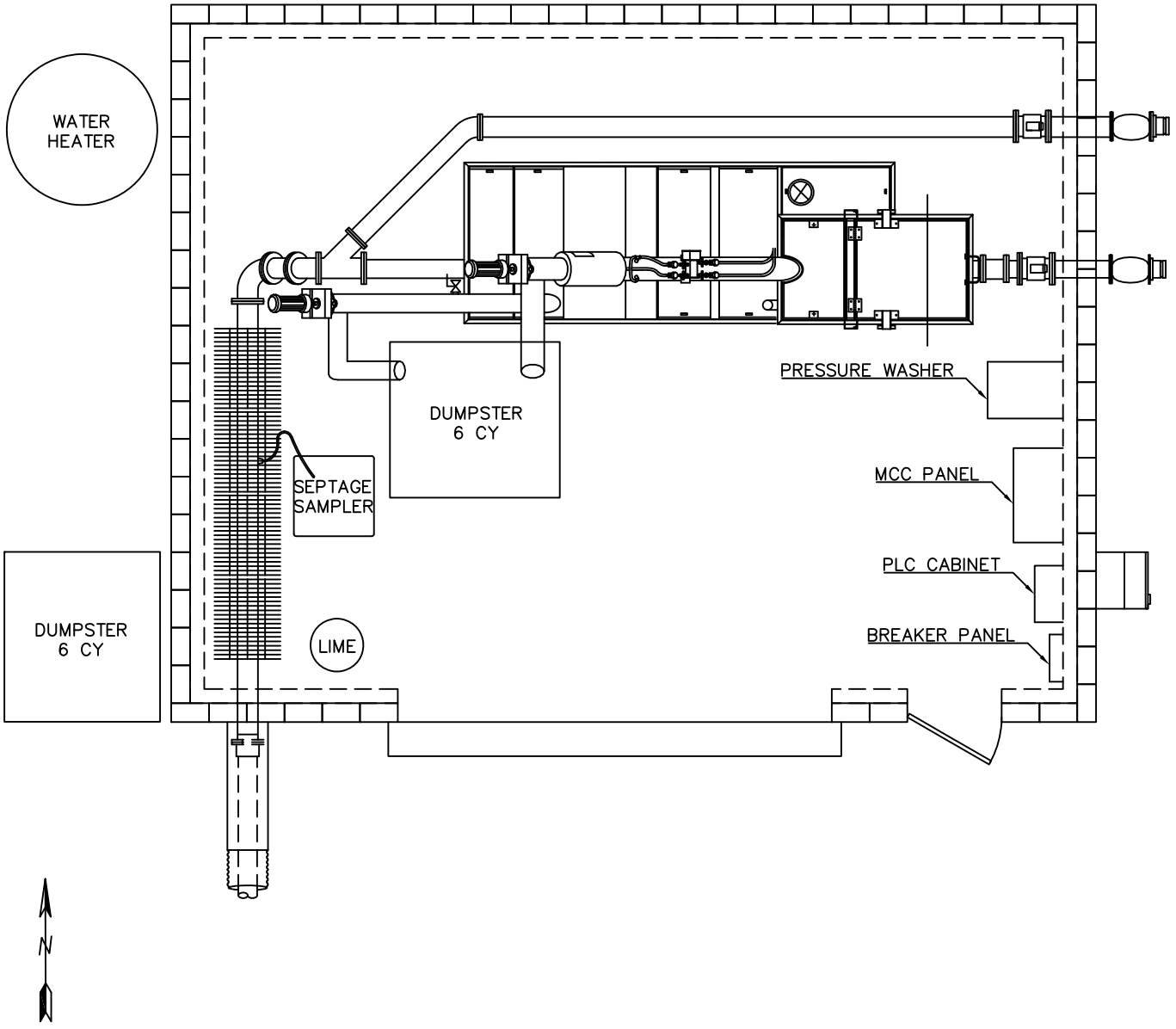




UNOFFICIAL GRAPHIC SCALE

SHEET INDEX	
NO.	SUBJECT
1	BUILDING DESIGN

PROJECT NAME: HAULED_WASTE_DISPOSAL_STATION
INVITATION TO BID No. N.A.
AWWU PROJECT ID. No. N.A.



2017_BUILDING_DESIGN.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

HAULED_WASTE_DISPOSAL_STATION

BUILDING_DESIGN

FLOOR_PLAN

REVISED	Date
DATE 04/2017	04/2017
	Scale NTS
	Sheet 1 of 1

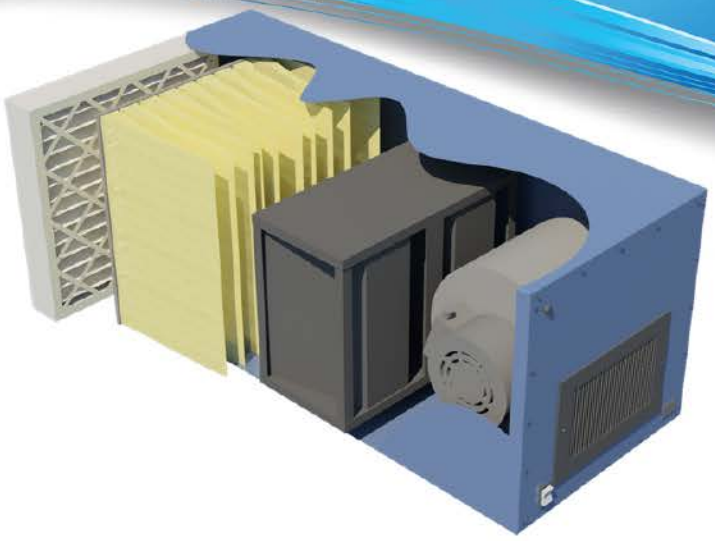
Appendix B

Mechanical Equipment

BLUE OX AIR CLEANERS

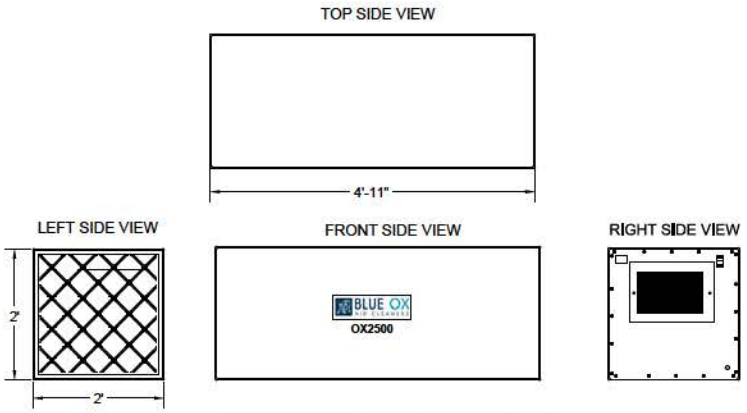
OX2500-CC Unit

2000 CFM Media Filtration System
¾ H.P. Direct Drive Fan



Featuring a straight through airflow, the Blue OX2500 utilizes high efficiency disposable filters which have been constructed from micro - glass fibers. The OX2500's housing is produced using 16 gauge Cold-Rolled steel, finished in a Polyester Powder Coating Paint. Each unit is a self-contained system and can be used individually for smaller operations or in groups for larger areas. This unit has a low air-flow-to-filter ratio that provides the highest efficiency and long filter life. Additional cabinet and filter options available. The CC Model also includes a 36 pound Carbon Canister for heavy odor control. A Three Year Warranty included on all parts besides filters.

Unit Specifications		Motor Specifications	
Air Flow Max	2000 CFM	**Motor Type**	PSC - Direct Drive
Ship Weight	200 lbs.	**H.P.**	¾ H.P.
Hang Weight	190 lbs.	**Volts**	115 V
Dimensions	24"W x 24"T x 59"L	**Amps**	10.2
Finish	Blue, Brown, Black	**Watts**	950W
Grill/Louver	4-Way Adjustable	**Noise Level**	62 dBA's @ 5'



OX2500-CC Accessories

Included Filters

- 24" x 24" x 4" - 35% Pleated Fiber Pre Filter
- 24" x 24" x 15" - 95% 8 Pocket Bag Filter
- 24" x 24" x 12" - 36 lb. Carbon Canister

Optional Filters

- 24" x 24" x 4" - Aluminum Mesh Pre Filter
  Washable and Reusable - Replaces Pleated
- 24" x 24" x 15" - 65% 8 Pocket Bag Filter
  Replaces 65% Bag Filter
- 24" x 24" x 15" - Oil Mist 8 pocket Bag Filter
  For Oil Mist Applications (65% / 95% Option)

Cabinet Options

- Silencer with Louver
  Reduces sound 6-8 decibels
- Silencer with Grille
  Reduces sound by 10-12 decibels
- Magnehelic Pressure Gauge
  Indicates when to change filters
- Eye-Bolts (4)
  Factory Installed Mounting Bolts
- Eye-Bolt Mounting Kit
  Includes Eye Bolts, Chain and Q-Links
- Duel L-Brackets
  Underside brackets for Wall Mounting
- Strut Channel
  Underside strut for Ceiling Mounting
- Drain Plug
  Oil/Mist application drain via Hose Barb
- Ultraviolet Light Bar Catalyst
  Kills airborne bacteria, mold and Viruses
- *Other options including different Motor Voltage available.*

info@aircleaningspecialists.com
Blue Ox is a Product of Air Cleaning Specialists, Inc.
(866) 455-2135
BlueOxAirCleaners.com

LAKESIDE EQUIPMENT CORPORATION
Water Purification Since 1928

1022 E. Devon Avenue | P.O. Box 8448 | Bartlett, IL 60103
T: 630-837-5640 | **F:** 630-837-5647 | **E:** sales@lakeside-equipment.com
www.lakeside-equipment.com

March 15, 2017

Budgetary Pricing

To: Tony Liang **From: James Aitkenhead**

Project: Unknown, Alaska
Septage Receiving Station

***RAPTOR*® Septage Complete Plant (Model 47SCP)**
With Dual Inlets
Unit Capacity – 1,000 gpm @ 3% Solids
47FS-0.25 Fine Screen

Unit Price: $455,000
Quantity: 1

Total Package Cost: $455,000

Items Included In Pricing:

Complete Plant
AISI 304 stainless steel construction
Tank assembly with vent
47FS Fine Screen (with 2 hp drive)
6-inch water-operated pinch type inlet valves (qty = 2)
8-inch horizontal grit screw (with 1 hp drive)
8-inch grit dewatering screw (with 2 hp drive)
Air header with diffusers
Screen and grit discharge chutes
External rock traps (qty = 2)
Anchor bolts (stainless steel)

Controls
Explosion proof design
NEMA 12 painted steel main control panel
NEMA 4/7/9 local control station
VFD (screen) and motor starters (grit screws)
Allen-Bradley MicroLogix 1100 PLC
Fusible disconnect switch with door handle
Transformer
Overload control monitors
Selector switches and indicator lights
Ultrasonic level sensor for screen

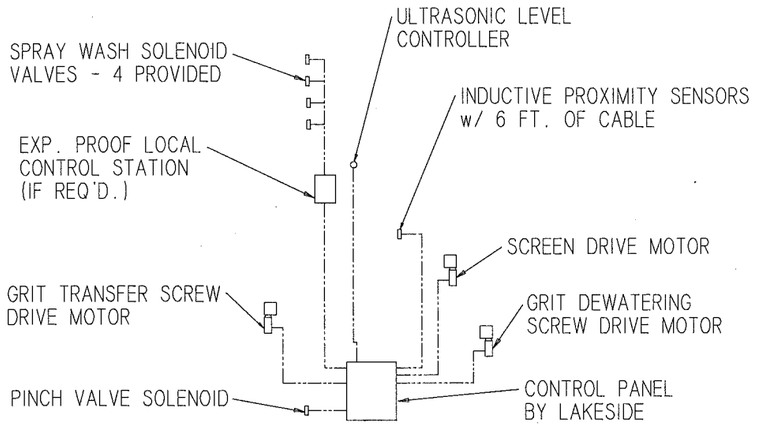
FOB:	Chariton, Iowa	Approvals:	6 to 8 weeks
Warranty:	One (1) year	Shipment after Approval:	26 to 29 weeks
Start-up service:	4 days in 2 trips	Shipping weight per unit:	12,000 lbs
Full freight allowed to job site		Installation Time per unit:	80 hours

Items Not Included In Budget Pricing:
Erection of equipment
Piping and valves
Access stairway or platform
Blower
Electrical conduit and wiring
Spare parts or special tools
Screenings and grit container

Optional Items:	**Unit Price:**
Bagger attachment (individual bagger design):	**$1,800 for screen & grit**
Blower package with 2.0 hp motor and fiberglass enclosure:	**$9,000**
RACS security access and flow measurement system:	**$56,000 ($28,000 per inlet)**
Automated invoicing system:	**$17,000**
Grease collection system:	**$60,000**

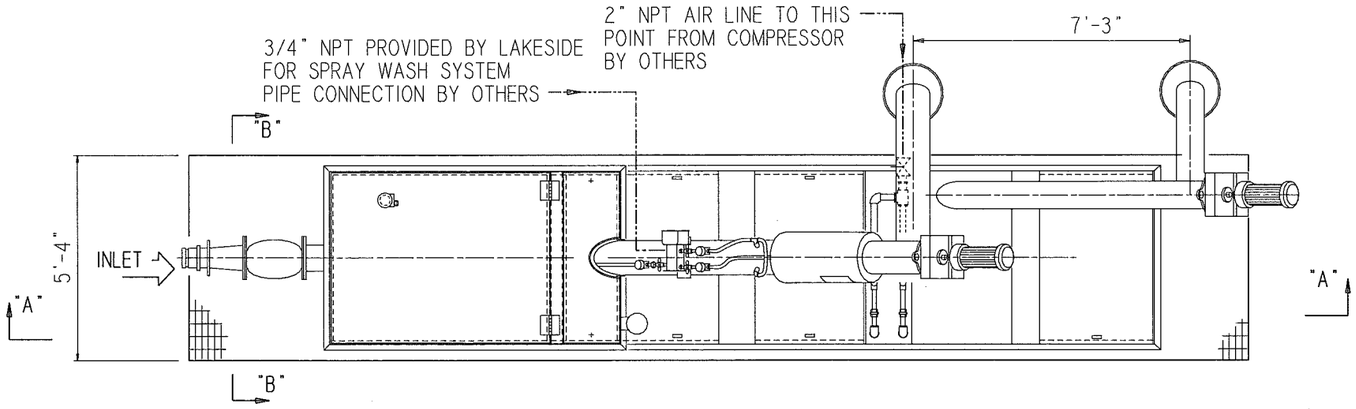
NOTE: Due to the current volatility of steel prices, budgetary cost of equipment may be subject to change.

James Aitkenhead (e-mail: jra@lakeside-equipment.com)

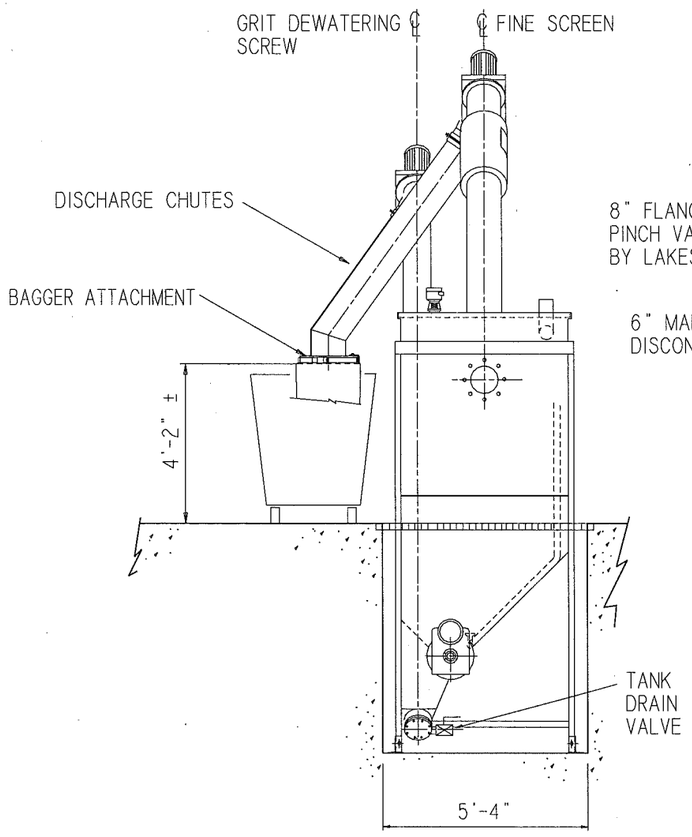


ELECTRICAL INTERCONNECTION DIAGRAM

ALL CONDUIT AND WIRE CONNECTIONS BETWEEN CONTROL PANEL AND SCREEN COMPONENTS BY OTHERS.

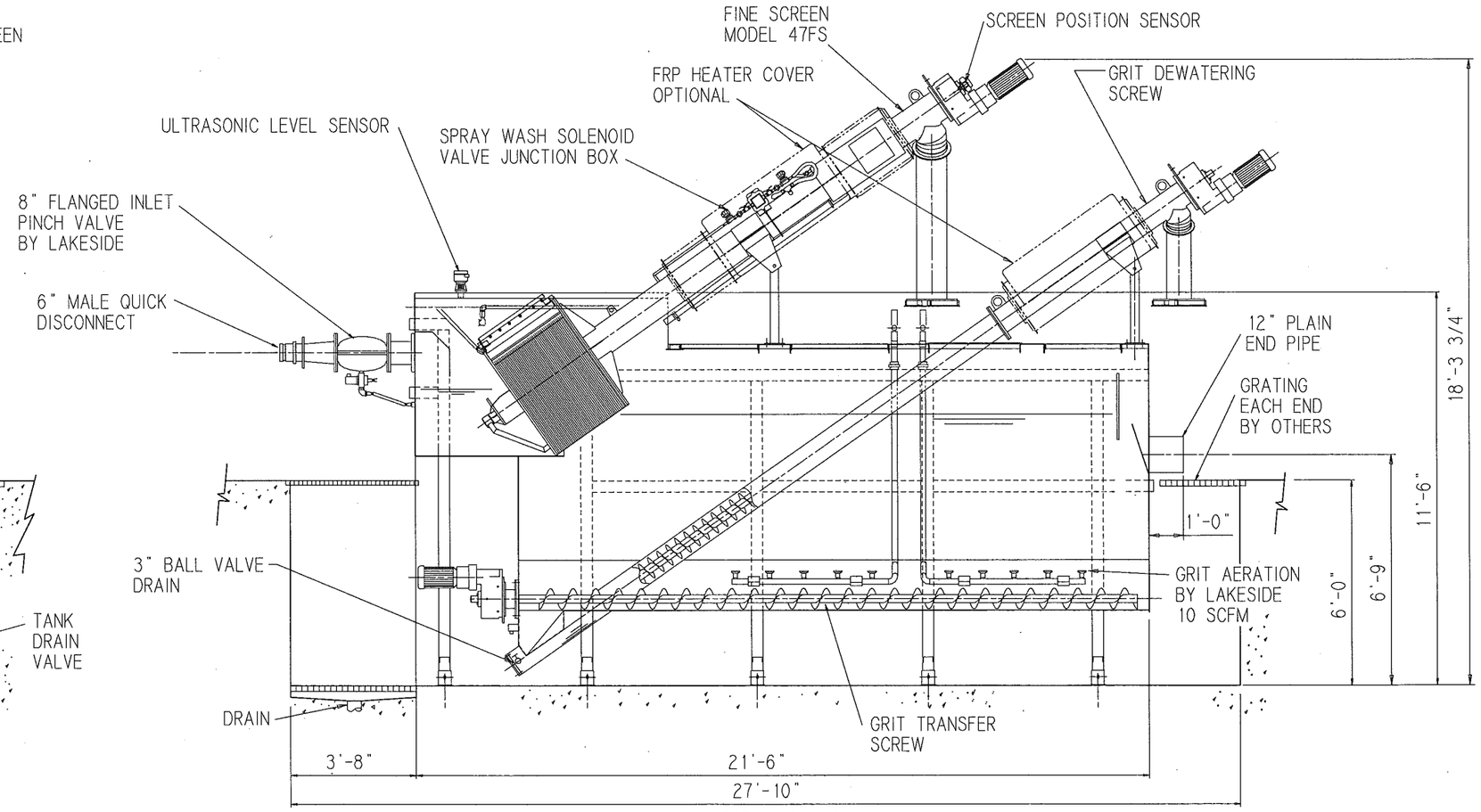


PLAN



VIEW "B-B"

MOTORIZED VALVE NOT SHOWN FOR CLARITY



SECTION "A-A"

REVISIONS	DATE	DR.	CHKD
REVISIONS	DATE	DR.	CHKD
REVISIONS	DATE	DR.	CHKD
A REVISED	03-02-06	GS	WWK
B REVISED	2-18-04	R.D.	
REVISIONS	DATE	DR.	CHKD

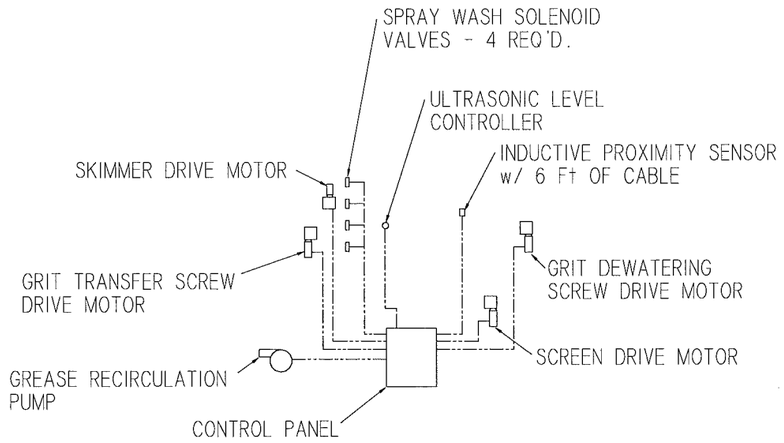
LAKESIDE EQUIPMENT CORPORATION

DR. SNYDER | DATE 4-30-93 | CHKD. | FILE NO. 250

RAPTOR® COMPLETE PLANT
MODEL 47CPSA

DWG. NO. D-48007-S | REV. C

ORIGINAL



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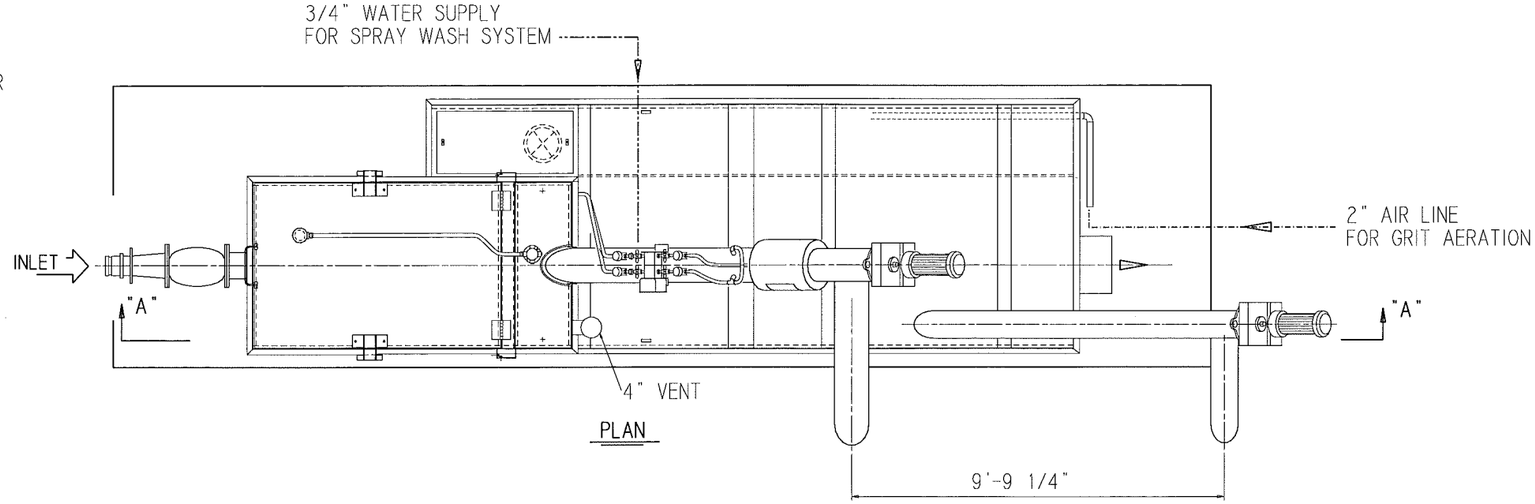
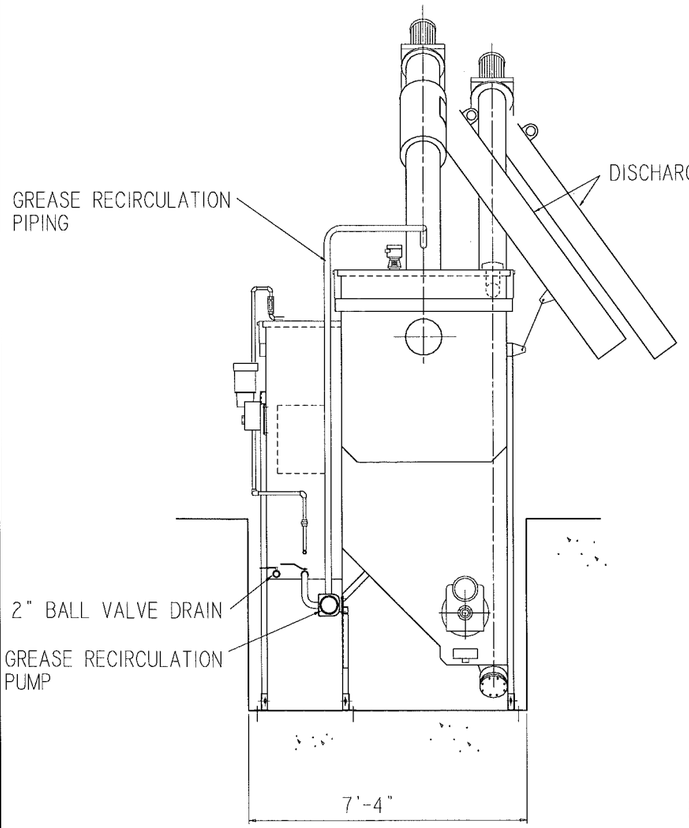
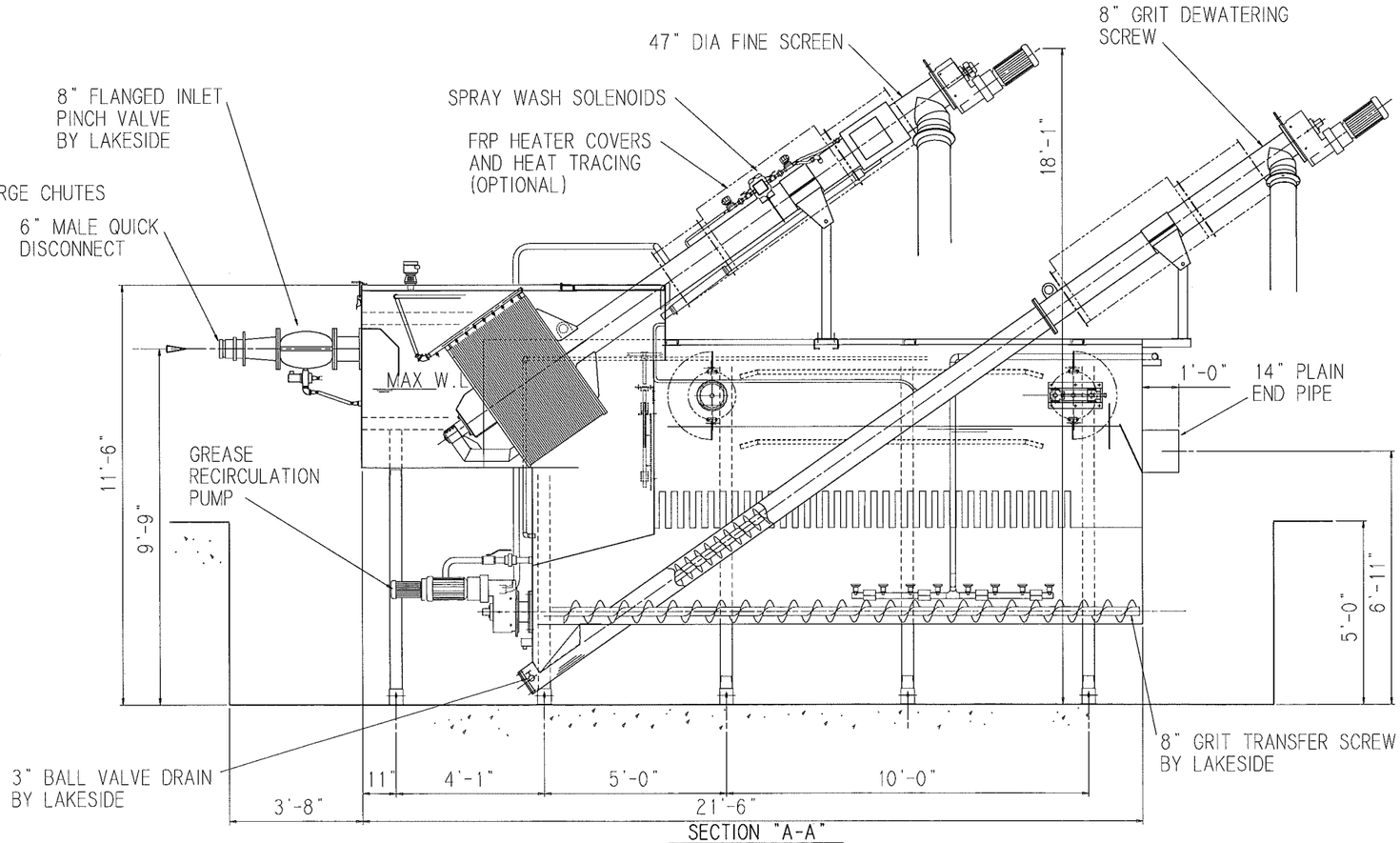


PLAN





SECTION "A-A"

REVISIONS	DATE	DR.	CHKD.	REVISIONS	DATE	DR.	CHKD.	REVISIONS	DATE	DR.	CHKD.	REVISIONS	DATE	DR.	CHKD.
												A REVISED	4-19-04	R.D.	

LAKESIDE EQUIPMENT CORPORATION | DR. SNYDER | DATE 4-30-92 | CHKD. | FILE NO. 250

RAPTOR® COMPLETE PLANT
MODEL 47CPSAG

DWG. NO. D-45746-S | REV. A

LAKESIDE EQUIPMENT CORPORATION
Water Purification Since 1928

1022 E. Devon Avenue | P.O. Box 8448 | Bartlett, IL 60103
T: 630-837-5640 | **F:** 630-837-5647 | **E:** sales@lakeside-equipment.com
www.lakeside-equipment.com

March 15, 2017

Budgetary Pricing

To: Tony Liang

From: James Aitkenhead

Project: Unknown, Alaska
Septage Receiving Station

***RAPTOR*® Septage Complete Plant (Model 40SCP)**

Unit Capacity - 700 gpm @ 3% Solids
40FS-0.25 Fine Screen

Unit Price:	**$364,000**
Quantity:	**1**
Total Package Cost:	**$364,000**

Items Included In Pricing:

Complete Plant
- AISI 304 stainless steel construction
- Tank assembly with vent
- 40FS Fine Screen (with 2 hp drive)
- 6-inch water-operated pinch type inlet valve
- 8-inch horizontal grit screw (with 1 hp drive)
- 8-inch grit dewatering screw (with 2 hp drive)
- Air header with diffusers
- Screen and grit discharge chutes
- External rock trap
- Anchor bolts (stainless steel)

Controls
- Explosion proof design
- NEMA 12 painted steel main control panel
- NEMA 4/7/9 local control station
- VFD (screen) and motor starters (grit screws)
- Allen-Bradley MicroLogix 1100 PLC
- Fusible disconnect switch with door handle
- Transformer
- Overload control monitors
- Selector switches and indicator lights
- Ultrasonic level sensor for screen

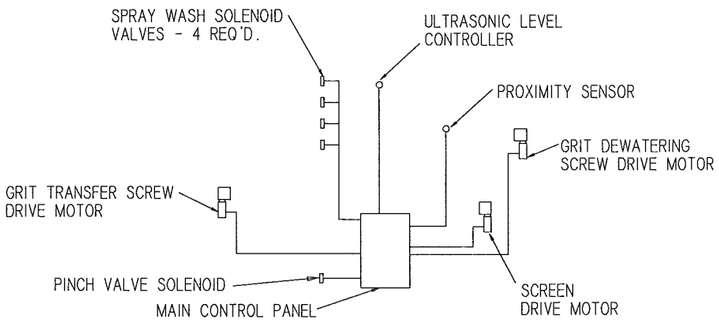
FOB:	Chariton, Iowa	Approvals:	6 to 8 weeks
Warranty:	One (1) year	Shipment after Approval:	26 to 29 weeks
Start-up service:	4 days in 2 trips	Shipping weight per unit:	9,000 lbs
Full freight allowed to job site		Installation Time per unit:	80 hours

Items Not Included In Budget Pricing:
- Erection of equipment
- Piping and valves
- Access stairway or platform
- Blower
- Electrical conduit and wiring
- Spare parts or special tools
- Screenings and grit container

Optional Items:	**Unit Price:**
Bagger attachment (individual bagger design):	**$1,800 for screen & grit**
Blower package with 2.0 hp motor and fiberglass enclosure:	**$9,000**
RACS security access and flow measurement system:	**$28,000**
Automated invoicing system:	**$17,000**
Grease collection system:	**$60,000**

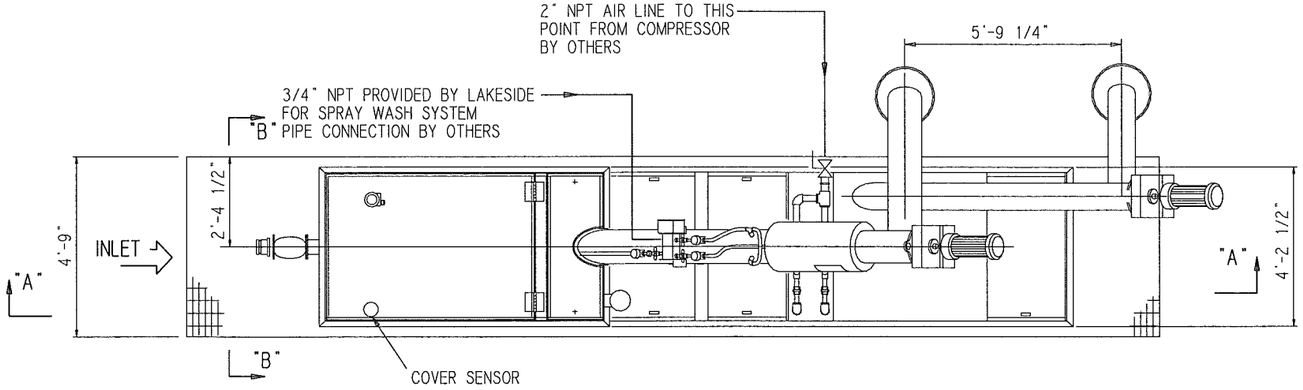
NOTE: Due to the current volatility of steel prices, budgetary cost of equipment may be subject to change.

James Aitkenhead (e-mail: jra@lakeside-equipment.com)



ELECTRICAL INTERCONNECTION DIAGRAM

ALL CONDUIT AND WIRE CONNECTIONS BETWEEN CONTROL PANEL AND SCREEN COMPONENTS BY OTHERS.



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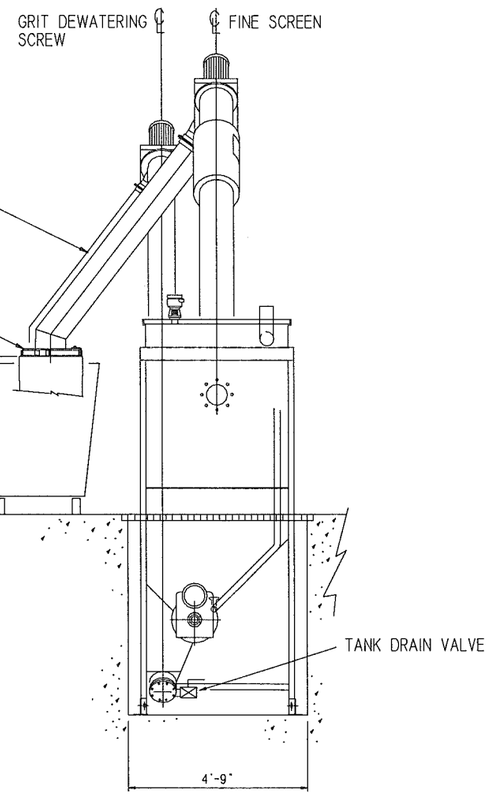
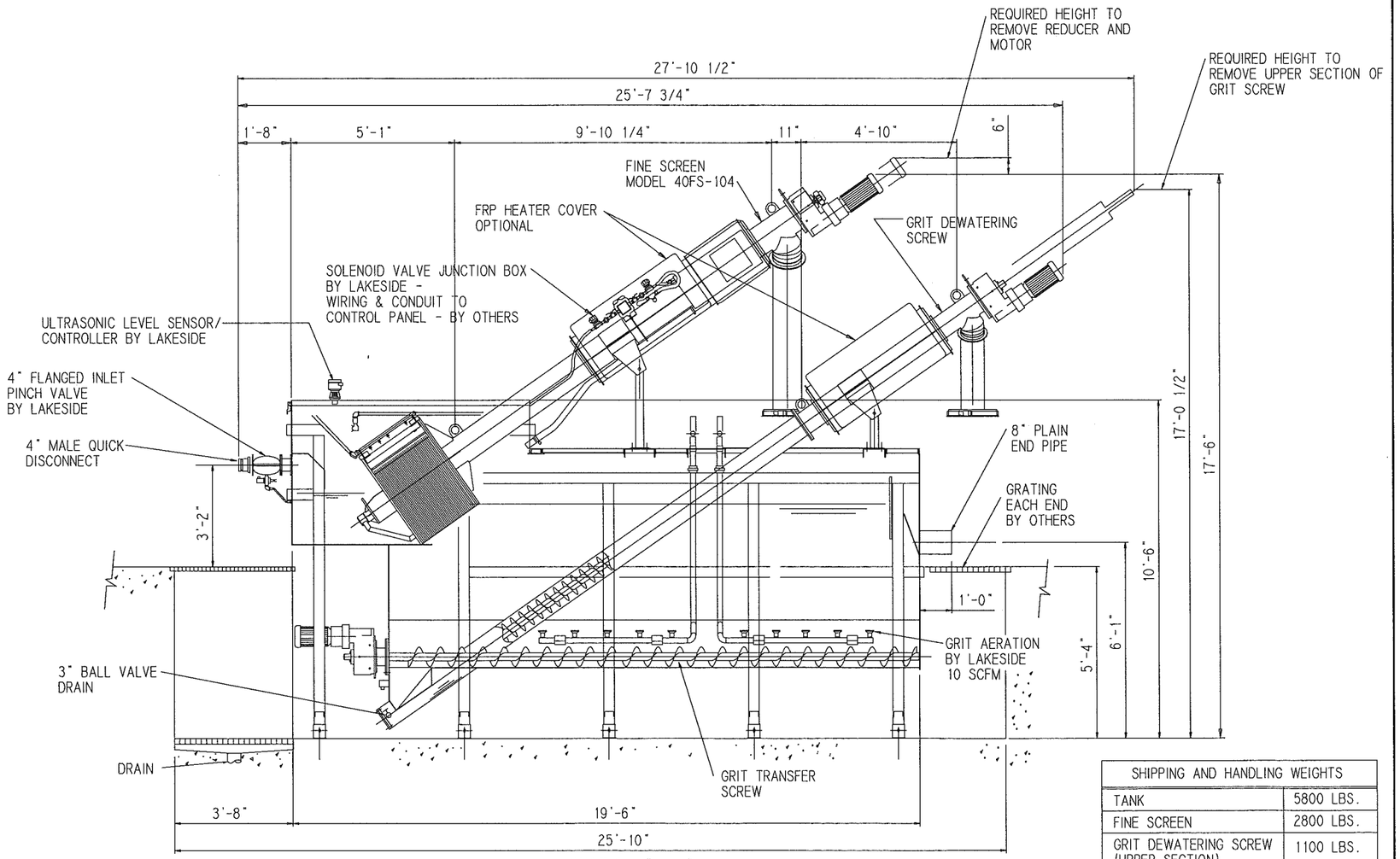


VIEW "B-B"

MOTORIZED VALVE NOT SHOWN FOR CLARITY



SECTION "A-A"

SHIPPING AND HANDLING WEIGHTS	
TANK	5800 LBS.
FINE SCREEN	2800 LBS.
GRIT DEWATERING SCREW (UPPER SECTION)	1100 LBS.

REVISIONS	DATE	DR.	CHKD.
A REVISED	4-11-06	RD	

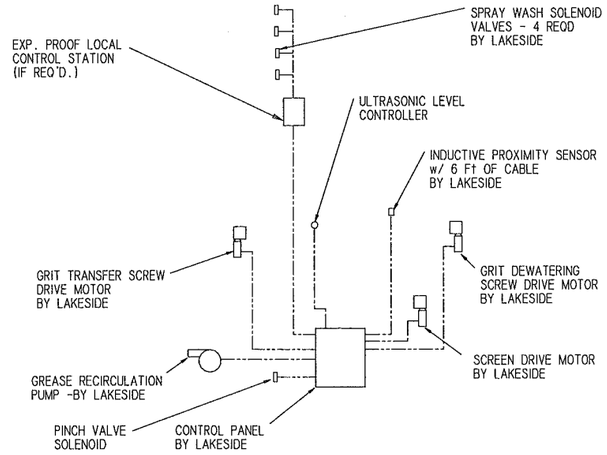
LAKESIDE EQUIPMENT CORPORATION

DR. SNYDER | DATE 4-30-93 | CHKD. | FILE NO. 250

RAPTOR® COMPLETE PLANT
MODEL 40CPSA

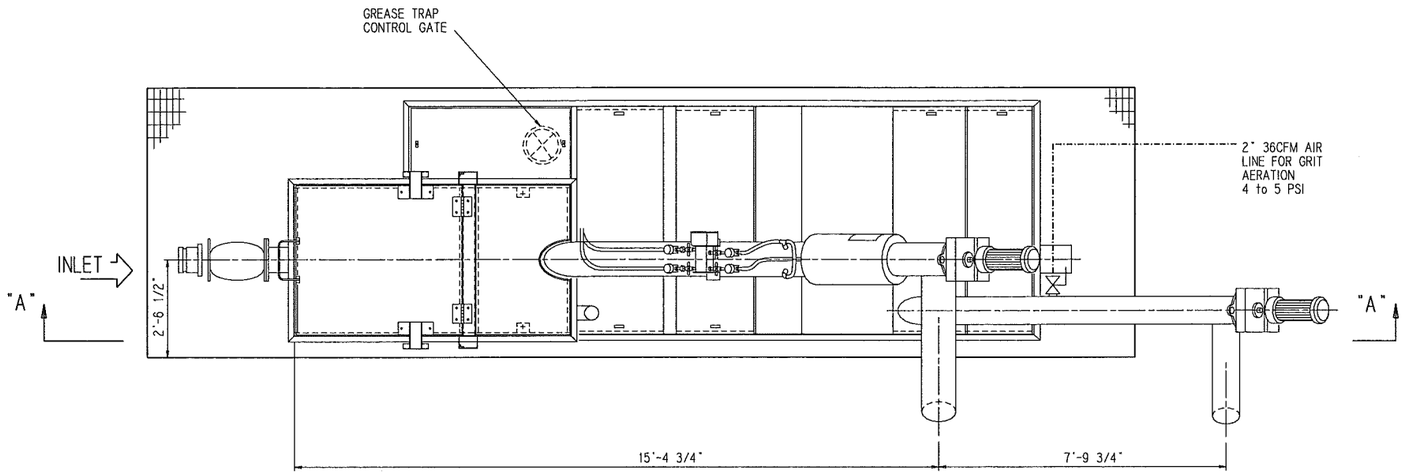
DWG. NO. D-47769-S | REV. E

ORIGINAL

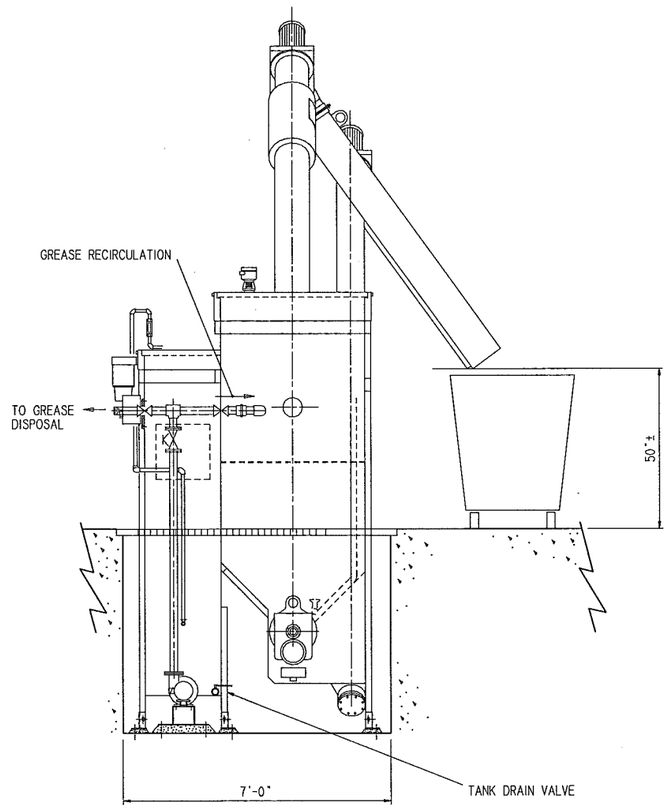


ELECTRICAL INTERCONNECTION DIAGRAM

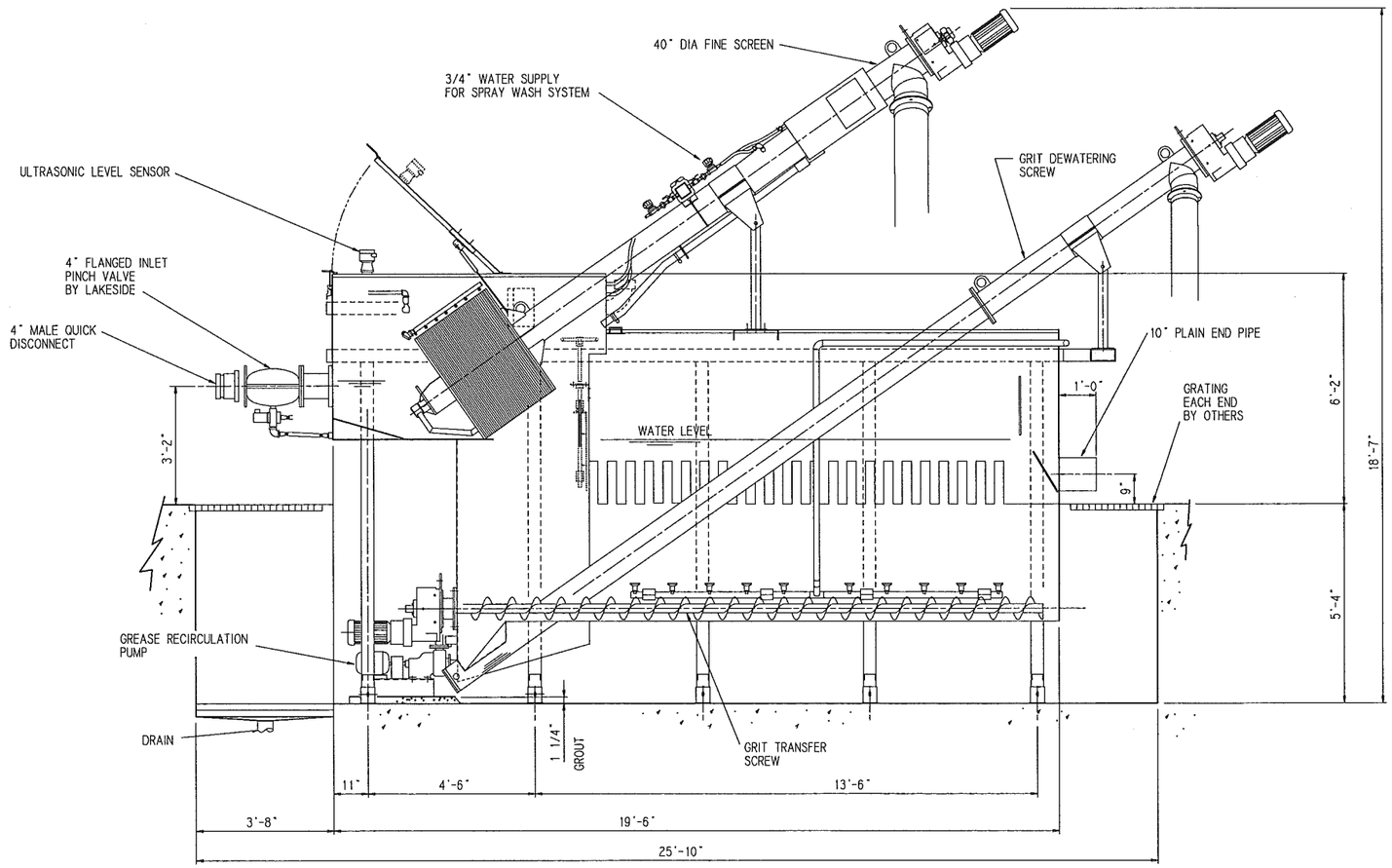
ALL CONDUIT AND WIRE CONNECTIONS BETWEEN CONTROL PANEL AND SCREEN COMPONENTS BY OTHERS.



PLAN



END VIEW



SECTION "A-A"

REVISIONS	DATE	DR.	CHKD.	REVISIONS	DATE	DR.	CHKD.	REVISIONS	DATE	DR.	CHKD.	REVISED	6-16-03	R.D.		REVISIONS	DATE	DR.	CHKD.
												A							

LAKESIDE EQUIPMENT CORPORATION

DR. SNYDER | DATE 2-11-93 | CHKD. JS | FILE NO. 250

RAPTOR® COMPLETE PLANT
MODEL 40CPSAG

DWG. NO. D-47332-S2 | REV. A

ORIGINAL

Technical Data and Specifications

Bussing

100–400 A: Tin-plated aluminum is standard, copper is available as an option.

600 A: Only copper density is available for these applications.

Boxes

Boxes are made from code-gauge galvanized steel.

Blank ends are supplied as standard, knockouts are available upon request.

EZ Trim

Trims are made from code-gauge steel and painted ANSI 61 gray.

All panelboards have door-in-door as standard with multi-point catch and lock, and concealed mounting hardware.

Modifications

Table 22.1-3. Sub-Feed Lugs (Main Lugs Only)

Ampere Rating	Panel Height Addition
100	0 Inches (0 mm)
225	0 Inches (0 mm)

Table 22.1-4. Through-Feed Lugs

Ampere Rating	Information
100	See **Table 22.1-6**
225	See **Table 22.1-6**
400	See **Table 22.1-6**
600	See **Table 22.1-6**

Table 22.1-5. Sub-Feed Breakers (One Per Panel)

Ampere Rating	Breaker Type	Interrupting Rating (kA Symmetrical) at 240 V
150	FDB	18
225	FD	65
225	HFD	100
225	FDC	200
225	EDB	22
225	EDS	42
225	ED	65
225	EDH	100
225	EDC	200
250	JD	65
250	HJD	100
250	JDC	200
400	DK	65
400	KD	65
400	HKD	100
400	KDC	200
600	LGE	65
600	LGS	85
600	LGH	100
600	LGC	100

Shunt Trips

Shunt trips are available on breakers. BAB, HQP, QBHW and QPHW require one additional pole space for shunt trip, i.e., single-pole is two-pole size, two-pole is three-pole size and three-pole is four-pole size.

Ground Bar

Standard bolted in box. Aluminum is standard, copper is available as an option.

Enclosures

Types 1, 12, 3R, 4 and 4X.

Surge Protective Device (SPD)

Integrated onto panelboard chassis. For complete product description and available ratings, refer to **Tab 34**.

Box Sizing and Selection

Box size for all Type 1 panelboards are available from **Table 22.1-6**.

Instructions

1. Select the rating and type of mains required.
2. Count total number of branch circuit poles (including spaces) required in the panelboard. Do not count main breaker poles. Convert two- or three-pole branch breakers to single-poles, i.e., three-pole breaker, count as three poles.

Note: For horizontal mounted mains (BAB Type), use main lug table, include space in branch section for mains.

3. Using correct table, type of mains and ampere rating per Step 1, find total number of poles.

Note: Where total number of poles (Step 2) fall between number in table, use the next higher number.

4. Read box size across columns to the right.

Top and Bottom Gutters (Minimum)

5.50 inches (139.7 mm).

Side Gutters

20.00-inch (508.0 mm) wide box: 6.50 inches (165.1 mm).

Table 22.1-6. Type 1 Panelboards—Dimensions in Inches (mm)

Ampere Rating of Mains	Main Breaker Type Mounting Position		Maximum Number of Branch Circuits Including Provisions ①	Box Dimensions ②③④		
				Height	Width	Depth
100 A						
100 A ⑤ Main lugs or main breaker	EHD, FDB, FD, FDE HFD, FDC, HFDE, FDCE Vertical		18 30 42 48 54 60 72 84	36.00 (914.4) 48.00 (1219.2) 48.00 (1219.2) 60.00 (1524.0) 60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
100 A ⑤ Main lugs or main breaker with 100 A through-feed lugs or sub-feed breaker	EHD, FDB, FD, FDE HFD, FDC, HFDE, FDCE Vertical		18 30 42 48 54 60 72 84	48.00 (1219.2) 48.00 (1219.2) 60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
225 A						
225 A ⑥ Main lugs or main breaker	EDB, EDS, ED EDH, EDC FD, HFD, FDC, FDE, HFDE, FDCE Vertical		18 30 42 48 54 60 72 84	36.00 (914.4) 48.00 (1219.2) 48.00 (1219.2) 60.00 (1524.0) 60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
225 A ⑥ Main lugs or main breaker with 225 A or 100 A sub-feed lugs or breaker	EHD, FDB, FD, HFD, FDE FDC, EDB, EDS, HFDE, FDCE ED, EDH, EDC Vertical		18 30 42 48 54 60 72 84	48.00 (1219.2) 48.00 (1219.2) 60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
400 A						
400 A Main lugs or main breaker	DK, KD, HKD, KDC, LHH Vertical		18 30 42 48 54 60 72 84	60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8) 72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
400 A Main lugs or main breaker with 225 A or 100 A sub-feed lugs or breaker	DK, KD, HKD KDC, LHH Vertical	Mains	18 30 42 48 54 60 72	60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
	EHD, FDB, FD HFD, FDC EDB, EDS, ED EDH, EDC Vertical	Sub-feed breakers				

① Greater than 42 branch circuit panelboards are available for jurisdiction governed by the 2008 National Electrical Code.
② Smaller panelboard box sizes are available if required. Contact Eaton for application information.
③ Add 8.00 inches (203.2 mm) for SPD.
④ 28.00-inch (711.2) optional width is available for panelboards with high circuit counts.
⑤ For horizontal mounted mains (BAB Type), use main lug table, include space in branch section for mains.
⑥ JD, HJD, JDC is same space requirement as 400 A DK, HKD, KDC.

Table 22.1-6. Type 1 Panelboards—Dimensions in Inches (mm) (Continued)

Ampere Rating of Mains	Main Breaker Type Mounting Position		Maximum Number of Branch Circuits Including Provisions ①	Box Dimensions ②③④		
				Height	Width	Depth
600 A						
600 A Main lugs or main breaker	LGE, LGS LGH, LGC LGU Vertical		18 30 42 48 54 60 72 84	60.00 (1524.0) 60.00 (1524.0) 72.00 (1828.8) 72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
600 A Main lugs or main breaker with 225 A or 100 A sub-feed lugs or breaker	LGE, LGS, LGH, LGC LGU Vertical	Mains	18 30 42 48 54 60 72	72.00 (1828.8) 72.00 (1828.8) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
	EHD, FDB, FD, HFD, FDC, EDB, EDS, ED EDH, EDC Vertical	Sub-feed breakers				
600 A Main lugs or main breaker with 400 A through-feed lugs or sub-feed breaker	LGE, LGS, LGH, LGC, LGU Vertical	Mains	18 30 42 48 54	72.00 (1828.8) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0) 90.00 (2286.0)	20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0) 20.00 (508.0)	5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1) 5.75 (146.1)
	DK, KD, HKD, KDC, LHH Vertical	Sub-feed breakers				

① Greater than 42 branch circuit panelboards are available for jurisdiction governed by the 2008 National Electrical Code.
② Smaller panelboard box sizes are available if required. Contact Eaton for application information.
③ Add 8.00 inches (203.2 mm) for SPD.
④ 28.00-inch (711.2) optional width is available for panelboards with high circuit counts.

EHW

Hot Water > Electric Powered > Electric Heated

The perfect choice for in-plant cleaning, this series couldn't be easier to operate – just plug it in and get hot water! The lack of combustible fuels or hazardous fumes makes it safe to store under the stairs or in a closet. The heating coil is uniquely designed for immersion in a tank of hot water for reduced maintenance needs, and a layer of oil floating atop the water assists in heat retention and prevents evaporation. The EHW is enclosed in a stainless steel cabinet and mounted on a platform, and can be fitted with our LanCom wireless remote system, time delay shutdown, and other labor saving options. Generating no fumes or noise, and easy to store, you'll wonder why you didn't choose this unit for your indoor cleaning needs ages ago!

OPTION

- Up to 4.2 GPM, and up to 3000 PSI
- Creates instant hot water without an open flame, combustible fuel or hazardous fumes, making it deal for in-plant cleaning
- Belt-Drive Landa Kärcher Group Pump with 7-year warranty
- Time delay shutdown allowing operator to adjust from 2-10 minutes
- Optional LanCom Remote allows users to work up to 300 feet away

Model #	Part #	GPM	PSI	Pump RPM	Motor HP	Volts	Phase	KW	Amps	Ship Wt (lbs)	List Price
EHW4-20024C	1.109-500.0	4.2	2000	1015	6.2	460	3	55	40.5	620	$10,195
EHW4-30024C	1.109-501.0	3.5	3000	845	7.5	460	3	59	40.5	640	$10,690
EHW4-20024F	1.109-954.0	3.5	2000	845	5.0	575	3	46	40.5	620	$10,195
EHW4-30024F	1.109-955.0	3.5	3000	845	7.5	575	3	49	40.5	640	$10,869

Field Installed Options & Accessories		List Price
8.930-163.0	LanCom Wireless Remote Control System, 1-Step Detergent *w	$963.00
8.930-177.0	LanCom Wireless Remote Control System, 2-Step Detergent *w	$1,209.00
8.930-358.0	Additional LanCom Remote *	$275.50
8.930-131.0	Wall Mount Bracket for Fixed LanCom Remote *	$22.80

w Factory Installed * For 460V Units Only

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1-800-547-8672 1-360-833-9100

Equipment Specifications
PRESSURE WASHER EQUIPMENT

EHW4-30024C (#1.109-501.0)

TYPE:

Hot water, high pressure, electrically heated, stationary washer. Machine shall be capable of operating on fresh water. The machine shall be fully automatic with appropriate safety controls. Machines must conform with CGA, CSA or ETL Certification. Must conform to UL Standard 1776 for Pressure Washers and be built in an ISO approved factory.

GENERAL SPECIFICATIONS:

Discharge	3.5 GPM *(13 LPM)*	
Pressure	3000 PSI *(207 Bar)*	
Pump RPM	800	
Electric Motor	7.5 HP	
	460/3	59 Amps
KW	40.5	

Machine shall be equipped to operate with more than one spray gun at the discretion of the operator. Remote operation allows machine to turn on and off at spray gun.

HOSES:

All hoses shall be 3/8" *(9.52 mm)* ID double steel braid type meeting or exceeding SAE100R2 performance specification. Rated at 5800 psi *(400 bar)* at 250° F *(121°C).*

TRIGGER SPRAY GUNS:

Insulated safety spray gun supplied shall be rated at 8 gpm *(30 lpm),* 5000 psi *(345 bar),* and 300° F *(149°C).*

WANDS:

A 42" *(107 cm)* angulated wand with built in variable pressure control and remote detergent control valve. Insulated grab handle and wand for operator protection.

NOZZLES:

Appropriate, color coded, identifiable high pressure nozzles for single spray gun operation shall be supplied in 0°, 15°, 25° & 40° flat spray pattern. The nozzle shall be of a hardened 420 stainless steel material with an interlock coupler nipple made of annealed 303 stainless steel with 80 Rockwell hardness rating.

DRIVES/PUMPS:

Belt drive system with cast iron pulley/sealed bearings and adjustment bolts for proper belt tension and alignment. All belts to be covered by safety machine cover.

HIGH PRESSURE PUMP:

Ceramic plunger, oil bath crankcase type with forged brass head, rated 4.5 gpm *(17 lpm*) at 3000 psi *(207 bar).* Pump bypass loop shall be equipped with 145°F *(63°C)* thermal relief valve to protect pump from high inlet water temperature.

UNLOADER VALVE:

The pressure washer shall be equipped with adjustable pressure trapping unloader valve suitable for single and multiple spray gun operation rated for 3600 psi *(248 bar)* and 7.8 gpm *(29.5 lpm).*

FRAME:

Machine shall be surrounded/protected by a 304 stainless steel frame/cover assembly. Components to be located for service/inspection accessibility. All painted material will be painted with an epoxy powder coating.

HEATING COIL:

Special alloy stainless steel coil to provide efficient heat transfer from heat storage solution to high pressure water passing through the coil.

HEATING TANK:

No direct immersion of heating elements will be allowed to prevent scale build up or element burn-out. An 80 gallon B.T.U. storage tank for heat retention will be used. The water tank will be treated with a permafilm to prevent corrosion and galvanic action. A low heater solution “cut off switch” is to be placed in the tank to shut off the power to the elements should the level drop. The tank temperature shall be thermostatically controlled by a thermostat and 24 volt control circuit. The tank shall be fully insulated to provide almost 100% energy efficiency.

HEATING ELEMENTS:

Calrod heaters are to be of the tubular design and encased in an incoloy sleeve for long life. Each pin must be able to be replaced independently.

CONTROLS:

Machine shall have control panel and chassis with the following:

- Lexan operating instructions and safety information in English, French and Spanish attached by a high strength adhesive
- Magnetic motor control with overload protection
- Unloader with pressure switch
  24V safety controls
- Solid state 10 second time-delay shutdown timer
- Step-down transformer with primary and secondary protection to meet NEC codes
- All controls are located in an enclosure inside the machine to protect from moisture

DETERGENT:

Downstream non-adjusting detergent injector for low-pressure application.

DIMENSIONS:

Length/width/height	32"/24"/52" *(81/61/132 cm)*
Net weight	600 lbs *(272kg)*

CONNECTIONS:

Quick couplers with stainless steel support balls.

ASME Packaged Electric Water Heater

15 - 1600 KW - All Voltages & Phases, 80 - 5000 Gallon Capacity

Features

- **Reliable**
  - √ Only high grade materials used in construction to ensure long operating life
  - √ Hydrastone cement lining provides superior protection and tank longevity
  - √ Heavy duty construction withstands demanding commercial/industrial use
- **Packaged System**
  - √ Fully packaged water heater saves time and money during installation
  - √ All electrical operating controls are factory selected and wired to ensure reliable operation
- **Versatile**
  - √ Full range of styles, sizes, and optional features to meet your exact water heating needs
  - √ Highly efficient design lowers peak power demand and reduces operating costs

APPLICATIONS

- Schools
- Office Buildings
- Prisons
- Stadiums
- Hotels
- Industrial Facilities
- Nursing Homes
- Hospitals

NO GLASS LINING

Model SH - Vertical configuration

ASME H HLW

A Heavy Duty Storage Electric Water Heater

The Model SH and H is a fully packaged water heater designed to be a reliable and long lasting source for hot water. Each component is carefully selected to ensure performance in even the most demanding application. Whether you are heating potable water in a commercial building or heating process water in an industrial application you can select a Hubbell Model SH or H to do the job. When you specify and install a Hubbell SH or H model water heater you will have confidence in knowing that the owner will be provided with a quality product that is a long lasting and trouble free source for hot water.

Cement Lined Tanks Provide Longer Service Life

Q? What is the most common reason why a water heater fails?

A! Failure of a tank's protective lining allows water to come into direct contact with the steel tank causing it to corrode and leak.

Therefore, the type of protective lining is the single most important feature when determining the quality of any water heater. The ability of a lining to protect the steel tank is primarily based upon its thickness and complete coverage of all steel surfaces.

Linings Available For A Steel Tank

1. Cement Lining

A specially formulated Hydrastone cement applied to a minimum of $^{5}/_{8}$" thickness on all surfaces. The cement lining covers 100% of all interior surfaces and is 125 times thicker than glass lining. Due to the thickness and guaranteed coverage of cement lining there is no need for a sacrificial anode. An extremely durable and long lasting lining suitable for hot and cold potable water storage in a variety of commercial and industrial applications.

2. Alternative Cement Formulations
To meet the specific requirements of DI Water, RO Water, extended service and/or high temperature applications, alternative formulations of cement are available. Please consult factory for assistance.

3. Phenolic Lining
An epoxy coating applied in 2 coats to a total of 10-12 mils DFT. Typically used in process applications using low conductivity DI, distilled, or food grade water.

4. Galvanizing
The steel pressure vessel is pickled and hot dipped in molten zinc to create a barrier which internally and externally protects a steel vessel for cold and hot water storage.

Unlined Tanks

An Unlined tank does not require a lining because the pressure vessel itself is constructed from material which is impervious to the corrosive effects of hot water. This type of tank will provide a significantly longer service life than all lined steel tanks, but is initially more costly.

1. 90/10 Copper-Nickel
A 90% Copper 10% Nickel alloy similar to copper-silicon, but with added strength and corrosion resistance. Typically used in applications with corrosive environments (salt water) or in critical commercial and industrial applications requiring long tank life.

2. Stainless Steel
Stainless steel (Specify: Type 304, 304L, 316, or 316L) is well suited for industrial and high purity applications requiring a corrosion resistant tank with minimal leaching of impurities into the water. Well suited for process, RO and DI water systems in the pharmaceutical, food and electronic industries.

NOTE: Unlined tanks do not require a Manway. Inspection openings will be provided as required.

SH and H Model Standard Equipment

Vessel Construction

1. All welded carbon steel vessel designed and built in strict accordance with the ASME Code Section IV and stamped, certified and registered with the National Board of Boiler and Pressure Vessel Inspectors
2. All internal tank surfaces are lined with a minimum of $^{5}/_{8}$" thick Hydrastone cement for superior protection and tank longevity
3. Designed for 125 psi working pressure and hydrostatically tested at 188 psi ($1^{1}/_{2}$ times the WP)

General

1. Heavy duty 2" thick fiberglass blanket insulation covers 100% of the pressure vessel for maximum operating efficiency and minimal standby heat loss
2. Heavy gauge galvanized steel protective jacket with both top and bottom heads keeps insulation in place and protected to ensure high efficiency during operation
3. Entire vessel is supported on heavy duty integrally welded steel supports for sturdy floor mounting
4. Full five (5) year Non Pro-Rated tank warranty and one (1) year electrical component warranty
5. Bronze ASME rated combination temperature and pressure safety relief valve set at the vessel working pressure and 210°F

Electrical Operating Controls

1. All electrical operating controls are factory sized, selected, wired, tested and mounted in a NEMA 1 enclosure to ensure safe and reliable operation
2. A power distribution block is supplied for single point electrical connection
3. Power fuses rated at a maximum of 60 Amps protect each heating element branch circuit per NEC and UL requirements. Each branch circuit has a maximum rating of 48 Amps
4. Heavy duty definite purpose magnetic contactor with integrally mounted power fuse block assembly switches power on/off to each branch circuit
5. Heavy duty removable flange type copper sheathed immersion heating element provides long service life
6. Fully adjustable thermostat maintains accurate water temperature and is sized by the factory to control the appropriate number of heating element circuits
7. A generously sized transformer provides fused 120V to the control circuit
8. A fully adjustable (100-240°F) safety hi-limit device with manual reset interrupts power to the control circuit in the event of over-temperature water in the storage tank
9. Safety door interlock mechanism interrupts power to the control circuit upon opening the electrical control panel
10. Louvers in the control panel as needed to allow for cooling of the electrical components to ensure maximum electrical component longevity

SH and H Model Optional Equipment

NOTE: Other optional features are available, please consult factory if required.

Vessel

- ☐ 1. **Alternate protective lining:** Phenolic epoxy resin, Flame spray copper, Hot dip galvanizing, other
- ☐ 2. **Alternate vessel construction:** Stainless Steel Type 304 or 316L, 90/10 Copper-Nickel, other
- ☐ 3. **Alternate working pressure:** Please specify
- ☐ 4. Tank designed, constructed and stamped to section VIII or Section I of the ASME Code

General

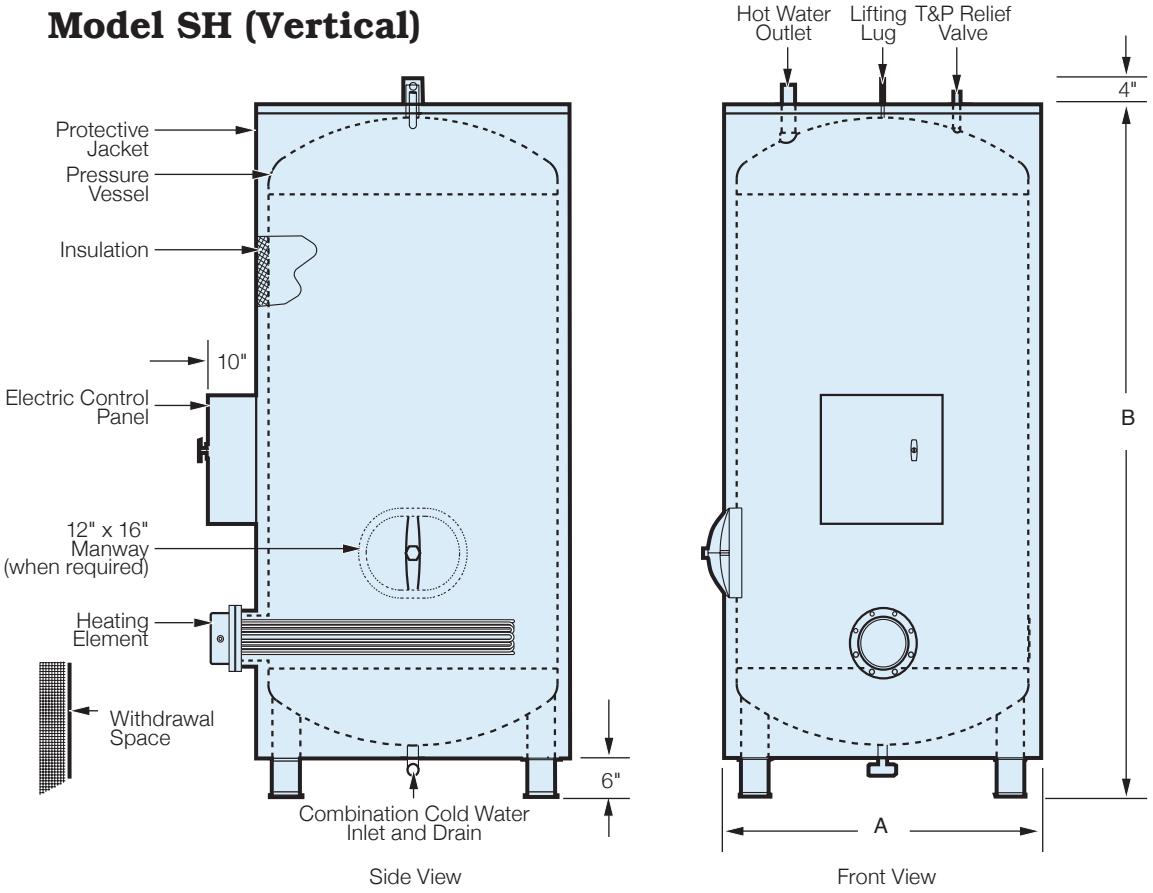
- ☐ 5. Skid mounting on heavy duty all welded I Beam
- ☐ 6. Type 304 stainless steel protective jacket, please specify if painted
- ☐ 7. Field removable (knocked-down) outer jacket
- ☐ 8. Alternate insulation system
- ☐ 9. Dual energy package provides operational flexibility for electric and (steam or boiler water) power
- ☐ 10. Manway 12" x 16" size
- ☐ 11. Inspection opening 3" NPT size
- ☐ 12. 316L Stainless Steel Temperature and Pressure relief valve

Electrical

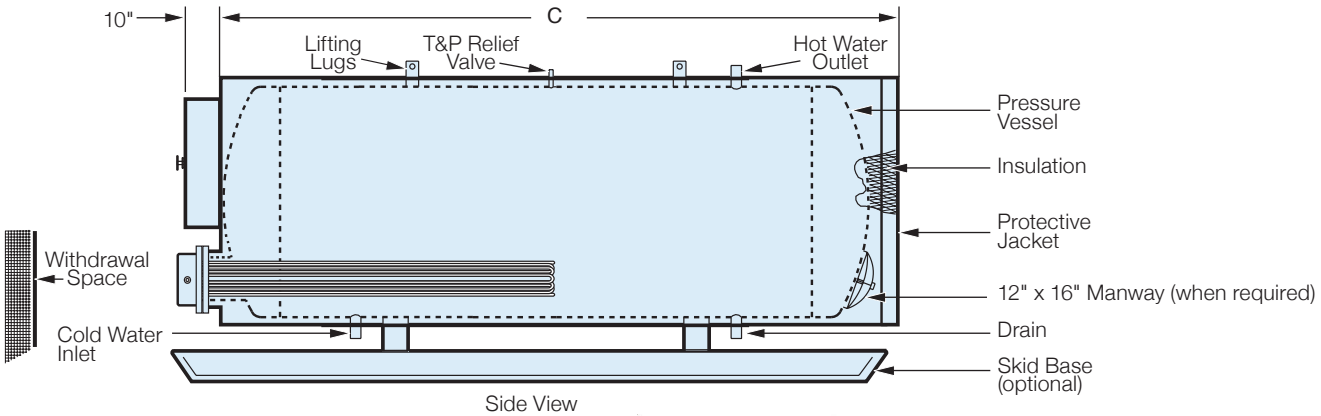
- ☐ 13. NEMA 4 weather resistant enclosure for outdoor/wet locations
- ☐ 14. Explosion resistant construction for hazardous locations
- ☐ 15. Built-in circuit breaker (with or without shunt trip) or a built-in non-fused On/Off disconnect switch
- ☐ 16. Alternate element sheath material (Please Specify: Incoloy, Stainless Steel, other)
- ☐ 17. Specialized heating element construction including: Special watt density rating, passivation, electropolishing, or any other feature required to meet the needs of your application
- ☐ 18. Factory installed low water cut out device to disengage electrically the heating element(s) in the event of insufficient water in the tank
- ☐ 19. Dial thermometer and pressure gauge factory installed in the tank
- ☐ 20. Intra-tank circulation pump package with On/Off switch to continuously circulate water within the tank and thereby reduce stratification. All bronze circulator pump is properly sized for the storage capacity
- ☐ 21. Status indicating lamp(s)
- ☐ 22. Audible alarm system
- ☐ 23. Digital display electronic temperature controller. Please specify with or without RS485 communication port for remote operation of the temperature controller
- ☐ 24. Building Automation System (BAS) package provides remote operating/alarm capability
- ☐ 25. Factory purchased mixing valve to supply high volume tepid water for safety shower systems. For details, please reference Hubbell Model EMV

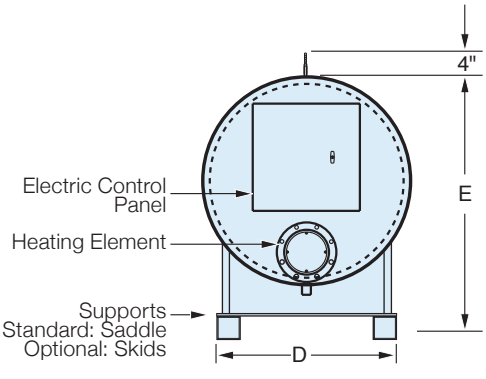
Outline Dimensions

Model SH (Vertical)



Model H (Horizontal)





Overall Dimensions, Models SH and H

Actual Storage Capacity (Gallons)	Overall Dimensions (Inches)					Storage Tank	Nominal Storage Capacity (Gallons)	Inlet Outlet Sizing (NPT)	Approx. Shipping Weight (Lbs.)
	Vertical		Horizontal						
	Diameter "A"	Height "B"	Length "C"	Width "D"	Height "E"	Diameter x Length			
80*	26	64	60	26	32	22 x 54	90	1½	700
120*	28	72	71	28	34	24 x 62	140	1½	900
150*	30	78	75	30	36	26 x 68	170	1½	1100
175	34	73	67	34	40	30 x 63	195	1½	1500
200	34	82	76	34	40	30 x 72	220	1½	1700
225	34	89	83	34	40	30 x 79	245	1½	1750
250	40	74	68	40	46	36 x 64	285	1½	1850
275	40	80	74	40	46	36 x 70	310	1½	2000
300	40	88	82	40	46	36 x 78	345	1½	2180
325	40	92	86	40	46	36 x 82	360	1½	2300
350	40	94	88	40	46	36 x 84	370	1½	2500
375	46	81	75	46	52	42 x 71	425	1½	2600
400	46	85	79	46	52	42 x 75	450	1½	2700
425	46	88	82	46	52	42 x 78	470	1½	2900
450	46	93	87	46	52	42 x 83	500	1½	3000
475	52	79	73	52	58	48 x 69	540	2	3100
500	52	82	76	52	58	48 x 72	565	2	3225
525	52	85	79	52	58	48 x 75	590	2	3350
550	52	89	83	52	58	48 x 79	620	2	3400
575	52	93	87	52	58	48 x 83	650	2	3500
600	52	95	89	52	58	48 x 85	665	2	3650
700	52	107	101	52	58	48 x 97	755	2	4000
800	52	119	113	52	58	48 x 109	850	2	4300
900	52	132	126	52	58	48 x 122	940	2	4800
1000	52	145	139	52	58	48 x 135	1060	2	5200
1250	58	149	143	58	64	54 x 139	1380	2	5600
1500	58	174	168	58	64	54 x 164	1625	2	6000
1750	64	168	162	64	70	60 x 158	1935	3	7400
2000	64	185	179	64	70	60 x 175	2145	3	8100
2500	76	169	163	76	82	72 x 159	2800	3	8200
3000	76	197	191	76	82	72 x 187	3300	3	8300
3500	88	174	168	88	94	84 x 164	3935	6 FLG.	8900
4000	88	195	189	88	94	84 x 185	4440	6 FLG.	9800
4500	N/A	N/A	178	94	100	96 x 160	5015	6 FLG.	10700
5000	N/A	N/A	200	94	100	96 x 175	5485	6 FLG.	11600

Note: All dimensions are approximate and subject to change. Please reference the submittal drawing for actual dimensions. The tank selections above are shown for convenience. A full selection of storage capacities are available by entering the desired capacity into the model number.

* 80, 120 and 150 gallon tanks do not come equipped with a manway. Please consult factory if desired on these sizes.

Recovery Ratings and Amperage at Selected KW

KW INPUT	BTU/HR RATING	Gallons Per Hour (GPH) Heated At Various Temperature Rises					Amperage Rating At Various Voltages				
		60°FΔ	80°FΔ	100°FΔ	120°FΔ	140°FΔ	208V3Φ	240V3Φ	380V3Φ	415V3Φ	480V3Φ
15	51,195	103	77	62	51	44	42	36	23	21	18
20	68,260	137	103	82	68	59	56	48	30	28	24
25	85,325	171	128	103	85	73	69	60	38	35	30
30	102,390	205	154	123	103	88	83	72	46	42	36
35	119,455	239	179	144	120	103	97	84	53	49	42
40	136,520	273	205	164	137	117	111	96	61	56	48
45	153,585	308	231	185	154	132	125	108	68	63	54
50	170,650	342	256	205	171	146	139	120	76	70	60
55	187,715	376	282	226	188	161	153	132	84	77	66
60	204,780	410	308	246	205	176	167	145	91	84	72
65	221,845	444	333	267	222	190	181	157	99	91	78
70	238,910	478	359	287	239	205	195	169	106	97	84
75	255,975	513	384	308	256	220	208	181	114	104	90
80	273,040	547	410	328	273	234	222	193	122	111	96
85	290,105	581	436	349	290	249	236	205	129	118	102
90	307,170	615	461	369	308	264	250	217	137	125	108
95	324,235	649	487	390	325	278	264	229	145	132	114
100	341,300	683	513	410	342	293	278	241	152	139	120
110	375,430	752	564	451	376	322	306	265	167	153	132
120	409,560	820	615	492	410	351	333	289	183	167	145
125	426,625	854	641	513	427	366	347	301	190	174	151
150	511,950	1025	769	615	513	439	417	361	228	209	181
175	597,275	1196	897	718	598	513	486	421	266	244	211
200	682,600	1367	1025	820	683	586	556	482	304	279	241
225	767,925	1538	1153	923	769	659	625	542	342	313	271
250	853,250	1708	1281	1025	854	732	695	602	380	348	301
275	938,575	1879	1409	1128	940	805	764	662	418	383	331
300	1,023,900	2050	1538	1230	1025	879	834	723	456	418	361
325	1,109,225	2221	1666	1333	1110	952	903	783	494	453	391
350	1,194,550	2392	1794	1435	1196	1025	973	843	532	487	421
375	1,279,875	2563	1922	1538	1281	1098	1042	903	570	522	452
400	1,365,200	2733	2050	1640	1367	1171	1112	963	608	557	482
450	1,535,850	3075	2306	1845	1538	1318	1251	1084	685	627	542
500	1,706,500	3417	2563	2050	1708	1464	1390	1204	761	696	602
1000	3,412,000	6833	5125	4100	3417	2929	2779	2408	1521	1393	1204
1200	4,094,400	8200	6150	4920	4100	3514	3335	2890	1825	1671	1445
1400	4,776,800	9567	7175	5740	4783	4100	3891	3372	2130	1950	1686
1600	5,459,200	10933	8200	6560	5467	4686	4446	3854	2434	2229	1927

Notes:

1. The KW selections above are shown for convenience. A full selection of KW ratings from 15 to 1600 KW is available by entering the desired KW into the model number.
2. For alternative voltages, including 220, 277, 440, 460, 575 and 600 volt please consult factory for full KW selection.

Electrical

$$\frac{\text{KW} \times 1000}{\text{Volts}} \div 1.73 = \text{Amps } 3\Phi$$

$$\frac{\text{KW} \times 1000}{\text{Volts}} = \text{Amps } 1\Phi$$

Example: 150 KW at 480V 3Φ

$$\frac{150 \times 1000}{480} \div 1.73 = 180 \text{ Total Amp Draw}$$

180 ÷ 48 Amps max circuit rating = 3.75

Round up the number of circuits to 4

NOTE:
Each branch circuit is rated at a maximum of 48 Amps and each circuit is typically operated as an independent temperature step.

Model SH and H Sizing Information

Step 1

Variables To Solve For:

Solve for the unknown using the formulas stated below.

1. **KW Requirement:**

_____ GPH x _____ °F ΔT x 0.00244 = _____ KW

2. **Temperature Rise:**

_____ KW x 410 ÷ _____ GPH = _____ °F ΔT

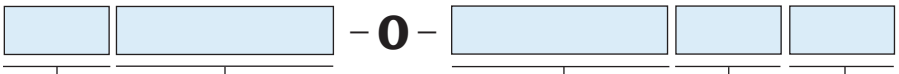
3. **Flow Rate:**

_____ KW x 410 ÷ _____ °F ΔT = _____ GPH

Metric Conversions

Liters x 0.2641 = Gallons	°F = (°C x 1.8) + 32	kPa x 0.1456 = psi
Gallons x 3.79 = Liters	°C = (°F - 32) x 0.556	Lbs x 0.4536 = Kg
Gallons x 0.003785 = m^3	psi x 0.06896 = Bar	Kg x 2.2 = Lbs
m^3 x 264.2 = Gallons	Bar x 14.5 = psi	Watts/Sq.Cm. x 6.4 = Watts/Sq.In.
1°C ΔT = 1.8°F ΔT	psi x 6.86 = kPa	Watts/Sq.In. x 0.155 = Watts/Sq.Cm.

Model SH and H Number Designation



Step 1
Model:
SH =
Vertical
H =
Horizontal

Step 2
Actual Storage Capacity:
80-5000 Gallons

Step 3
Lower KW:
5-1600 KW

Step 4
Vessel Type:
SL =
Cement Lined Steel
GL =
Phenolic Lined Steel
M =
Hot Dip Galvanized Steel
CN =
Solid 90/10 Copper-Nickel
SS =
Solid Stainless Steel
(specify Type 304 or 316L)

Step 5
Voltage/ Phase/Hz:
RS = 208-1-60
R = 208-3-60
S = 240-1-60
T = 240-3-60
W = 277-1-60
T3 = 380-3-50/60
T7 = 415-3-50/60
T5 = 440-3-60
T4 = 480-3-60
T6 = 600-3-60

Example: SH350-0-90SLT4

A vertical 350 gallon storage capacity water heater with a 90 KW heating element. Tank is cement lined. Power required is 480 VAC, 3 phase, 60 Hz.

Option Note

Any and all optional equipment for a water heater must be called out in the written specifications. A model number in and of itself does not reflect any optional equipment selected.

Master Specification: Model SH & H

JOB NAME _____ ENGINEER / ARCHITECT _____

REPRESENTATIVE _____ CONTRACTOR _____

General

Provide a quantity of _____ packaged type electric water heater(s) Model No. _____ as manufactured by HUBBELL The Electric Heater Co., Stratford, CT. The pressure vessel section, including the electrical control panel, shall be mounted on structural supports and be suitably insulated, jacketed, painted and provided with lifting lugs. The entire unit is to be packaged ready for plumbing and electrical service connections and shall bear the UL listing mark certifying the entire water heater.

Pressure Vessel

The pressure vessel shall be all welded construction and ASME Code Section IV stamped for a working pressure of 125 psi (☐ **Optional Specifications:** Select 100, 150, 160, _____ psi) and contain a minimum of _____ gallons of storage. The storage vessel shall be carbon steel and lined with seamless Hydrastone cement applied to a minimum thickness of $^{5}/_{8}$" on 100% of all interior tank surfaces (☐ **Optional Specifications:** Phenolic lined steel tank, Hot dipped galvanized steel tank, solid 90/10 copper-nickel tank, solid Type 304 or 316L stainless steel tank). The pressure vessel is to be completely covered with 2" thick energy conservation fiberglass blanket insulation (☐ **Optional Specification: Foam Insulation**) and enclosed in a heavy gauge galvanized steel metal jacket finished in gray hammertone enamel. The vessel shall be protected by an ASME approved automatic reseating combination temperature and pressure relief valve set at the tank working pressure and 210°F.

Recovery

The recovery section shall be rated at _____ KW which will heat _____ GPH of water at _____ °F rise (_____ °to _____ °F).

Electrical

The heater shall be designed to operate at _____ volts, _____ phase, _____ Hz, with a fused low voltage transformer providing 120 volt to all operating controls. The immersion heating element(s) shall be high quality copper sheathed (☐ **Optional Specifications:** Incoloy, Type 304 or 316 stainless steel Inconel) and sized to obtain the rated recovery. Each element circuit is to be independently operated through a definite purpose magnetic contactor having a resistive load rating equal to or exceeding the ampere rating of that particular circuit and shall be protected by individual power fuses rated at approximately 125% of the ampacity of the circuit. Multiple circuit elements shall be provided with a master terminal block for connecting of the incoming power feeds (☐ **Optional Specifications:** Built-in non-fused On/Off disconnect switch, Built-in circuit breaker with On/Off handle). A safety door interlock switch shall interrupt power to the control circuit when the control panel door is opened. The control thermostat shall be immersion type and shall be consistent with the recovery rate of the heating element as to the number of steps required. A hi-limit control with a manual reset button shall be factory installed to disconnect all ungrounded conductors to the heating element(s) in the event of an over-temperature condition in the storage section.

In addition, the water heater shall be supplied with the following optional features:

☐ **Option** _____

☐ **Option** _____

☐ **Option** _____

Warranty

Hubbell shall warranty all electrical components against defects in workmanship and material for a period of one (1) year from date of start-up and the pressure vessel for a full five (5) years Non Pro-Rated (☐ **Optional Specification:** full ten (10) years Non Pro-Rated) from date of start-up, provided that the unit is started within three (3) months of date of shipment and installed and operated within the scope of the tank design and operating capability. Each water heater shall be shipped with a complete set of installation and operating instructions including spare parts list and approved drawing.

ISO 9001:2008

Committed to continuous improvement...

Continuing research results in product improvement; therefore specifications are subject to change without notice. For the most updated information, consult the factory directly.

Made in the U.S.A.

The Electric Heater Company ■ P.O. Box 288 ■ Stratford, CT 06615-0288 ■ Phone: 203-378-2659 ■ Fax: 203-378-3593
info@hubbellheaters.com ■ ***www.hubbellheaters.com***

Rolling ServiceDoor Systems

Product Line	SERIES	600 610 620 625

OVERHEAD DOOR®

INDUSTRY LEADING
COMMERCIAL & INDUSTRIAL SOLUTIONS

Rolling Service Door Selection Chart

Slat Data

A Variety of Profiles, Finishes, Materials and Options

Overhead Door Corporation offers a broad range of rolling service door curtains to satisfy any number of project requirements. Rolling service doors are available with a variety of slat profiles, materials, gauges and finishes.

Our rolling service doors feature a standard galvanized steel curtain, in a range of gauges to suit your project requirements. Steel slats are finished with a rust-inhibitive, roll-coating process that incorporates baked-on prime paint, and a baked-on polyester top coat of gray (standard) or tan (optional, but not available on C-600). An optional powder coat finish is available in 197 standard colors, or can be color matched to your specifications.

Aluminum and stainless steel slats are offered as options for 610, 620 and 625 Series doors. An array of finishes create an attractive and polished appearance for your rolling door closure. Stainless slats are manufactured with a No. 2b finish (standard) or No. 4 mill finish (option). Aluminum slats are available with a mill finish (standard) clear-anodized finish (option) or bronze-anodized finish (option).

Slats for Special Applications

Our insulated Stormtite™ door features the F-265i slat, a CFC-free insulated slat that provides additional protection against air infiltration. For special, oversize, heavy-duty, non-insulated applications, we offer the C-600 slat — a 6" (152 mm), 1 3/8" (35 mm) curved slat.

The F-265 and C-275 slat profiles are also available with perforation or fenestration for applications where ventilation is required. Perforated slats feature 1/16" (2 mm) diameter holes on 3/32" (2 mm) centers, and are fabricated of 18 gauge galvanized steel with a durable, baked-on gray paint finish. Fenestrated slats feature uniformly spaced openings of 5/8" x 3" (16 mm x 76 mm) for air flow and light infiltration. Doors can be constructed entirely of perforated or fenestrated slats, or these special slats can be used selectively to provide air flow and light infiltration as required.

197 Standard Powder Coat Finishes

The Color Palette for Rolling Steel Products specifying from powder coat finishes in 197 colors is available from your Overhead Door distributor. Color may also be matched to architect's specifications to best compliment the look of the facility.

Rolling Service

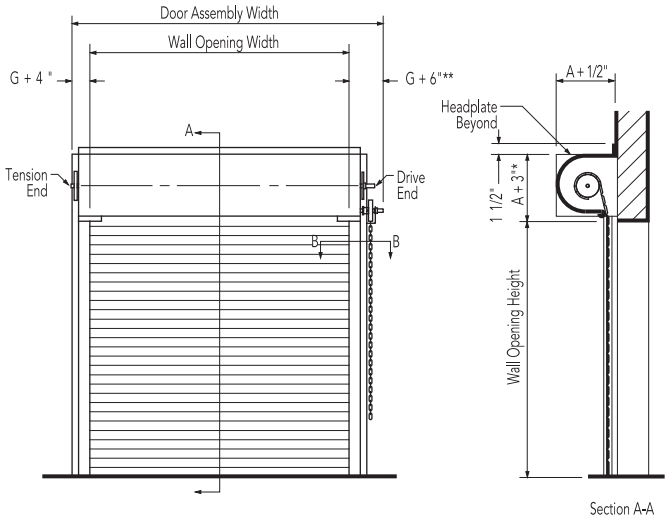
GENERAL SPECIFICATIONS

	SERIES		Standard Maximum width	Standard Maximum height	Maximum size	Standard mounting	Standard operation	Curtain material Standard	Curtain material Optional	Slat profile type Standard	Slat profile type Optional	Wind load	Insulated slats	Standard finish
Heavy Duty	625	Stormtite™ Insulated	30' (9144 mm)	28' (8534 mm)	900 sq ft (83,613 sq.mm)	face of wall	chain	galv steel	ss/ alum	F-265I		20 psf	•	primed paint
	620	Stormtite™	30' (9144 mm)	28' (8534 mm)	900 sq ft (83,613 sq.mm)	face of wall	push up	galv steel	ss/ alum	F-265		20 psf		primed paint
	610		30' (9144 mm)	28' (8534 mm)	900 sq ft (83,613 sq.mm)	face of wall	push up	galv steel	ss/ alum	C-187	C-275 F-265	20 psf		primed paint
	610	C-600 Slat	65' (19812 mm)	30' (9144 mm)	1500 sq ft (139,355 sq.mm)	face of wall	motor	galv steel		C-600				primed paint
Medium Duty	610 w/24 guage		16' (4877 mm)	16' (4877 mm)	16' (23,560 sq.mm)	face of wall	push up	galv steel		C-187/ F-265		20 psf		primed paint
Light Duty	600	Coil-Away™	16' (4877 mm)	16' (4877 mm)	256 sq ft (23,560 sq.mm)	face of wall	push up	galv steel		CAW		optional		primed paint

Door Clearance Elevation

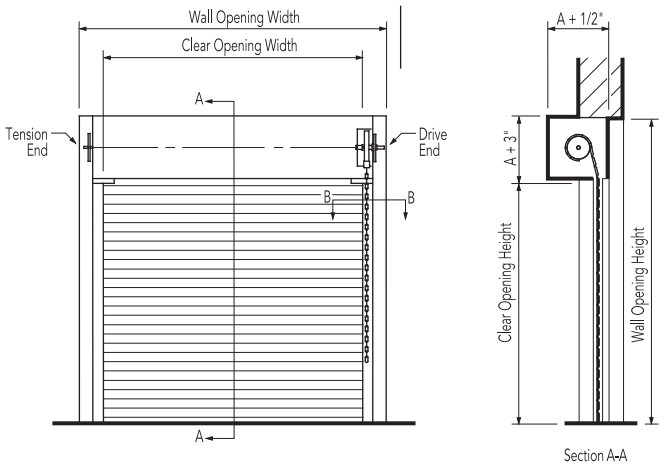
Face-of-Wall Mounted

Operation: Chain hoist or electric.



Between Jambs Mounted

Operation: Push-up, chain hoist, crank or electric.



For clearance details on electrically operated doors, see Electric Operators pages 24.

Door Clearance Dimensions

Dimension A C187 Slat
(Series 610 only)

Opening Height	Max. Door Opening Widths 15'4" (4674 mm)
Thru 6'0" (1829 mm)	14" (356 mm)
Thru 11'0" (3353 mm)	14" (356 mm)
Thru 18'0" (5486 mm)	16" (356 mm)
Thru 21'0" (6401 mm)	18" (356 mm)
Thru 30'0" (9144 mm)	24" (356 mm)

Dimension A F265 Slat

Opening Height	Max. Door Opening Widths 20'0" (6096 mm)	24'0" (6096 mm)	30'0" (9144 mm)
Thru 6'0" (1829 mm)	16" (406 mm)	16" (406 mm)	18" (457 mm)
Thru 8'0" (2438 mm)	18" (457 mm)	18" (457 mm)	20" (508 mm)
Thru 9'0" (2743 mm)	18" (457 mm)	18" (457 mm)	20" (508 mm)
Thru 11'0" (3353 mm)	18" (457 mm)	18" (457 mm)	20" (508 mm)
Thru 13'0" (3962 mm)	20" (508 mm)	20" (508 mm)	20" (508 mm)
Thru 16'0" (4877 mm)	20" (508 mm)	20" (508 mm)	22" (559 mm)
Thru 18'0" (5486 mm)	20" (508 mm)	22" (559 mm)	24" (610 mm)
Thru 21'0" (6401 mm)	22" (559 mm)	24" (610 mm)	24" (610 mm)
Thru 23'0" (7010 mm)	22" (559 mm)	24" (610 mm)	24" (610 mm)
Thru 25'0" (7620 mm)	24" (610 mm)	24" (610 mm)	26" (660 mm)
Thru 28'0" (8534 mm)	26" (660 mm)	26" (660 mm)	26" (660 mm)
Thru 30'0" (9144 mm)	26" (660 mm)	26" (660 mm)	28" (711 mm)

Dimension A C275 Slat *(Series 610 only)*

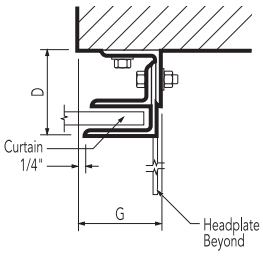
Opening Height	Max. Door Opening Widths 20'0" (6096 mm)	24'0" (6096 mm)	30'0" (9144 mm)
Thru 6'0" (1829 mm)	14" (356 mm)	14" (406 mm)	18" (457 mm)
Thru 8'0" (2438 mm)	16" (406 mm)	16" (406 mm)	18" (457 mm)
Thru 9'0" (2743 mm)	16" (406 mm)	18" (457 mm)	20" (508 mm)
Thru 11'0" (3353 mm)	16" (406 mm)	18" (457 mm)	20" (508 mm)
Thru 13'0" (3962 mm)	18" (457 mm)	18" (457 mm)	20" (508 mm)
Thru 16'0" (4877 mm)	18" (457 mm)	20" (508 mm)	22" (559 mm)
Thru 18'0" (5486 mm)	20" (508 mm)	22" (559 mm)	24" (610 mm)
Thru 21'0" (6401 mm)	22" (559 mm)	22" (559 mm)	24" (610 mm)
Thru 23'0" (7010 mm)	22" (559 mm)	24" (610 mm)	24" (610 mm)
Thru 25'0" (7620 mm)	24" (610 mm)	24" (610 mm)	26" (660 mm)
Thru 28'0" (8534 mm)	26" (660 mm)	24" (610 mm)	26" (660 mm)
Thru 30'0" (9144 mm)	26" (660 mm)	26" (660 mm)	28" (711 mm)

Angle Guide

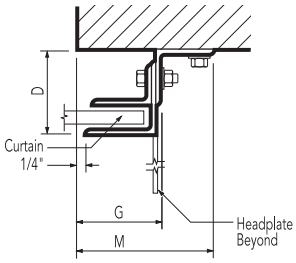
Face-of-Wall Mounted

Section B-B

E Guide

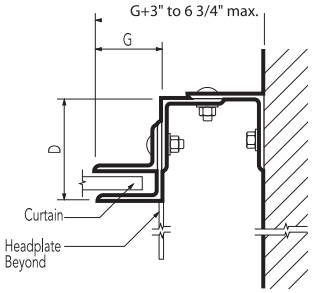


Z Guide



Between Jambs Mounted

Section B-B



Dimensions G, M and D* C187 Slats

Dimensions	Max. Door Opening Width					
	8'0"	(2438 mm)	15'0"	(4572 mm)	20'0"	(6096 mm)
G	3"	(76 mm)	3 1/2"	(89 mm)	4"	(102 mm)
M	4 3/4"	(121 mm)	5 1/4"	(133 mm)	5 3/4"	(146 mm)
D	4 1/2"	(114 mm)	4 1/2"	(114 mm)	5"	(127 mm)

Dimensions G and D* C275 and F265 Slats

Dimensions	Max. Door Opening Width									
	9'0"	(2743 mm)	15'0"	(4572 mm)	20'0"	(6096 mm)	30'0"	(9144 mm)	40'0"	(12,192 mm)
G	3"	(76 mm)	3 1/2"	(89 mm)	4"	(102 mm)	4 1/2"	(114 mm)	5 5/8"	(144 mm)
D	4 1/2"	(114 mm)	5"	(127 mm)	5"	(127 mm)	6"	(152 mm)	6"	(152 mm)

Dimensions G, M and D* C275 and F265 Slats

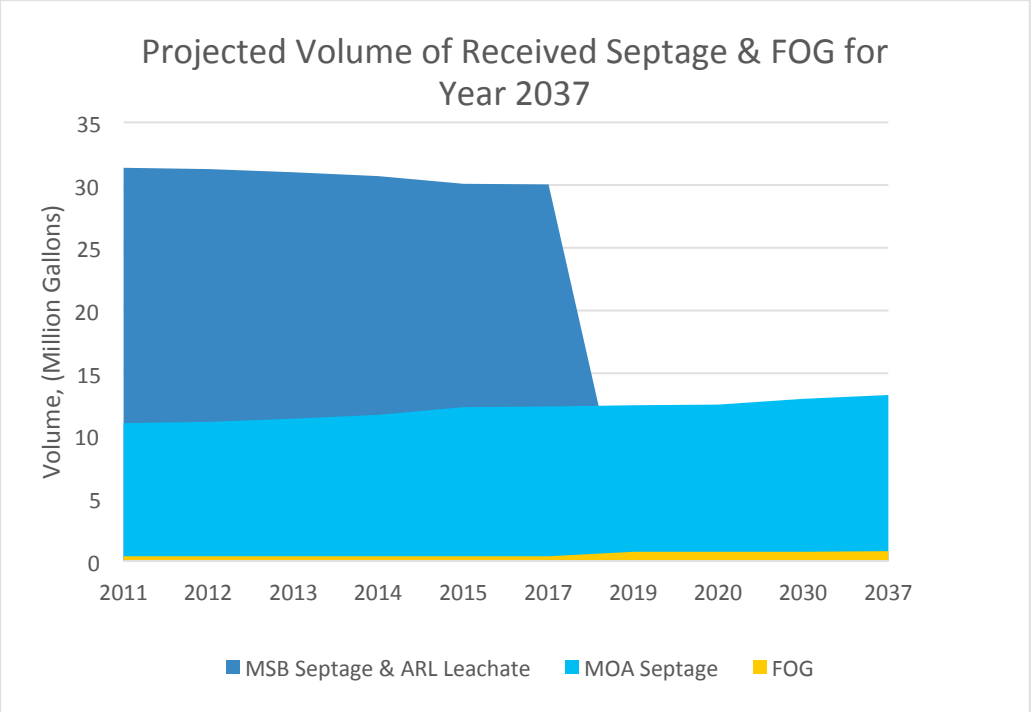
Dimensions	Max. Door Opening Width									
	9'0"	(2743 mm)	15'0"	(4572 mm)	20'0"	(6096 mm)	30'0"	(9144 mm)	40'0"	(12,192 mm)
G	3"	(76 mm)	3 1/2"	(89 mm)	4"	(102 mm)	4 1/2"	(114 mm)	5 5/8"	(144 mm)
M	4 3/4"	(121 mm)	5 1/4"	(133 mm)	5 3/4"	(146 mm)	8 1/4"	(210 mm)	8 1/4"	(210 mm)
D	4 1/2"	(114 mm)	4 1/2"	(114 mm)	5"	(127 mm)	6"	(152 mm)	6"	(152 mm)

** For max. door opening height*
Note: Windbars provided for doors over 15' 4" (4674 mm)
Series 620 guides include weatherstrip on exterior side of door.

Appendix C

Calculations

		MSB		ANC & MSB & Leachate	ANC & Leachate
Year	Equ. year	Million Gal/Year	Equ. Year	Million Gal/Year	Million Gal/Year
2011	11	18.04	11	42.40	24.36
2012	12	19.05	12	46.90	27.85
2013	13	17.76	13	52.82	35.06
2014	14	18.96	14	56.83	37.87
2015	15	20.16	15	57.58	37.42
2020	20	26.16	20	61.33	35.17
2025	25	32.16	25	65.08	32.92
2030	30	38.16	30	68.83	30.67
		MSB Septage & ARL Leachate	MOA Septage	FOG	
	2011	31	11.0	0.37	
	2012	31	11.1	0.37	
	2013	31	11.4	0.37	
	2014	31	11.7	0.37	
	2015	30	12.3	0.37	
	2017	30	12.3	0.37	
	2019	0	12.4	0.73	0.05
	2020	0	12.5	0.73	
	2030	0	12.9	0.76	
	2037	0	13.3	0.78	



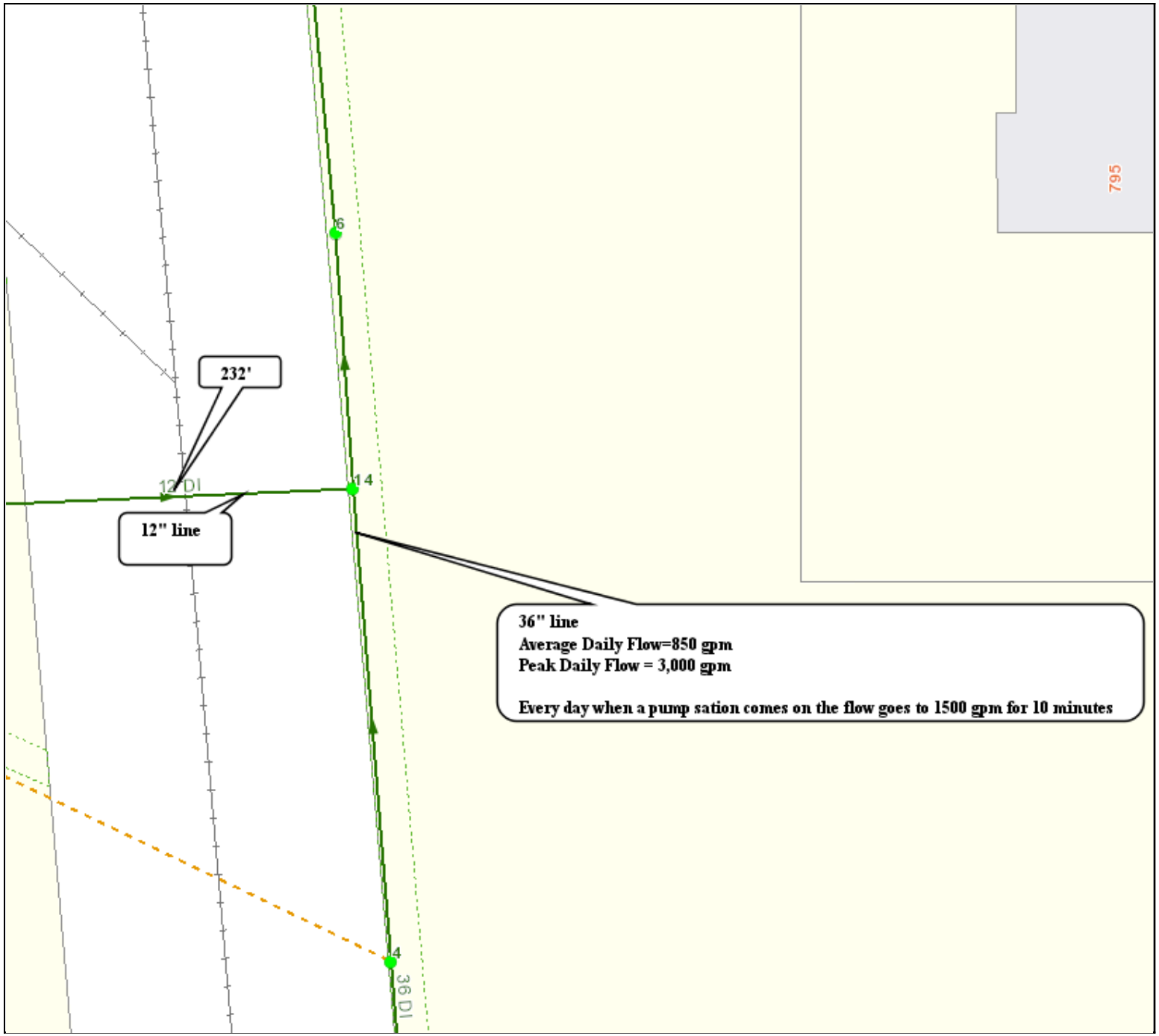
Building Heat Loss Calcs

Design Temperature

WINTER OUTDOOR TEMP:	-10
WINTER INDOOR TEMP:	55

CONSTRUCTION:			CEILING	SLAB	PERIMTER	WALL	DOOR	WINDOW						
(R-VALUES)			4.35	28.00	50.00	4.55	0.83	2.78						
	ENVEL COMP	ROOM HEIGHT (FT.)	CLG. TO COLD	SLAB TO COLD	FLOOR TO COLD	EXT. WALLS	EXT. DOOR	EXT. WINDOW	AIR CHG./ HOUR	INFL. RATE CFM		TOTAL HEAT LOSS W/ SAFETY FACTOR	BTUH/ SQ. FT.	BB @ 730 BTUH./ LIN. FT
INPUT SQ. FT.	U-VALUE		0.230	0.036	0.020	0.220	1.200	0.360		1.080		(SF=1.2)	(SF=1.3)	
ROOM NAME	LD FCTR		15.0	2.3	1.3	14.3	78.0	23.4		70.2				
825.000	S.F.	17	825		825	1972	212	0	3	701				
Alternative 1	BTU/HR		12334	0	1073	28200	16497	0		49228		128797	156	176
825.000	S.F.	17	825		825	1972	212	0	3	701				
Alternative 2	BTU/HR		12334	0	1073	28200	16497	0		49228		128797	156	176
825.000	S.F.	17	825		825	1972	212	0	6	1403				
Alternative 3	BTU/HR		12334	0	1073	28200	16536	0		98456		187917	228	257

OPEN CHANNEL FLOW BY MANNING FORMULA							
Pipe Dia in inches		12	0.5		**Friction Fact=.0F**		0.013
h=X*Dia.			0.1		**SLOPE =**		0.005
Rad = E3/(12*2)							
		A=D7	0.040875277			A = wetted area in sq. ft.	
		P=D8	0.643501109			P = wetted perimeter in ft.	
		R=D7/D8	0.063520135			R = hydraulic radius in ft.	
		V=	1.286653179			V = velocity in ft./sec.	
		Q=VA	23.60342663			Q = flow in GPM	
	h=.1D	h=.2D	h=.3D	h=.4D	h=.5D	h=.6D	h=.7D
Depth ft.	0.10	0.20	0.30	0.40	0.50	0.60	0.70
A=	0.04	0.11	0.20	0.29	0.39	0.49	0.59
P=	0.64	0.93	1.16	1.37	1.57	1.77	1.98
R=	0.06	0.12	0.17	0.21	0.25	0.28	0.30
V=	1.29	1.97	2.49	2.89	3.21	3.44	3.59
Q(gpm)=	23.60	99.01	221.40	381.00	565.30	759.59	946.59
Q/A=V			2.49	2.89	3.21	3.44	3.59
Q=VA				381.00	565.30	759.59	946.59
Aticipated Peak Dialy Flow							
Q (2037)	13,270,000						
Q (GPM)	101				*calculations provided by AWWU		
h	h=0.2D						



N

Scale 1:1,000
1 in = 83 ft

Appendix D

Cost Estimation

Alternative 3					
Item	**Unit**	**Quantity**	**Cost per Unit $**	**Cost $**	**Remark**
Raptor Fine screen:					
Raptor Fine Screen	each	1	$ 180,000.00	$ 180,000.00	10000 lbs
Freight Shipping	each	1	$ 4,000.00	$ 4,000.00	Quote 10000 lbs
Assemble crew	Hour	36	$ 100.00	$ 3,600.00	3 men 24 hours each
10,000 lb capacity forklift	day	2	$ 300.00	$ 600.00	
Total Raptor station				$ 188,200.00	
All other equipment including ship and install					
Odor Control	each	1	$ 9,000.00	$ 9,000.00	Blue Ox Air Cleaner OX2500D CC $2650
Heating and Air	each	1	$ 3,000.00	$ 3,000.00	Reznor EGHB size 25 perfect for the job both air flow up to 6 ACH and heating requirement
Water Tank	each	1	$ 20,000.00	$ 20,000.00	Hubbell model E H and SH 1750 gallon
Pressure washer	each	1	$ 13,000.00	$ 13,000.00	Landa EHW
Aerator	each	1	$ 45,000.00	$ 45,000.00	
Pumps	each	4	$ 7,500.00	$ 30,000.00	
Total equipment				$ 308,200.00	
Building					
Floor and Structure typical base cost	SF	1400	$ 375.00	$ 525,000.00	Includes all
Bay door	Lump sum	1	$ 7,000.00	$ 7,000.00	Overhead Door Company of Cook Inlet
Demolition	Lump sum	1	$ 6,000.00	$ 6,000.00	
Excavation	Ton	4000	$ 17.40	$ 69,600.00	
Load and haul demolished excavated material	CY	650	$ 15.00	$ 9,750.00	
Sedimentation Basin	Ea	2	$ 115,000.00	$ 230,000.00	
Grease Siphter	ea	1	$ 120,000.00	$ 120,000.00	
Water service line	LF	210	$ 75.00	$ 15,750.00	
Shrub, dwarf rose	Each	30	$ 63.00	$ 1,890.00	
Collections Bin	Each	2	$ 5,000.00	$ 10,000.00	
Total Building				$ 994,990.00	

Subtotal		$ 1,303,190.00			
Contingency	10%	$ 130,319.00			
Total Construction Cost		$ 1,433,509.00			
Engineering and Construction Admin	15%	$ 215,026.35			
AWWU Administration & legal costs	5%	$ 71,675.45			
Engineering/Admin Subtotal		$ 286,701.80			
Capitalized interest bond	6.50%	$ 93,178.09			
Direct Allocated charge	10%	$ 143,350.90			
Total Project Cost		$ 1,956,739.79			
Operation and Maintenance costs					1 Year Warranty
Item	Unit	Cost per unit	Monthly quantity	Annual cost	
O&M worker	Hour	75	50	$ 45,000.00	approx. 2 hrs/day, twice a week
Power	Contingent sum	1	8317	$ 99,800.00	16.82 cents/kWh
Equipment upkeep	Contingent Sum	1	600	$ 7,200.00	estimate
Waste Pick Up	Monthly	500	1	$ 6,000.00	2 bins $50 each + $400 for pick up
FOG	Contingent Sum	1	221000	$ 221,000.00	
			Subtotal O&M	**$ 379,000.00**	
			Solids	$ 227,000.00	
			Other	$ 52,200.00	

Table: Electrical Cost for Concept 1

alt 1	kw	hours/day	cost per year
pressure washer	40.5	0.5	$ 1,241.73
water heater	120	1.5	$ 11,037.60
heater	25	12	$ 18,396.00
odor control	0.95	24	$ 1,398.10
raptor	400	3	$ 73,584.00
Pumps	120	1.5	$ 11,037.60
rate ($/kwh)	$ 0.168	Total	**$ 116,695.03**

Table: Electrical Cost for Concept 2

Alt 2	kw	hours/day	cost per year
pressure washer	40.5	0.5	$ 1,241.73
water heater	120	1.5	$ 11,037.60
heater	25	16	$ 24,528.00
odor control	0.95	24	$ 1,398.10
raptor	400	3	$ 73,584.00
Pumps	120	1.5	$ 11,037.60
rate	$ 0.168	Total	**$ 122,827.03**

Table: Electrical Cost for Concept 3

Alt 3	kw	hours/day	cost per year
pressure washer	40.5	0.5	$ 1,241.73
water heater	120	1.5	$ 11,037.60
heater	25	16	$ 24,528.00
odor control	0.95	24	$ 1,398.10
raptor	175	3	$ 32,193.00
Pumps	240	2	$ 29,433.60
rate	$ 0.168	Total	**$ 99,832.03**

Table: Total Cost for Solids Removal

Peak week solids quantity	lbs	CY	Annual (CY)	removal efficiency	After removal CY	Rate ($/CY)	cost	cost 85% removal Alt 3
FOG Non-FSE	37200	23.39	677.6	0.45	304.9	$ 68.00	$ 20,733.20	39162.71116
FOG total	209600	131.79	3817.6	0.45	1717.9	$ 68.00	$116,819.32	220658.7166
Screenings	3400	1.44	41.8	0.95	39.7	$ 68.00	$ 2,697.47	
Grits	14700	4.36	126.4	0.4	50.6	$ 68.00	$ 3,437.40	4201.267982

Table: Cost Breakdown for Concepts

	Upfront With Additional Project Cost Factored			O&M			Levelized upfront Time value of money adjusted 20 years 4%			Emergency Cleaning + EPA Fine	
	Equipment	Building	Total w/ Miscellaneous	Solids Disposal	Power	Other	Equipment	Building	Total	Cost $	% reduced from current $920,000
Alt. 1 FOG Bypass	$644,280	$ 491,400	$ 1,135,680	$ 6,000	$117,000	$ 22,200	$ 64,639	$ 49,301	$113,940	$ 706,090	23%
Alt. 2 FOG Partial Collection	$929,565	$ 491,400	$ 1,420,965	$123,000	$123,000	$ 22,200	$ 93,261	$ 49,301	$142,562	$ 623,560	32%
Alt. 3 FOG basin	$420,420	$1,358,175	$ 1,778,595	$227,000	$ 92,500	$ 52,000	$ 42,180	$136,262	$178,442	$ 458,500	50%
Status Quo W/ FSE					$ 12,000	$ 6,000				$ 733,600	20%

Appendix E

Permits

Engineering Support and Plan Review (ESPR) Engineering Plan Intake Form

Use of this form is mandatory for submittal of an engineering plan to ESPR for review.

Items in bold are required. Submittal instructions are on the following page.

Project Name: *How you will refer to this project*		
Property Legal Description: *Subdivision Lot Block - OR - Survey and Tract - OR - Township, Range, Section, Meridian, and Tax Lot*		
Property Street Address: *Street Address, City, State, Zip Code*		
Wastewater System Location Coordinates: *Latitude in decimals of a degree* *DATUM (select one)* *Longitude in decimals of a degree*		NAD-83
Community system is installed (select one): *Or nearest community*	Adak - 2501	
Owner's Name: *First and Last name*		
Owner's Telephone: (###) ###-####		
Owner's Address: *Street Address, City, State, Zip Code* *If same as above, enter Same*		
Owner's e-mail Address:		
Submitting Design Engineer's Name: *First and Last name*		
Submitting Design Engineer's Telephone: (###) ###-####		
Submitting Design Engineer's Firm:		
Submitting Design Engineer's e-mail Address:		
Project Type (select one):	Conventional Septic Tank/Soil Absorption	
Discharge Type (select one):	Subsurface	
Wastewater Type (select one):	Domestic	
Design Flow in Gallons Per Day <u>OR</u> If a Sewer Line Extension/Replacement the Length in Feet:		
Water System Designation (select one):	Private	
If applicant is seeking general permit coverage for this discharge, enter the permit number here:		

CONTACT INFORMATION

ESPR will communicate primarily with the below identified Project Manager and copy the identified owner of the project on all correspondence. E-mail is the primary means of communication. The Project Manager will serve as the focal point for information requests. The Project Manager may be the same as the Design Engineer, and if no project manager information is provided, the submitting Design Engineer will be the default Project Manager.

Engineer Responsible for Construction Oversight and Record Drawing Submittal: *enter "Same as Design Engineer" OR Name, Telephone, Company Name, Address and e-mail*	
Project Manager *enter "Same as Design Engineer" OR "Same as Engineer Responsible for Construction Oversight and Record Drawings" OR Name, Telephone, Company Name, Address and e-mail*	

Submittal Instructions

NOTE : If printing the form, the Submittal Instruction Page is not required to be printed or submitted.

General Instructions:

- Plans must be sealed, signed and dated by a professional engineer licensed by the State of Alaska
- Plans submitted in hardcopy must be submitted on 11 by 17 inch or 8.5 by 11 inch paper, whichever is most legible
- Plans submitted electronically must comply with electronic submittal guidance available at:
  - The Department is currently migrating e-mail servers and once resolved, electronic submittals will be available
  - http://dec.alaska.gov/water/wwdp/onsite/ww_planreview-cklist.htm
- Plans are reviewed within 30 days of receipt of a complete plan submittal
- Plans should be submitted to the ESPR regional office having jurisdiction of the project location, available at:
  - http://dec.alaska.gov/water/wwdp/onsite/areaOffices.html
- **NOTE: Engineering plan checklists are for reference only and shall not be included with the submittal**

Domestic Wastewater Engineering Plan Submittal:

1. The following forms/documents are required for domestic wastewater engineering plan submittal, arranged in the following order:
   - This completed form
   - A Plan Review Invoice with payment (see invoice for instructions)
   - A completed Owner's Statement form
   - Engineering plans sealed in accordance with 12 AAC 36.185-36.245
     - Cover letter and/or engineers report describing project, sealed
     - Other supporting documents
     - Performance Certification as needed (for Private Residential Marine Outfalls only)

2. Upon successful review of the submittal ESPR will issue to the Project Manager and Owner:
   - An Approval to Construct Letter
   - A Construction and Operation Certificate with the Approval to Construct section signed

3. The system is constructed.
   - Major design changes require prior written approval and issuance of a Change Order
   - Interim Approval to Operate is granted to domestic wastewater systems automatically along with the Approval to Construct for 90 days after system construction

4. The Project Manager requests Final Approval to Operate once the system is constructed and operational
   - **Final Approval to Operate is the Owner's only document that demonstrates the wastewater system has been properly documented and should be stored with the facility's important papers like O&M manuals, permits and surveys**
   - Project Manager submits a completed Certification of Construction form
     - The Owner must sign the form
     - The Contractor or person who conducted the installation work under supervision must sign the form
     - The Certifying Engineer must sign the form
   - Additional documents which were specified, if any, in the Approval to Construct must be included
   - If modifications of the submitted design were made, record documents accurately depicting the installed system must be submitted bearing the seal of the Certifying Engineer

5. ESPR will issue an Approval to Operate once all documents are received
   - ESPR may issue conditions on the Approval to Operate such as maintenance requirements, sampling or renewal time limits
   - Unless otherwise conditioned, an Approval to Operate is valid indefinitely
   - Modification of the system without prior approval of ESPR invalidates the Approval to Operate

Non-domestic Wastewater Engineering Plan Review:

This intake form is required for non-domestic engineering plan submittal. The Approval to Construct and Approval to Operate two-step process is **not applicable** for non-domestic plan review. The engineering plan requirements for non-domestic engineering plans is different from the above domestic requirements. For non-domestic engineering plan requirements, see 18 AAC 72.600(c).

NOTE : If printing the form, the Submittal Instruction Page is not required to be printed or submitted.

State of Alaska
Department of Environmental Conservation

PUBLIC DRINKING WATER SYSTEM
OR
DOMESTIC WASTEWATER SYSTEM
OWNER'S STATEMENT

This information is required by 18 AAC 15.030.
Please type or print all non-signature items in ink:

Department Completion Only
Project No.
Date Received: _____

Project Name: _____

I submit the enclosed items concerning the above referenced proposed project for review. By my signature, I certify that the project is (check one):

☐ privately owned and that I am the owner.

☐ owned by a sole proprietorship and that I am the proprietor.

☐ owned by a partnership of which I am a general partner.

☐ owned by a corporation of which I am a principal executive officer of at least the level of vice-president, or a duly authorized representative responsible for the overall management of this project.

☐ owned by a municipal, state, federal, or other public agency of which I am a principal executive officer, ranking elected official, or other duly authorized employee.

_____

Signature (please sign in ink) Date

_____

Name and Official Title

_____

Company or Agency (if applicable)

18. AAC 15.030. SIGNING OF APPLICATIONS: All permit or approval applications must be signed as follows:

(1) in the case of corporations, by the principal executive officer of a t least the level of vice-president or his duly authorized representative, if the representative is responsible for the overall management of the project or operation;
(2) in the case of a partnership, by a general partner;
(3) in the case of a sole proprietorship, by the proprietor; and
(4) in the case of municipal, state, federal, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee. (Eff. 11/25/77, Register 64)

Authority: AS 46.03.020(10), AS 46.03.090, AS 46.03.100, AS 46.03.110, AS 46.03.160. AS 46.03.330, AS 46.03.720

Municipality of Anchorage

Handout AG.06

Building Permit Requirements for Commercial Buildings

The following will be needed for application for a building permit. Permits are considered abandoned and expired if no activity occurs within 360 days. You must do enough work within this period of time to call for an inspection to prove activity. All fees are required upon submittal of application, with the exception of traffic review fees and landscape review fees, which are calculated during zoning review and are payable prior to issuance of any permit.

COMMERCIAL BUILDING (New and additions; for metal buildings, see Policy S.04)

1. Full legal description of property (lot, block and subdivision), street address, tax account number.

2. Two copies of Soil Engineers reports and recommendations for new building and additions.

3. Three sets of COMPLETE CONSTRUCTION PLANS (stamped and signed by appropriate Alaskan P.E. or Architect), showing how the building is to be built.

4. Code study, including building construction type, occupancy, exiting, and applicable code.

5. One set of engineering calculations and specifications for all commercial buildings.

6. Submit two copies of any previous agreements, clarifications, requests for Alternate Means and Methods, etc., when applicable. Agreements and other special considerations shall be signed by agreeing parties.

7. Three certified plot plans stamped and signed by a Professional Land Surveyor, registered in the State of Alaska, showing the proposed location of the building site and including the following information:

   LOT IDENTIFICATION
   - a) legal description
   - b) lot square footage
   - c) basis and evidence of horizontal control
   - d) lot line dimensions and directions
   - e) dedicated easements and rights-of-way
   - f) description of all found and established lot corner monumentation
   - g) north arrow, scale of map, grid number and date of survey

   SITE INFORMATION
   - a) basis of vertical datum
   - b) lot corner elevations
   - c) existing and proposed lot drainage pattern
   - d) building footprint dimensions and the location referenced to front, side and back lot lines measured to the nearest tenth of a foot.
   - e) proposed finished floor elevation land building corner elevations
   - f) dimensions of upper floor projections and roof and deck overhangs
   - g) location of any existing structure(s) and utilities referenced to the property line

Right-of-Way

Show all civil design items on and adjacent to the lot, such as existing and proposed water, sewer, storm drainage, and existing and proposed service connection lines.

Show existing and proposed roads, type of road (strip paved, gravel, etc.), presence and type of curb and gutter, sidewalks, trails, and other improvements in the right(s) of way.

Show the driveway(s) as existing or planned, type of road being joined into, and presence and type of curb and gutter.

All plot plans shall be sealed and signed by a professional Land Surveyor who is currently registered in the State of Alaska. The Surveyor shall state on the plot plan that he has conducted a physical survey of the lot and that he has found or established all the lot corners as shown on the plan and, to the best of his knowledge and abilities, all dimensions have been measured true and correct.

8. One State DEC approval for WELL AND SEPTIC TANK, if the building is to be on a private system, or written determination from the On-Site Water and Wastewater program at the Building Safety Division if on-site system is not required.

9. Plans submitted for commercial, industrial, 5-plex and above shall be drawn by a LICENSED ARCHITECT AND APPLICABLE ENGINEERS, by discipline registered in the State of Alaska. Change orders shall be endorsed by the professional designer of record.

10. Three copies of PARKING LOT LAYOUT conforming to Title 21 and 23 of AMC, showing access to adjoining roadways, limits of paving, dimensions of aisles and stalls, and indicating handicap parking stalls, loading berths and refuse collection areas. Fee for review may be required.

11. Three copies of HANDICAP RAMP DETAILS and HANDICAP SIGNAGE.

12. Two copies of ON-SITE DRAINAGE PLANS as per Appendix Chapter 70, Uniform Building Code, to an outfall which shows no impact on adjoining properties.

13. Three (3) signed copies of **Handout AG.21, Stormwater Treatment Plan Review, Stormwater Site Plan Review Checklist, Small and Large Projects** with supporting documents. One copy is to be attached to inspector's plans, one copy is for the contractor/job site, and one copy is provided for the Municipal project file

14. A Certified "as-built" of the complete structure must be submitted before any Conditional or Final Certificate of Occupancy will be issued. The "Completed Structural As-Built" will contain the following information:

    a) The drawing shall be identified as a "Final Structure As-Built";
    b) The legal description of the lot and record plat file number;
    c) The date of survey, north arrow, drawing scale and grid number;
    d) The Surveyor's name and address;
    e) The Surveyor's signed registered seal (must have original signature);
    f) A drawing depicting the lot lines, lot dimensions and bearings;
    g) The monumentation the Surveyor used to determine the location of the lot lines;
    h) Easements and right-of-ways of record and appropriate building setback requirements;
    i) The physical outline of the foundation with the field measured dimensions;
    j) Distance measured perpendicular to the property lines from the nearest corners of the foundation to the front, sides and rear property lines;
    k) A surveyor's certification stating:

    I (name of surveyor), hereby certify that I have performed an As-Built survey of the foundation on this lot and all the dimensions and information as shown hereon are true and no encroachments exist unless shown otherwise.

15. Any structure to be built in Hazard Zones 4 and 5 may require engineered design and Geotechnical Commission Review. Check with a Building Safety Division plans examiner for complete requirements.

16. Health Department approval for food service area (restaurants, grocery store, etc.) childcare and similar facilities, swimming pools, hot tubs, must be submitted before final approval will be given.

17. When required by Title 21, three copies of a landscape plan that includes the information specified by AMC 21.45.125(B). Fee involved.

18. Planning and Zoning Commission and Urban Design Commission approvals or resolutions when applicable.

COMMERCIAL BUILDING (Interior Alterations)

1. Three sets COMPLETE PLANS showing how alteration work is to be performed.

2. A code analysis for the building must be submitted to allow for complete review.

3. Submit two copies of any written previous agreements, clarifications and Requests for Alternate Methods and Materials, with signatures of approval, as required.

4. PARKING CALCULATION AND PARKING LAYOUT when changing occupancy or use of existing building. An additional fee will be charged.

5. Health Department approval for food service areas (restaurants, grocery stores, etc.) childcare and similar facilities, swimming pools, hot tubs, etc. must be submitted before final approval will be given.

6. When required by Title 21, three copies of a landscape plan that includes the information specified in AMC 21.45.125(B). An additional review fee will be charged.

Ron Thompson, Building Official
Effective date: February 9, 2006
(Ref. 96-12, 97-08, 00-03, 01-03, 02-05, 02-06; 03-08)

NEW COMMERCIAL BUILDING PRE-PERMIT CHECKLIST:

		Check
1.	Completed **Commercial Permit Worksheet**	
2.	Three **Sets of Drawings** *stamped* by an Architect and Engineer *licensed* in the State of Alaska	
3.	One **Set of Calculations** to match the drawings	
4.	Three **Plot Plans** showing the proposed location of the building site, stamped by an Alaska registered Land Surveyor	
5.	**Code Study** showing construction type, use, and occupancy	
6.	Two **Geo Technical** reports (One to Mike Krueger, soils)	
7.	For lots requiring site water and/or sewer, a permit or application from DHHS must be provided.	
8.	**Plan Review Time**	
If all of the above has been provided and acceptable, approve the plan to be submitted for review. ***CHECK-IN INITIALS***		

Route	
S	
A	
M	
P	
E	

STATE OF ALASKA

Department of Environmental Conservation

Wastewater Invoice

EIN: 926001185

Billing Information (who's paying?)

Name:

Address:

Phone:

Email:

Invoice Date: (MM/DD/YY)

10/22/16

Invoice Number (DEC use):

Plan Tracker #, CI #, or other (DEC use):

Legal Description or Facility Name:

IMPORTANT:

1. Please reference ESPR in memo field of check
2. Please make checks payable to "State of Alaska"

Inv Code	ADEC Project ID: Description	Fee Amount** Between 10/22/16 12/31/17	Between 1/1/18 12/31/18	On or After 1/1/19	QTY	Amt Due
WQ29	48729: Homeowner Training	$120	$200	$275		
WQ27	48727: Certified Installer/Contractor Training	$100	$100	$100		
WQ27	48727: Certified Installer - Certification fee (2 years)	$850	$850	$850		
WQ27	48727: Certified Installer - Certification fee (2 annual installments)	$460	$460	$460		
WQ28	49119: Registration fee per Documentation of Construction form	$115	$115	$115		
WQ32	48732: Searching, retrieving, and copying the document or record of a wastewater disposal system filed by property legal description	$25	$25	$25		
WQ40	49111: Domestic WW Plan Review (A) Based on peak design flow of: 0 - 1,500 gpd (0-10 bedrooms*)	$405	$530	$655		
WQ41	49113: Domestic WW Plan Review (B) Based on peak design flow of: 1,501 - 2,500 gpd (11-16 bedrooms*)	$540	$790	$1,040		
WQ42	49114: Domestic WW Plan Review (C) Based on peak design flow of: 2,501-15,000gpd	$1,095	$1,535	$1,970		
WQ43	49115: Domestic WW Plan Review (D) Based on peak design flow of: 15,001-50,000gpd	$1,800	$2,560	$3,320		
WQ44	49116: Domestic WW Plan Review (E) Based on peak design flow of: 50,001 and over	Hourly fee by 18 AAC 72.959				
WQ45	49127: Waiver/Modification of Provisions under 18AAC72.060 per prescribed standard: **NOTE: Not applicable for engineering plans submitted for review.**	$295	$295	$295		
WQ60	48731: Line extension/replacements (Including Storm Drain collection) up to 1,000 ft	$465	$625	$785		
WQ61	48730: Line extension/replacements (Including Storm Drain collection) for each additional 1,000 ft or fraction thereof.	$240	$315	$385		
WQ38	48738: Non-Domestic WW Plan Review Does not include stormwater runoff	Hourly fee by 18 AAC 72.959				

DEC Contact (printed): **Phone:** **Date Paid:** **Total Due:**

Amount Paid: Check # Cash ☐ Credit Card (MC/Discover/Visa) ☐

* unless otherwise specified and substantiated by the design engineer in their submittal, the Department uses 150 gpd per bedroom as the design flow value.

** some of the fee increases are significant, so the Division is phasing-in fee increases of more than 50% of the current fee over a three-year period

Commercial Permit Worksheet

4700 Elmore Road

Municipality of Anchorage Telephone (907)343-8211 **Building Safety Division**

TAX CODE NUMBER ***PERMIT NUMBER***

COMPLETE ALL APPLICABLE PARTS

SUBDIVISION: _____ LOT: _____ BLOCK: _____

TRACT: PLAT #: GRID #: ZONING:

PLEASE CIRCLE WHICH BEST APPLIES TO YOUR LOT: (**EX** = EXISTING OR **N** = NEW)

UTILITIES TO LOT: PUBLIC WATER: **EX** **N** PUBLIC SEWER: **EX** **N** WELL: **EX** **N** SEPTIC: **EX** **N**

ACCESS TO LOT: UNDEVELOPED GRAVEL STRIP PAVED CURB AND TYPE: Y N 1 2 OTHER

Construction Site Address: _____ *City* _____

Legal Property Owner: _____

Address: _____ *Phone:* _____ *Fax:* _____

Permittee: _____

Address: _____ *Phone:* _____ *Fax:* _____

Contractor: _____

Email Address _____ *Phone:* _____ *Fax:* _____

Contact Person: _____

Email Address: _____ *Phone:* _____ *Fax:* _____

Designer/Architect: _____

Email Address: _____ *Phone:* _____ *Fax:* _____

NEW OR ADDITION

	Number of Stories	#of Dwelling Units	Living Area Sq Ft	Garage Sq Ft	Carport Sq. Ft.	Air Conditioning	Sprinkler Sq. Ft.
Multi-Family Dwelling							

	Type of Const.	Use	Occupancy	Square Footage per Occupancy
New Commercial Bldg				

FILL, GRADING OR EXCAVATION

Cubic Yards of: Fill: _____ Excavation: _____ Grading: _____

SIGNS

Electric: Quantity _____ Non Electric Quantity _____ Valuation: _____

COMMERCIAL ALTERATIONS

DESCRIPTION OF WORK: # OF INSPECTIONS: _____ TOTAL CONSTRUCTION VALUATION _____

COMPLETED BY: _____ DATE: _____

FOR OFFICE USE ONLY

PERMIT NUMBER	LOT	BLOCK	SUBDIVISION

NEW COMMERCIAL BUILDINGS

Building Permit Fee: _____

$1 to $500,000:	$0.015 of Valuation
$500,001 to $1,000,000:	$0.010 of Valuation
$1,000,001 to $5,000,000:	$0.008 of Valuation
$5,000,000 and up:	$0.006 of Valuation

Plan Review Fee: _____
($.0031 of Valuation, with a minimum of $65)

Eplan Review Surcharge: _____
($.0005 of Valuation)

Fire Review Fee: _____
($.0011 of Valuation, with a minimum of $65)

Land Use Plan Review: _____
($0.00075 of Valuation, with a minimum of $25)

Address Fee:	**$85.00**
NPDES:	**$600.00**
Flood Plan Review:	**$45.00**
Storm-Water	**$650.00**
Zoning Inspection Fee:	**$130.00**

New Commerical Pre-Approved: _____
($.0017% Valuation with a minimum of $65.
In place of Building Plan Review Fee)

Outsourcing: _____
(additional 25% of the Building Permit Fee)

GRAND TOTAL: _____

Cash: _____
Check: _____
Visa/MC: _____
Receipt Number: _____
Date: _____

FILL, GRADING & EXCAVATION

**** Please reference AAC 23.10 Table 3-G Sections 1 & 2, for fees ****

FILL _____ cu yds.
GRADE _____ cu yds.
EXCAVATION _____ cu yds.
Permit Fee: _____
Plan Review Fee: _____

NPDES	**$600.00**
Flood Plan Review Fee	**$45.00**
Storm-Water Fee	**$550.00**
GRAND TOTAL:	

COMMERCIAL ALTERATIONS

Building Permit Fee: _____
$150.00 per inspection, which includes structural, electrical, plumbing, mechanical and fire.

Plan Review Fee: _____
($.0031 of Valuation, with a minimum of $65)

Eplan Review Surcharge: _____
($.0005 of Valuation)

Fire Review Fee: _____
($.0011 of Valuation, with a minimum of $65)

Land Use Plan Review: _____
($0.00075 of Valuation, with a minimum of $65)

Number of Inspections: _____
(project provide by General Contractor)

GRAND TOTAL: _____

Cash: _____
Check: _____
Visa/MC: _____
Receipt Number:

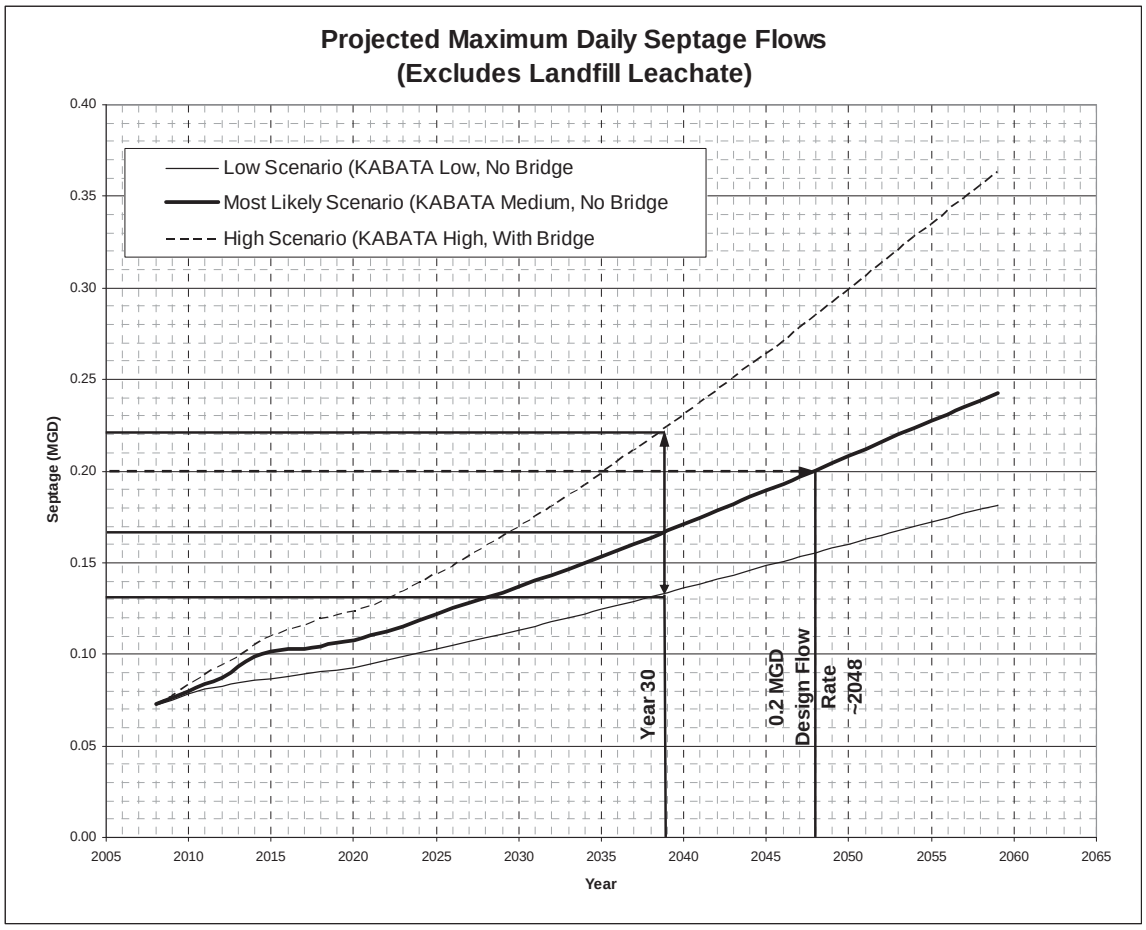
Appendix F

Research

4.2.4 MSB Septage Flow Projections

Figure 12 illustrates anticipated peak summer septage flow rates from septic tanks within the Borough excluding Central Landfill leachate and septage currently collected and processed by Wasilla for a 50-year period:

Figure 12: Projected Maximum Daily Flow Rates – Septage



This model suggests that the projected 30-year septage flow will range between 0.13 and 0.22 MGD ADF with the most likely flow being 0.17 MGD ADF, assuming that there is no development of additional wastewater collection/treatment systems serving customers outside the study area or Talkeetna. This septage flow projection also assumes that customers currently served by Wasilla's STEP system would be converted to a system which did not involve pumping of septage solids (grinder pumps or gravity collection). The study team has designed septage collection and treatment equipment to handle an average daily flow of 0.2 MGD of septage. (See Section 5.2.2 on Page 48)

AWWU records show that around 700,000 gallons of landfill leachate are disposed at the Turpin Street receiving station per year. Future leachate flow rates are expected to grow as the lined area in the central landfill increases. Future leachate flows were not estimated for this report, as conversations with the Borough indicate that they would prefer to process and dispose of leachate on-site.

2. Literature review

With the increasing interests in FOG control, studies have been conducted on different aspects of FOG control regarding its formation, characteristics, degradation pathways, physical and chemical methods for FOG removal, and biological degradation.

2.1 FOG deposits formation and characteristics

Chemically, fats, oils, and greases are similar. They are triglycerides, a sort of ester formed by combination of glycerol and three fatty acids (shown in *Figure 2.1*).

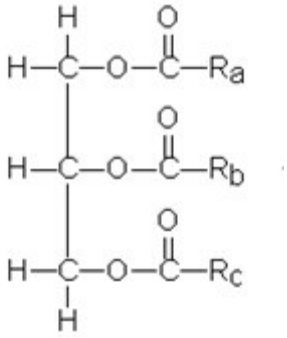


Figure 2.1. Fundamental structure of triglyceride.

Generally, unsaturated fats have relatively lower melting point and are more likely to be liquid while saturated fats have a higher melting point and are more easily to be solidified at room temperature. The glycerides of fatty acids that are liquid at ordinary temperature are called oils; those that are solids are deemed as grease (fats) (McMurry, 1997) .

According to Lissant (1974), FOGs present in wastewater could be categorized based on particle sizes including free, dispersed, emulsified, and dissolved FOGs. For FOG cleaning methods, gravitational separation can be used for free and dispersed FOGs

removal while emulsified and dissolved FOGs require physicochemical and biological treatments for their removal . Despite the fact that FOG deposits is the main reason for sanitary sewer overflows, the mechanisms of FOG deposits formation in sites such as pipe systems and pump stations are not completely clear. To help better understand this issue, researchers have conducted several experiments including FOG formation under laboratory condition, FOG spatial formation and accumulation, influencing factors, and actual FOG deposits analysis.

FOG deposits appear to be adhesive and can be bound to interior pipe walls or internal walls in structures like pump stations. Meanwhile, most of FOG deposits have a grainy, sandstone-like texture and high yield strength when high-pressure jet cleaning is needed for FOG removal (Keener et al., 2008). As FOG deposits is a type of complicated material, they show high variation in physical characteristics such as composition and moisture. Physical characteristics rely hugely on sampling locations, related FOG sources, and even sampling time. For example, in Williams et al. (2012), they found the FOG deposits had a mean moisture content value of 55% with a large range from 15 to 95% though. Such thing can also be found in Keener et al. (2008) with range between 6 and 86%. Sampling locations played an important role in FOG moisture content: generally higher moisture content is easier to be noted in FOG deposits obtained from sewer systems than that from pump stations. A possible reason is the locations differ from each other in environments and sewage characteristics. Also the maturation of the FOG in the network might contribute to the differences. With little impact from sampling locations, the majority (94%) of the FOG solids were found to be volatile among which the extractable oils could make up 15% (Williams et al., 2012). As for metals, the dominant

one is calcium followed by Na, Fe, Al and Mg (Williams et al., 2012). Variations can also be found in characteristics such as yield strength (4 to 34 kPa) and porosity (10 to 24%) (Keener et al., 2008).

In Keener et al. (2008), they proposed three possible categories of FOG deposits based on their formation mechanism. The dominant FOG deposits are classified as metallic salts of fatty acids as observed in 84% of all the FOG deposits samples they collected. Among these samples, layering effects are obvious and distinct indicating an intermittent formation process in practice which can often be seen in restaurants and industries. The second category of FOG deposits is caused by accumulation of lipids from wastes containing highly concentrated lipids. Insignificant metals or minerals can be found among samples of this category which is similar with that of cooking oils. The last and minor category is just mineral deposits without any FOG contents by misidentification.

He et al. (2011) have done a series of experiments regarding FOG deposit formation and its characteristics. In He et al. (2011), they collected grease interceptor effluent from a steakhouse in Cary, NC to provide free fatty acids and used jar test apparatus for a 10 days' run and it was the first documented FOG deposits formation using grease interceptor under laboratory conditions. Compared with FOG deposits samples collected from sewer lines, fatty acids profiles indicated that all of them had similar fatty acids types. The major component of FOG deposits was saturated fat among which palmitic saturated fatty acid was the primary one and Keener et al. (2008)'s work showed a similar analysis results about palmitic being the primary fatty acid in FOG deposits. The observation of palmitic as the primary fatty acids in FOG deposits samples has also been documented in a recent study based on samples collected from different sites in UK

(Williams et al., 2012). According to He et al. (2011)'s comparison among lab-scale FOG deposits product, samples collected from real sites and calcium soap, FOG deposits are likely metallic salts of fatty acid with calcium as the major metal ion and resulted from chemical reaction named saponification. Great property variations in FOG deposits samples including fat content, metals, and saturated fatty acids to unsaturated fatty acids ratios have been reported in recent studies (He et al., 2011; Keener et al., 2008; Williams et al., 2012). He et al. (2011) hypothesized that aggregation between excess calcium or free fatty acids might be another formation mechanism for FOG deposits expect for saponification and they deducted that different FOG sources could have gone through oxidative changes and FOG sources had different concentrations from different samples respectively from the observation that spectral peak intensities for all the samples were quite distinct from each other.

To better analyze impacting factors in FOG deposits formation, researchers took calcium concentration into consideration. Keener et al. (2008) observed higher calcium concentrations in FOG deposits compared with that in wastewater concentration levels. In their study, no correlation between water hardness and high calcium concentrations was noted. From the fact that high concentrations of sulfur and iron (which are usual materials in concrete) were measured in FOG deposits, Keener et al. (2008) and He et al. (2013) proposed that the excess calcium present in FOG deposits might be partly caused by concrete corrosion. He et al. (2013)'s work introduced biogenic concrete corrosion into the formation of FOG deposits through which excess calcium released into water could react with fatty acids and form FOG deposits caused by a charged double layer type compression process. Nevertheless, Williams et al. (2012) observed a correlation between

wastewater hardness and high calcium levels in FOG deposits samples and raised a possible reason: bio calcification. Based on recent literature, He et al. (2013) proposed a relatively complete formation mechanism of FOG deposits which can be seen in *Figure 2.2*.

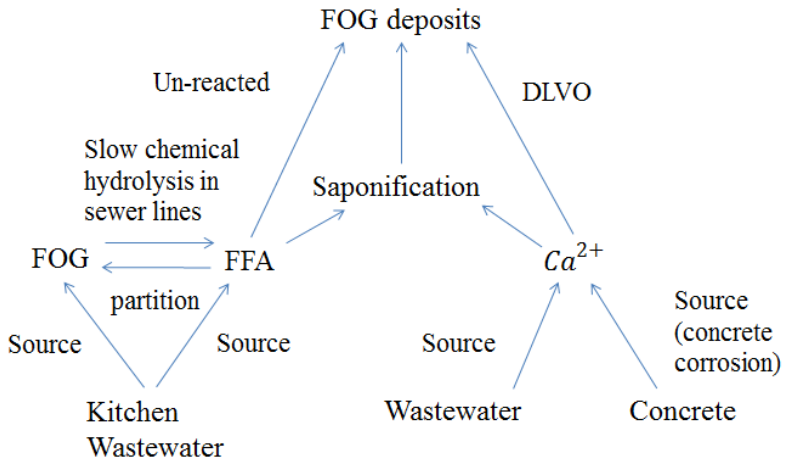


Figure 2.2 Proposed mechanisms of FOG deposits formation in sewer lines adapted from (He et al., 2013)

Generally, there are four contributors in FOG deposits formation: calcium, free fatty acids (FFAs), FOGs, and water. During the formation process, FOGs could be deemed as transporter and a minor source of FFAs in wastewater. Two main sources for FFAs in sewer systems are cooking process and microbial activities in grease interceptors (Canakci, 2007; Monterfrio et al., 2010). Once generated, they would come together with FOGs and stay on wastewater surface. Calcium mainly comes from original wastewater or released by concrete corrosions. Saponification which is the main chemical reaction that FOG deposits be formed could occur at a fast rate at the oil/water or oil/concrete interface with the presence of calcium and FFAs. Other than saponification, the aggregation of excess calcium in wastewater (He et al., 2011; Williams et al., 2012), un-

reacted free fatty acids, and debris in wastewater help the accumulation of FOG deposits on the surface of sewer lines or internal walls in structure (He et al., 2011). Throughout the built up process, the saponified solid act as a core adhered to sewer lines or internal walls with un-reacted FFAs accumulated around it. Due to Van der Waals attraction and electrostatic repulsion, the adhered un-reacted FFAs are able to gather more calcium and other cations towards the solid core matrix. Again, saponification would happen between the un-reacted FFAs and calcium resulting in accumulation of FOG deposits around the solid core matrix. Meanwhile, debris in wastewater could also accumulate and cause the formation of debris layers interspersed with hardened FOG which is consistent with the observation in Keener et al. (2008).

2.2 Methods for FOG removal

In general, physical/chemical and biological methods are most used in FOG control in municipal wastewater. For physical/chemical methods, current researches focus on structure design, technique upgrade for higher FOG loadings, FOG removal improvement and FOG removal estimation. The majority of those studies are laboratory related and computer modeling has been applied sometimes. For biological areas, researchers have been trying to find potential bacteria for FOG degradation, apply combined bacteria species, combine bacteria with enzymes, surfactants, or with physical methods, and optimize operation conditions under lab condition and in practice as well.

2.2.1 Physical/chemical methods

The grease trap method (to achieve floatable FOG separation using gravity), also known as passive and mechanized grease abatement devices (GADs) is the main technique used for separating fat and oil from wastewater (Cammarota &Freire, 2006). Typically, a

grease trap is a rectangular or circular vessel. When FOG containing wastewater passes through the trap under laminar-flow conditions, a proper rate can allow fat, oil and grease inside the water to rise to the surface before they come to the outlet of the trap. After a period of operation, the accumulated FOG layer will be removed manually or mechanically. For its operation, the depth of a typical fat trap is around 1.5m with addition 0.5m added to total liquid depth if accumulation of bottom sludge is considered. *Table 2.1* shows typical surface loading rates applied in practice.

Table 2.1. Typical surface loading rates for different types of water adapted from (Willey, 2001).

Water type	Max surface loading rate ($m^3/m^2/h$)
Margarine wash water	1.5
Acid water	1
Barometric water	3~6

For the aspect of trap design, current design guidelines for grease traps such as Uniform plumbing code (UPC) (IAPMO, 2006) recommend addition of at least one baffle wall configuration to improve separation effects. Contrarily, Aziz et al. (2011) conducted a series of research using experimental results and computational fluid dynamics on alternative inlet, outlet, and baffle wall designs and found that the inclusion of a baffle wall failed to improve oil separation. Moreover, their studies indicated that the high performance of FOG trap might be achieved using shortened inlet pipe, no compartmentalization and flared piping and combination of distributive inlet with a distributive baffle wall (Aziz et al., 2011). Practice suggested FOG removal could fail to meet related regulations easily: high FOG residue within FOG traps get accumulated frequently resulting in manually cleaning up. Furthermore, grease traps are usually

unaesthetic, need more area for construction, and sometimes could cause air pollution around them (Cammarota &Freire, 2006). All these drawbacks require more improvement for grease traps.

As an improvement of traditional grease trap, titled plate separators (TPS) was introduced firstly in petrochemical industry (Willey, 2001). Unlike grease traps, the important factor in the separation process is surface area instead of depth. Tilted plates installed within the vessel can provide many parallel gravity separators resulting lower depth and higher surface area. Consequently, TPS occupy less than 10% of the area of a conventional grease trap (Willey, 2001). Meanwhile, TPS has the advantage of mobility which can bring much more convenience for family and restaurant use (Iggleden, 1978). Several issues thwart the widely application of TPS: readiness to fouling because of the narrow gaps between the plates; long time consumption for plates cleaning; and more strict requirement for pumps and flow control in order to avoid fluctuations and surging. As for FOG layer removal after its formation, directly pouring chemical cleaners has been used in certain practical cases except cleaning manually or mechanically. Nevertheless, it's reported that this process is harmful both for the users and the environment as well (Rashid &Imanaka, 2008).

Dissolved air flotation (DAF) is another important physical process used in FOG control. After the compressed air is introduced into water through nozzles, microbubble clouds can be formed which can attach to the surface of the fat/oil particles resulting in an increase in rise rate (Willey, 2001). To improve the performance of DAF in FOG control, different techniques have applied in the enhancement. Rattanapan et al. (2011) conducted a novel approach using acidification (pH=3) and coagulants (alum, polyaluminum

chloride and ferric chloride) to enhance efficiency of the DAF process. The results turned a notable 80% removal of oil and grease from biodiesel wastewater and a 30% removal in COD (Rattanapan et al., 2011). Le et al. (2012) examined efficiency of microbubble (MB) treatment, microbubble treatment with polyaluminium chloride (PAC) as a coagulant, and MB treatment with cetyltrimethylammonium chloride (CTAC) as a cationic surfactant in the separation of emulsified oil (EO) (1000 mg/L) by flotation. Both the MB treatment with PAC (50 mg/L) and MB treatment with CTAC (0.5 mg/L) showed high EO removal efficiencies of 92% and 89%, respectively (Le et al., 2012). The main concern with DAF process is its operation issues and energy requirement for foam tripping. Although have not been applied in a large scale in practice, some other physical-chemical processes have been evaluated by researchers including microwave irradiation and electrocoagulation (Kuo &Lee, 2009; Tansel &Pascual, 2011; Tir &Moulai-Mostefa, 2008).

In general, physical/chemical processes have been proved to be effective in reducing solidified FOG wastes and FOG layers. Nevertheless, these techniques are prone to fail in reducing dissolved and emulsified fats resulting in reduction of oxygen transfer rates that are important for aerobic biological wastewater treatment downstream (Chao &Yang, 1981). Meanwhile, anaerobic processes can also be affected because of the lipids that can reduce the transport of soluble substrates to the bacterial biomass (Rinzema et al., 1994).

2.2.2 Biological methods

Biological treatment is the process by which targeted wastes are degraded through microbial activities, microbial products like enzymes and so on. With the increasing interests in biological FOG treatment, experiments have been demonstrated on different aspects of biological treatment including FOG degradation pathways, effective strains,

factors that affect treatment efficiency, and operation issues in practice that will be introduced in the following sections.

2.3 Pathway of FOG biodegradation

Pathway of FOG biodegradation is the foundation of biological FOG control processes and provides related theories for further studies and experiments. As a result, the process of how FOG is degraded has been explained by several research groups (Nunn, 1986; Ratledge, 1992). As presented in *Figure 2.3*, once triglycerides are attacked by competent microorganisms using extracellular lipases or phospholipases, free fatty acids will be released and ester bonds within the structures are hydrolyzed (Ratledge, 1992).

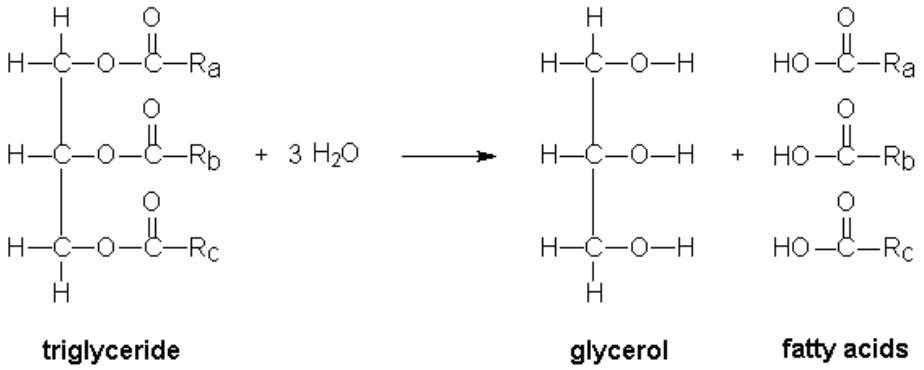


Figure 2.3. Chemical equation for triglyceride hydrolysis (glycerol is formed and fatty acids are released).

Beisson and Tiss (2000) concluded numerous methods for measuring hydrolytic activity and the detection of lipases and suggested that the general triacylglycerol hydrolysis reaction catalyzed by lipases can be expressed in the following format.

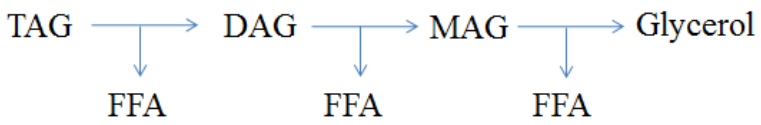


Figure 2.4. General triacylglycerol hydrolysis reaction catalyzed by lipases
Note: (TAG= triacylglycerols, DAG= diacylglycerols, MAG= monoacyglycerols, FFA= free fatty acids)

It's obvious from *Figure 2.4* that for each step in the general triacylglycerol hydrolysis, a free fatty acid will be released and a corresponding type of multi-glycerol will be formed waiting for further hydrolysis which will produce glycerol eventually.

Free fatty acids can be used by a larger group of microorganisms as carbon source. If a microorganism is growing in an environment of fatty acids with the number of carbon atom between C_{14} and C_{18}, including ones with an odd number of carbon atoms, some of the fatty acids can be incorporated into the microorganisms' constituent (Ratledge, 1992). After entering cell body, fatty acids can either be catabolized or directly incorporated into complex lipids for further use. In general, the cyclic β-oxidation is the main process by which fatty acids degradation occurs (Nunn, 1986). The β-oxidation yields a succession of acetyl-CoA units as the fatty acid is progressively shortened by C_2 units. The first step of fatty acid degradation is the activation of the free fatty acid to an acetyl-CoA thioester by acetyl-CoA synthestase (fatty acid: CoA ligase) in which one molecule of adenosine triphosphate (ATP) and CoA per molecule of free fatty acid activated are needed. The next step is called acetyl-CoA dehydrolysis in which acetyl-CoA dehydrogenase is required. Unfortunately, little is known about this sort of enzyme in bacteria (Nunn, 1986). Saturated fatty acids follow the traditional β-oxidation pathway. Nevertheless, the pathway for degradation of unsaturated fatty acids is not determined and two possible

pathways have been proposed: the degradation of unsaturated long chain fatty acids requires complete saturation firstly through which the unsaturated fatty acids could be saturated and ready for further degradation and then followed by the typical β-oxidation pathway (Novak &Carlson, 1970); However, Roy et al. (1986) isolated an anaerobic bligately syntrophic fatty acid degrading acetogenic bacterium (Strain OM) which could ferment all linear saturated fatty acids (C_4 to C_{18}). Meanwhile, they found some mono- and di-unsaturated fatty acids including obleate, elaidate and linolenate could also be oxidized suggesting that β-oxidation of unsaturated fatty acids might occur before saturation. In terms of anaerobic degradation, fatty acids are degraded through β-oxidation pathway to acetate and H_2 and acetate is converted to methane eventually (Long et al., 2012). According to Kim et al. (2004), β-oxidation pathway could be expressed as follow:

$$CH_3(CH_2)_nCOOH + 2H_2O \rightarrow CH_3(CH_2)_{n-2}COOH + CH_3COOH + 2H_2$$

2.4 Analysis of potential species for FOG degradation

As shown in *Table 2.2*, a large number of microorganisms capable of degrading FOG deposits have been identified and may be potential for further application. Markossian et al. (2000) isolated an efficient lipid-degrading thermophilic aerobic bacterium that categorized as *Bacillus* thermoleovorans IHI-91 from an Icelandic hot spring. Being different from regular *Bacillus* species, the optimum temperature for IHI-91 was 65℃. It could secrete high concentration of thermoactive lipases and esterases to degrade a large range of lipids. This isolation have shown the possibility of application of commercial products within a wide temperature range (Markossian et al., 2000).

Mixed microbial cultures have been identified to degrade a variety of oils showing the potential to treat FOG wastewater from different sources (Tano-Debrah et al., 1999; Wakelin &Forster, 1997). Tano-Debrah et al. (1999) developed an inoculum which was a mixed-culture of 15 bacterial isolates from fatty wastewater samples and all of them had demonstrated the ability for FOG (generated from both plant and animal origins) degradation. Despite the fact that the optimum temperature for the inoculum to show FOG removal was 20 to 25℃, they observed the inoculum was active within the temperature range of 8 to 42℃. Wakelin and Forster (1997) compared a range of pure and mixed cultures in degrading vegetable oils, lard and "grease" from a fast-food restaurant grease-trap and found that the removal efficiency depended on FOG materials ranging from 29% for rapeseed oil to 73% for the restaurant grease while activated sludge displayed a relatively more consistent removal in FOG from different sources with the value higher than 90%. Rashid and Imanaka (2008) identified four isolates that belonged to *Bacillus* and found them be able to decrease the suspended solid of the trapped grease from 102 to 40 mg/L and show an extensively removal rate (around 100%) of n-hexane extractable material.

As for application of commercial microbial supplement, the most point is they should not cause a human health hazard or environmental disruption. Additionally, the species should be active in regular conditions, that is to say, the requirement for working condition of these species are reasonable. These criteria limit some potential species for application in commercial products and many of current commercial supplements contain mostly *Bacillus* sp. and closely related bacteria (Brooksbank et al., 2006). Both of the products applied by City of Edmonton, Bio-Brick and Bio-Block contain surfactants,

enzymes, colorants and a *Bacillus* spore blend (including *B. amyloliquefaciens, B. pumilis, B. licheniformis, B. megatarium*). *Figure 2.2* also shows the isolated and identified *Bacillus* that is able to produce lipase and effective in FOG degradation and its fermentation conditions. *Table 2.2* indicates that fermentation of *Bacillus* can occur within a large range of temperature and range of pH value (7.0-9.0) is manageable in practice.

Septage Receiving Practices

PREPARED FOR: AWWU Septage Receiving Team

COPY TO: Mark Corsentino/AWWU

PREPARED BY: Tom Wolf/ANC

REVIEWED BY: Doug Berschauer/PHX

DATE: April 4, 2013

At the request of the committee, I polled our senior wastewater engineers for responses to the questions I heard at the February 28, 2013 committee meeting. The responses below are the practices we've observed with several of our clients around North America.

1) How are others measuring truck and/or discharge volumes?

   General Response: Flow meter after screening, truck capacity regardless of load quantity, percentage of truck capacity, or truck weigh scales are all used.

   Community/Utility Specific:

   - **Spokane County, WA** - Flow meter after screening
   - **City of Spokane, WA** – Rated truck capacity regardless of load quantity
   - **Johnson County, KS** – 75% of rated truck capacity
   - **City of Salem, OR** - Flow meter after screening
   - **City of Tacoma, WA** – Flow meter without screening (located adjacent to WWTP)

2) What are the impacts from receiving septage on the treatment process (particularly secondary treatment processes)?

   Responses:

   - Septage is a blend of partially digested sludge and debris. It varies a lot depending on the source.
   - Domestic septage with good drain fields is very stable, but commercial tanks that are pumped frequently are much more active for all parameters because it isn't stabilized.
   - Septage has both a BOD and TSS element that can have an impact to the loading of the secondary process depending on the volume.
   - Some plants have considered blending screened septage with primary sludge and sending directly to digester since septage is basically primary sludge that has partially digested. Material can be sent to secondary process, but screening and removal of un-wanted material/garbage is essential. The loading on the ¼" perforated plate screens is significant and could be an issue particularly with a small WWTP.
   - Some plants opt to bleed the septage into the system to avoid shock loadings from large volumes hitting the process at once.

   Many of these items depend on the WWTP, normal flows, septage receiving schedules, and treatment process. Septage can also be a source of things that you really don't care to have, so a prequalification process for the haulers and periodic auditing of them is a good idea to make sure that undesirable loads don't show up.

Community/Utility Specific:

- Many years ago **Madison, WI MSD** had a problem with a hauler that would bring in essentially toxic (to the treatment process) loads from time to time. The hauler was eventually debarred and possibly prosecuted.
- **City of Spokane, WA** occasionally has loads of nearly pure FOG that can play havoc with the washer compactors.
- **Spokane County, WA** monitors the pH of each load before allowing it to be dumped. The septage receiving station is enclosed and connected to odor control.
- In our work with **Bellingham, WA** (20 mgd), **Olympia, WA (10 mgd)**, **Renton, WA** (70 mgd) and **City of Spokane, WA** (35 mgd) and septage doesn't cause any significant problems that we've been asked to look into.
- At **Port Townsend, WA** we designed a septage receiving facility with their yardwaste and biosolids composting facility—the biggest loads come from porta-potty waste—very high solids, BOD and nitrogen.
- In **Tacoma, WA** septage is discharged just upstream of plant screens and the station is more for billing and keeping haulers out of WWTP site.
- **Salem, OR** has "septage monsters" which screen the material prior to going into a major interceptor.
- **Centralia, WA** has a relatively new WWTP and doesn't have a septage receiving facility.
- **Bellingham, WA**; **Olympia, WA**; **Renton, WA**, and the **City of Spokane, WA** have receiving stations with hose connections using quick couplers and discharge into the main flow stream without any storage or treatment. They rely on the screening and grit facilities to remove the debris and grit. Design of the piping and septage dump area is largely for making the hosing convenient to the septage haulers and making the area easy to clean by the haulers. None of these facilities has enclosed septage dumping.

3) What sort of permitting processes to other communities use?

Community/Utility Specific:

- Both **Johnson County, KS** and **Metro Denver, CO** only allow permitted haulers to deliver septage.
- **Omaha, NE** just accepts whatever waste is brought in.
- **Spokane County, WA** and **City of Spokane, WA** both have a prequalification process and monitor closely.
- **Calgary, AB** has an industrial waste services group that regulates dischargers under a source control bylaw for liquid waste
- **Jacksonville, FL** has a "preferred haulers" program to control FOG issues. The Utility qualifies the haulers. Preferred haulers contract with the food service establishments and have pump out reporting responsibilities to the Utility. The Utility spot checks 10% of the grease traps. Significant reduction in FOG in the first 5 years of the program.

4) Do other communities review videos? What is their procedure for doing that?

Community/Utility Specific:

- Currently in **Salem, OR**, site is manned, but new site will be remote and will be monitored 24/7. Gate access will only allow day time use in Salem.
- **Tacoma, WA** allows night time access – monitored with camera 24/7 from adjacent WWTP.

- **Johnson County, KS**; **Omaha, NE**; and **Metro Denver, CO** only allow deliveries during normal working hours, ~7 am to 4 pm. All have video feed to main control room.
- Spokane County, WA and the **City of Spokane, WA** both have video security. Access at the City is restricted to daytime when the gates are open. The County system has a quota for how much can be taken in a day; drivers have to card in to the site and to the facility with a key card.
- **Calgary, AB** has CCTV. Site is manned and accessible on weekdays for 10 hours per day.

5) Do other communities the man the facilities?

Community/Utility Specific:

- Both **Tacoma, WA** and **Salem, OR** have un-manned facilities. They do have the ability to override the system to not allow disposal if there is a problem (shutting down valve to not allow hauler to discharge).
- **Calgary, AB** is a manned facility
- **Johnson County, KS**; **Omaha, NE**; and **Metro Denver, CO** facilities are all unmanned, but behind the facility gates
- **Spokane County, WA** and the **City of Spokane, WA** are both unmanned but at the WWTP's

6) Charges

Location	**Rate**	**Notes**
King County, WA	$0.125/gallon	Actual gallons disposed
City of Spokane, WA	$0.139/gallon	Rated capacity of truck to avoid measuring loads
Spokane County, WA	$0.15/gallon	Flow meter
Johnson County, KS	$0.04/gallon $0.07/gallon	Septage – volume based on ¾ rated truck capacity FOG – Actual volume
Salem, OR	$0.10/gallon $0.03/gallon	Septage Leachate