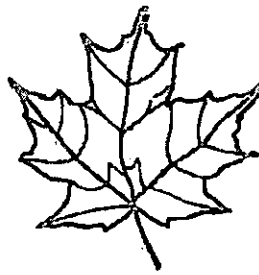
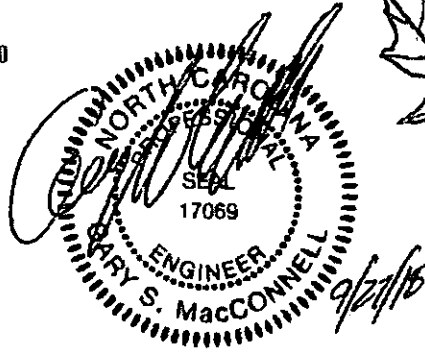


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Technical Memorandum

To: Ziad Qudwa
From: Gary S. MacConnell, P.E. and Aershen Muheyati
Date: September 27, 2018
Client: Ziad Qudwa
Subject: Custom Exempt Slaughterhouse Cost Analysis
Project No. A67601.00

Introduction

MacConnell & Associates, P.C. (M&A) has been contracted to perform an evaluation of wastewater options for a proposed slaughter house and meat processing facility for Mr. Ziad Qudwa, at 1253 Atkins Road in Harnett County, North Carolina. This memorandum consists of an evaluation of: the existing site conditions, wastewater flow analysis, and cost opinions and recommendations for water supply, wastewater treatment, and disposal systems.

Existing Conditions

The site is located on a 5.3 acre parcel of land with an existing single family residence and several sheds. The current residence is served by county water as well as a private subsurface septic system. A new slaughtering building is proposed at the northern side of the farm. The owner will need to extend water service to the building for potable water supply. Wastewater treatment and disposal systems will also be designed and installed for the slaughterhouse operation as public sewer is not available at the site.

Proposed Business Classification and Type

Per inspection requirements for meat and poultry businesses by North Carolina Department of Agriculture and Consumer Services (NCDA&CS), the slaughtering facility will be considered as a custom exempt facility as the owner only wishes to provide services for slaughtering and processing meat and poultry for the general public for personal consumption only.

name. These facilities are inspected for sanitation and proper labeling of products. The meat and poultry products are not inspected for disease or quality and cannot enter commerce. All products must be returned to the original owner for his/her personal use and cannot be sold.

In order to obtain the custom exempt status, the facilities must first meet regulatory performance standards. For example, production rooms constructed of materials impervious to moisture; adequate restrooms, hand wash stations, lighting, ventilation, drainage; equipment and utensils which are cleanable and maintained in sanitary condition, etc. A free analysis can be provided by NCDA&CS. Secondly, an Application for Inspection to NCDA&CS must be completed and submitted. Thirdly, obtain an approved well or public water permit and a wastewater construction authorization permit through local or state environmental health agencies. Lastly, provide the written documents about hours of operation, request to dispose of inedible wastes, chemical list, and safety data sheets.

Flow Analysis

The flow capacity is calculated based on the maximum septic field available, soil conditions and long term acceptance rate (LTAR) provided by Licensed Soil Scientist Alex Adams. The estimated flow is calculated based on both surface and subsurface disposal options. Subsurface is preferred due to the greater setbacks required for spray or drip systems. Surface disposal is regulated by the North Carolina Department of Environmental Quality – Non-Discharge Permitting Unit per Rule 15A NCAC 02T. Per soil scientist Alex Adams, the proposed LTAR will be 0.3 to 0.4 gallons per day (GPD) per square feet (SF). The irrigation field will be located on the Southwest side of the property, yielding about 8,500 square feet (50 feet x 115 feet) conservatively. Therefore, the total maximum flow for this field is 1,275 gallons per day ($0.3 \text{ GPD/SF} * 8,500 \text{ SF} / 2 = 1,275 \text{ GPD}$), putting half of the field for future repair as demanded on subsurface codes and regulations. The purpose of the calculation is to determine the maximum proposed floor space for this field.

Please see the attached setback rules 15A NCAC 18A .1950 (Subsurface) and 15A NCAC 02T .0506 (Surface) in Appendix A for setback comparisons.

Depending on the type of wastewater disposal system, the proposed market floor space can vary from 1,533 SF to 2,300 SF (estimated area minus offices, bathrooms, and refrigeration areas) with 5 total full-time employees conservatively. This is a conservative estimate as it is doubtful that there will be 5 full-time employees simultaneously working at the site. The estimated flow is calculated based on both surface and subsurface disposal options. Subsurface is preferred due to the setbacks required for spray or drip systems. Surface disposal is regulated by the North Carolina Department of Environmental Quality - Non-Discharge Permitting Unit per Rule 15A NCAC 02T. Under these regulations 75 gallons per day (GPD) /100 square feet (SF) of market area are used in calculating the flow. Table 1 shows the flow without flow reduction. Please note that flows for slaughter houses are not provided in the 15A NCAC 02T regulations and this will be discussed later.

Table 1. Projected average daily design flow for systems using surface disposal of wastewater per Rule 15A NCAC 02T.

Meat Market Flow	Daily Average Flow/Unit	Unit	Average Daily Flow
Meat department, butcher shop or fish market	75 Gal/100 SF market floor	+/- 1,533 SF	1,150 GPD
Employees	25 Gal/employee	5 Employees	125 GPD
Total:			1,275 GPD

Sub-surface disposal is regulated by the North Carolina Department of Health and Human Services - Division of Public Health - On-site Water Protection Branch per Rule 15A NCAC 18A. Under these regulations 50 gallons per day (GPD) /100 square feet (SF) of market area are used in calculating the flow. Table 2 shows the flow without flow reduction for subsurface disposal. Flows for slaughter houses are also not provided in the 15A NCAC 18A regulations and will be discussed later.

Table 2. Projected average daily design flow for systems using sub-surface disposal of wastewater per Rule 15A NCAC 18A.

Meat Market Flow	Daily Average Flow/Unit	Unit	Average Daily Flow
Meat department, butcher shop or fish market	50 Gal/100 SF market floor	+/- 2,300 SF	1,150 GPD
Employees	25 Gal/employee	5 Employees	125 GPD
Total:			1,275 GPD

We have summarized the two major factors used to determine the water requirements of the slaughter operation in Table 3. This table provides the number of animals killed per day of operation (as provided by the Client) and the water usage based on EPA design guidelines for meat processing facilities. Per EPA's "Technical Development Document for the Final Effluent Limitations Guidelines and Standards for the Meat and Poultry Products Point Source Category (40 CFR 432)", no value for goat and lamb water usage was found. Since hogs are closer in size to goats and lambs than cattle (hogs used 291 - 442 gallons per 1,000 lbs. and cattle used 532 gallons per 1,000 lbs.), we used 400 gallons per 1,000 lbs. for goats and lambs.

Table 3. Factors used to calculate water usage of the slaughter operation.

Processed Animal Type and Average Weight	Daily Animal Kill	Average Water Usage
Goats (310 lbs./kill)	3 - 4 Live Stock	400 gallons/1,000 lbs.
Lambs (350 lbs./kill)	2 Live Stock	400 gallons/1,000 lbs.
Veal (2,400 lbs./kill)	1 Live Stock	532 gallons /1,000 lbs.
Chicken (3.83 lbs./kill)	15 - 20 Live Stock	2,428 gallons /1,000 lbs.

Table 4 shows a summary of the calculated daily water use for the proposed slaughter operation, based on the factors presented in Table 3. The following calculations also show the peak hour with a peaking factor of 3.

Table 4. Slaughter operation calculated flows.

Live Stock	Weight/Animal (lbs.)	Numbers Processed/Week	Average Water Usage/1,000 lbs.	Average Daily Flow (GPD)	Peak Flow (GPH)
Goats	310	4*7	400	496	186
Lambs	350	2*7	400	280	105
Veal	2,400	1	532	182	479
Chicken	3.83	20*7	2,428	186	70
Average and peak flows				1,144	840

In evaluating the three methods above for calculating flows, we propose a design flow of 1,270 GPD. This is based on the slaughterhouse calculated flow 1,150 GPD plus the worker flow 125 GPD.

Wastewater Analysis

The principle sources of wastewater and wastes are from live stock holding, killing, hair removal, eviscerating, carcass washing, trimming, and general cleanup operations. Wastewater from the slaughter operation is typically considerably higher than domestic strength wastewater. Wastewater from the slaughtering of animals contains organic matter (grease and fats), suspended solids, and inorganic material such as phosphates, nitrates, nitrites, and salts. These materials enter the wastewater treatment system as blood, meat and fatty tissue, meat extracts, paunch content, bedding, manure, hair, dirt, potential contaminated cooling water losses from rendering, curing and pickling solutions, preservatives, and caustic or alkaline detergents. Biochemical oxygen demand (BOD) from blood is high in concentration as well as total suspended solids (TSS), and nitrogen (N). A generalized raw wastewater pollutant summary of slaughterhouse wastewater which was conducted by the United States Environmental Protection Agency (EPA) is shown below in Table 5.

Table 5. Summary of plant and raw waste characteristics for a simple slaughterhouse (EPA).

Base	Flow 1/1000 kg LWK	Kill 1000 LWK/day	BOD5 kg/1000 kg LWK	Suspended solids kg/1000 kg LWK	Grease kg/1000 kg LWK	Kjeldahl Nitrogen as N kg/1000 kg LWK	Chlorides as Cl kg/1000 kg LWK	Total Phosphorus as P kg/1000 kg LWK
Facilities Studied	24	24	24	22	12	5	3	5
Average	5,328	220	6.0	5.6	2.1	0.68	2.6	0.05
Std. Dev.	3,644	135	3.0	3.1	2.2	0.46	2.7	0.03
Range	1,334-14,641	18.5-552	1.5-14.3	0.6-12.9	0.24-7.0	0.23-1.36	0.01-5.4	0.014-0.086

Based on the information presented in Table 5 and other sources of slaughterhouse wastewater pollutant concentrations, we recommend the wastewater characterization of the proposed slaughterhouse as presented in Table 6.

Table 6. Proposed slaughterhouse wastewater characteristics.

Major Contaminants	Concentration (mg/L)
BOD5	1,273
Suspended Solids	1,188
Grease	446
Kjeldahl Nitrogen (N)	144
Chlorides (Cl)	552
Phosphorus (P)	11

Blood is a valuable product and should be collected and not introduced into the waste stream. It may be collected: for a food source, for rendering, dried and used for fertilizer, or for composting. This also helps to keep high strength pollutants (BOD, etc.) out of the wastewater system. The pH of the wastewater may vary because of inclusion of detergent, blood and other contaminations. However, the pH is to be maintained in between 6 to 9 at all times.

Slaughterhouse Building

The slaughterhouse will be built per USDA and NCDA&CS guidelines as well as other lawful authority agencies. Generally, lairage is sized to hold the expected daily kill. This will allow stock to be held overnight before slaughter. We recommend that a greater capacity be provided. However, the holding of stock at the abattoir for an extended period before slaughter should not be permitted. Lairage areas for each specific abattoir should therefore be assessed relative to expected throughput. The area required as a rule of thumb is usually 18 SF per head per cattle and 2.7 SF per head per goat, and 3.8 SF per head per sheep. The size will be determined by the owner, and the pens used to hold species can have one specie per pen or a mixture of two species per pen. Truck access to this area shall be considered. The pens will be divided into sections by fences. In areas where animals, particularly cattle, are normally tethered, a larger area without dividing fences may be preferred to allow tethering rather than penning of animals. The cooler should have a holding capacity of approximately 661 pounds and a chilling capacity of 331 pounds/day shall be provided. In this size range the use of a prefabricated unit has the advantage that complete assembly and testing before leaving the factory is possible. Also a factory built and tested unit will generally be the lowest in cost as skilled on-site work is minimized. The locations of tripe room, meat cutting tables and processing area will be determined by the owner and as a floor plan is proposed.

The new building costs can vary greatly based on size, type of construction, and amenities of the structure. Cost for a basic pre-engineered metal building installed on a concrete foundation runs about \$20.00/S.F. This does not include any internal upfit (bathrooms, plumbing, electrical,

furnishings, and equipment). These items are highly variable based on your needs and wants. A basic 40 ft. by 60 ft. structure would be about \$48,000 constructed on site. This is exclusive of any upfit and equipment.

Potential Water Supply Options & Funding

There is a nearby public water service to the site, and the connection is located along Atkins Road on the Eastern side of the proposed building. To request an installation of a water service for a commercial business, Harnett County Department of Public Utilities shall be contacted at 910-893-7575 for required fees. Once the fees are established for the commercial services, application will need to be made at the Public Utilities office at 700 McKinney Parkway in Lillington. It is required to obtain a permit from the Central Permitting office of Harnett County.

Another option is constructing a private well to serve the slaughterhouse at the current site. The construction of the well will not require a permit from the Regional Office under North Carolina Division of Water Resources because the water usage will be under 100,000 gallons per day. The Public Water Resources will not have additional requirements for the well since the proposed number of employees will be under 25. However, a well permit from Harnett County Environmental Health Department will be required. Since public water is available at a reasonable distance to the site, we do not recommend a well construction because there will be further potential costs for water monitoring and well maintenance.

Collection, Treatment & Disposal Options & Costs

Collection: Blood & Waste Disposal

Blood is a valuable source of protein. However, a by-products plant to produce blood meal is not viable at this scale. Blood should not be diverted down the floor drains or sinks of the building since it will quickly clog up the screens and disposal trenches. By using the following treatments blood may be incorporated into stockfeed per the owner's preference. Fresh blood can be directly incorporated into bran, cassava or other stock food where poultry are kept nearby. This represents the simplest and most efficient means of disposal. With this method, it is essential that the resulting meal be fed to the chickens the same day, as it will spoil. When a somewhat longer life for the feed is required, approximately 1% of unslaked (burnt) lime can be added to the blood container and stirred in as the fresh blood is added. The hardened product will keep for up to one week. Lime treated blood can be used similarly as fresh blood. When it is not possible to directly add fresh blood to poultry feed, it may be mixed with bran or cassava after drying. The blood may be dried in the sun on either a concrete floor or matting. Drying will generally be complete in three days. However, the drying area needs to be completely covered to protect it from rain. During rainy periods it would be necessary to dry the mixture on corrugated iron trays placed over a copra dryer or similar fire. Because of the additional cost of drying using this method, we do not recommend on-site blood drying due to its higher cost of design, installation, and operation for the small scale meat processing facility.

It is highly recommended to collect the blood when draining the blood from livestock in order to distress the treatment system from having extremely high BOD, FOG, nitrogen, phosphorus

concentrations in the wastewater. Therefore, blood may be stored per renderer's requirements with other byproducts to be collected. Generally, wastes like dry paunch, blood, animal bones, meat extracts, fats and tissues are recycled by renderers for use as animal feeds and fertilizers. The pickup of wastes and rendering process may be provided by Valley Proteins, Inc. Please contact the regional representative, Mr. Van Kloempken, at (919) 995-8376 or email him at VKloempken@valleyproteins.com for detailed rendering procedures, requirements, costs and frequency of pickup services.

Another method is to collect and dispose wastes offsite periodically. The waste storage area shall be kept away from potential contact with the byproducts and meat. Consideration should be given in finding a source for the animal hides.

Treatment & Dispersal:

The residence onsite is not connected to a public sewer system. The house operates under its own on-site wastewater treatment and subsurface dispersal system. There is no sewer line nearby according to Harnett County GIS record. Thus, a private wastewater system is desirable and more cost effective.

The proposed on-site wastewater treatment and dispersal system consists of a solids interceptor, a grease trap tank, pH adjustment and coagulant rapid mixing basin, a settling tank with anaerobic treatment, conventional subsurface drainage lines, and necessary appurtenances. To reiterate, rendering service is required for collection of slaughtering byproducts such as animal skin, bones, meat extracts, paunch, and (possibly) blood. These byproducts shall be prevented from entering the treatment system. As much as possible, all animal slaughtering wastes shall be kept from entering into the on-site system, and they should be collected in designated areas for collection and offsite disposal.

Since the slaughterhouse operation will be on a much smaller than large scale than traditional commercial meat processing facilities, an alternative to conventional screening equipment is a solid interceptor by Striem (model AA-XL, see Appendix B) with screening openings less than 0.1 inches. This will ensure that hair, feathers, meat chunks, animal tissue, and other wastes which were unintentionally drained are screened. This simple device will greatly reduce concentrations of BOD, TSS, FOG and other pollutants from the wastewater. The cost of this tank is \$4,600. The installation and maintenance cost of the interceptor is relatively low due to its "do it yourself" style maintenance, light weight, and ease of installation. Other solids interceptors may also be used.

The solid interceptor effluent flows into a grease trap basin to collect excess fat, oil and grease (FOG) which is in suspension, and which passes through the solids interceptor. FOG are one of the main concerns in the meat processing business. Conventionally, a skimmer and a scraper are used to separate FOG and TSS. This may be part of a dissolved air flotation thickener (DAF). The skimmer collects the floatable solids including FOG on the surface, and the scraper directs the heavier settleable wastes into a hopper. The byproduct from the hopper may be rendered. The detention time for the basin is usually 20 to 40 minutes at a minimum. However, we propose a grease trap basin only due to the relatively small slaughtering volume. As a rule of thumb, the volume of the basin is typically 1 peak hour with 30 to 40 minutes of detention time. At a

minimum, 80% to 90% FOG shall be designed to be removed from this process. The calculated hourly peak flow of the system is 840 GPH (14 GPM). Theoretically, a 50 GPM rated grease interceptor (Model GB-50 by SCHIER) should be sufficient to handle the waste flow. However, it is highly recommended to upsize the grease interceptor to model GB-250 by SCHIER or equal concrete unit for variability of upstream production, less grease tank maintenance frequency, and allowance for future growth. Model GB-250 costs \$5,534 USD whereas model GB-50 costs \$1,872 USD.

A concrete or steel tank, depending on the preference of the owner, may be used as an alternative. Concrete tanks require less maintenance, however, they are typically larger than steel tanks. Although more costly than concrete tanks, the HDPE tank is less expensive than a steel tank and it can be installed above or below ground for the recommended models. The ease of installation and maintenance will lower the total cost of the investment.

Conventionally, a dissolved air flotation tank, also known as DAF, is used to remove suspended solids after screening. The advantage of a DAF is its capability of removing small or light particles more completely and in a shorter time frame. The liquid is compressed with air and a polymer, and the micro bubbles bring the waste to the surface. A skimmer is used to remove the floatable solids. The DAF is usually sized at its optimum depth between 4 to 9 feet depending on the flow generated. However, we deem it is not feasible to use a DAF for the following two reasons. One, for the peak flow and average daily flow, we sized a DAF from HydroFloTech (Model HF005) which would cost \$23,450 dollars per unit according to the manufacturer. The cost is substantial for a small private business owner. Secondly, a DAF requires more consistent flow to effectively remove the TSS from wastewater, whereas the flow from the plant is not constant or substantial. The plant will likely generate some wastewater in the mornings and later in the afternoons and use less or none when customers are not present.

Considering the relatively small-scale production in conjunction with the oversized catch basin and the grease interceptor, we do not consider the DAF applicable for this operation. Following the solids interceptor and grease trap, wastewater will be treated anaerobically in a larger sedimentation/septic tank. The anaerobic treatment is highly applicable because anaerobic treatment is typically used for BOD level between 250 mg/l to up to 10,000 mg/l and the plant will generate high BOD concentration as shown in Table 5. The anaerobic tank is capable of reducing approximately 90% BOD, 80% TSS, high in nitrate (NO₃), and some nitrite (NO₂) according to "HANDLING OF BY-PRODUCTS AND TREATMENT OF WASTE" by the Food and Agriculture Organization of the United Nations (also known as FAO). An anaerobic septic tank is one of the most economical nutrient treatment methods. No additional energy cost of recycling and controlling will be necessary in the tank as opposed to aerobic treatment.

The pH adjustment and coagulants addition may be designed and installed before wastewater flows into the anaerobic tank to further optimize treatment. However, an inline pH monitoring system is roughly \$20,000 USD (\$17,500 for the CC-1 model by Striem and \$2,500 USD for other necessary equipment, see Appendix B). A less costly option is to install two tanks in series and test and adjust the pH daily in the first tank. This batch type arrangement would require a portable pH meter which is plus/minus \$1,000 depending on the model (see Appendix B). Unfortunately, pH adjustment is necessary for processes that encounter detergents, blood, and other animal wastes

in the waste stream. Coagulants are generally available in organic forms or inorganic forms. Organic coagulants are generally made of polyamine and polyDAMAC or melamine formaldehydes and tannins. The organic coagulants are more expensive than the inorganic ones. More often, inorganic solutions like aluminum sulfate (alum), aluminum chloride, Polyaluminum Chloride (PACl) and Aluminum Chlorohydrate (ACH) are applied in wastewater treatment. We recommend the alum solution as the coagulant as the other options are more expensive. We cannot emphasize enough the importance of separating blood disposal from the septic system as we have addressed previously. This will not only ease the operation and optimize septic performance but also will decrease the cost of chemical purchases and additional treatment storage requirements.

The effluent from the anaerobic tank prior to subsurface disposal must meet the minimum dispersal requirement as presented in Table 7. The treated wastewater will meet the requirement per rule 15A NCAC 02T .0505 (b) as shown in the following table. The wastewater is considered as industrial wastewater per category listed in 15A NCAC 02T .0103 (20).

Table 7 Treatment Effluent Limitations

Wastewater Containment	Concentrations
BOD5	< 30 mg/l
TSS	< 30 mg/l
NH3	< 15 mg/l
Fecal Coliforms	< 200 colonies/100 ml

In accordance to rule 15A NCAC 18A .1952, 1,986 gallon minimum liquid capacity is required for the sedimentation tank. The pre-treatment (anaerobic) tank is recommended to be 4,000 gallons (David Brantley & Sons Model ST H20-561 or equal) considering potential business future growth. A traffic rated tank is recommended for trucking and animal passing safety concerns. Non-traffic rated tanks are acceptable if the areas are protected from vehicular and animal traffic. The anaerobic tank will provide sufficient detention time for bacteria to reduce the BOD level before subsurface drainage.

The proposed effluent disposal is subsurface disposal. This system is often lower in cost and easier to operate than the alternatives. The drainfield size will be dependent on the soils evaluation by the Harnett County Environmental Health Department or a licensed soil scientist. Control over the drainfield is essential for the subsurface disposal.

As for the power need for the building, well and the wastewater system, electricity should be connected to the nearest power pole by a certified electrical contractor.

Additional Treatment Option:

Additional treatment is available if the owner or state regulatory agency demand further treatment steps after the anaerobic treatment in the septic tank. The wastewater treatment system will consist of one (1) Model 1200 E-Z Treat recirculating media filter (treatment unit), one (1) E-Z Treat recirculation tank, one (1) field dosing / storage tank, an ultraviolet disinfection unit, and all the necessary appurtenances. The wastewater enters the E-Z Treat recirculation tank where it is pumped through the E-Z Treat treatment unit. The E-Z Treat treatment unit removes additional

BOD that were not removed in the previous screening and treatment steps. The wastewater then flows by gravity into the E-Z Treat recirculation tank or is diverted to the field dosing/storage tank by means of an effluent bypass valve. Wastewater flowing into the field dosing/storage tank is treated by an ultraviolet disinfection unit prior to entering the tank. One adequately sized pump tank may be divided into two separate compartments to serve as the recirculation chamber and the field dosing chamber. Each of these treatment units are described in additional detail below.

E-Z Treat Recirculation, and Field Dosing / Storage Tanks:

The E-Z Treat recirculation tank will be provided as specified on the construction drawings, or approved equal by Engineer. Septic tank effluent will drain into the E-Z Treat recirculation tank. Wastewater will be pumped from the E-Z recirculation tank into the E-Z Treat treatment unit, and the E-Z Treat treatment unit effluent will flow by gravity into the E-Z Treat recirculation tank or the field dosing / storage tank. The field dosing/storage tank shall be provided as specified on the construction drawings, or approved equal by Engineer. The effluent from the field dosing / storage tank will be pumped to the disposal fields.

The E-Z Treat recirculation and field storage/dosing tanks will be connected to audible and visible high water alarms. These alarms will alert the operator when too much wastewater has accumulated in the tanks so that he may turn on the pumps to empty the tank. If the property, otherwise specified on the construction drawings, is served by a well system, water will not be used during a power failure. A portable generator shall be provided if water is used during power failure at the slaughtering facility.

E-Z Treat Treatment Unit:

The Model 1200 E-Z Treat treatment unit will be used to provide additional treatment to the septic tank effluent as well as removing suspended solids not removed by the septic tank. The treatment unit will be housed in the container provided by E-Z Treat. The E-Z Treat treatment unit will be dosed by a Sta-Rite pump (Catalog Number STEP 30, ½ hp) with a distribution system placed above the styrene media which will discharge onto the media. The underdrain system will transport the E-Z Treat treatment unit effluent back into the recirculation or field dosing / storage tank.

Ultraviolet Disinfection Unit:

The ultraviolet disinfection unit will be used to treat the E-Z Treat treatment unit effluent before it reaches the field dosing / storage tank. The ultraviolet disinfection unit shall be E-Z Treat UV-101, or approved equal by Engineer.

Summary of Costs

Please see the summary of the cost for the recommended water and wastewater construction.

Table 8: Total Cost of Water & Wastewater Systems

Items	Cost (USD)
Water Connection (Back Flow Preventer May be Required)	\$ 4,000
Wastewater Treatment Equipment (pH adjustment included)	\$ 45,000
Contingency (10% of project total)	\$ 5,450

Engineering Wastewater Only	\$ 5,500
Total Cost of Water & Wastewater systems	\$ 59,950

Table 9 shows the wastewater treatment system cost if the owner decides to install further wastewater treatment. An update of a more precise quote will be provided by the E-Z Treat manufacturer upon request. Please contact Cory Brantley at 1installer@gmail.com for price updates and E-Z Treat manufacturer's information.

Table 9: Cost of Wastewater System (Only) With E-Z Treat Treatment

Items	Cost (USD)
One (1) Solid Interceptor (Striem AA-XL)	\$ 4,600
One (1) Grease Trap (Schier GB-250)	\$ 5,534
One (1) pH Unit	\$ 1,000
One (1) Anaerobic/Pretreatment Tank	\$ 3,500
One (1) E-Z Treat Treatment Pod	\$ 2,500
One (1) E-Z Treat Recirculation Tank	\$ 2,500
One (1) Storage/Dosing Tank	\$ 1,800
Treatment Construction	\$ 25,266
Contingency (10 %)	\$ 5,800
Engineering Wastewater Only	\$ 5,500
Cost of Wastewater System With E-Z Treat Treatment	\$ 58,000

APPENDIX A

Subsurface & Surface Setback Rules

7

15A NCAC 18A .1950 LOCATION OF SANITARY SEWAGE SYSTEMS

(a) Every sanitary sewage treatment and disposal system shall be located at least the minimum horizontal distance from the following:

- | | | |
|-------|---|---------------------------------------|
| (1) | Any private water supply source, including any well or spring | 100 feet; |
| (2) | Any public water supply source | 100 feet; |
| (3) | Streams classified as WS-I | 100 feet; |
| (4) | Waters classified as S.A. | 100 feet, from mean high water mark; |
| (5) | Other coastal waters | 50 feet, from mean high water mark; |
| (6) | Any other stream, canal, marsh, or other surface waters | 50 feet; |
| (7) | Any Class I or Class II reservoir | 100 feet, from normal pool elevation; |
| (8) | Any permanent storm water retention pond | 50 feet, from flood pool elevation; |
| (9) | Any other lake or pond | 50 feet, from normal pool elevation; |
| (10) | Any building foundation | 5 feet; |
| (11) | Any basement | 15 feet; |
| (12) | Any property line | 10 feet; |
| (13) | Top of slope of embankments or cuts of 2 feet or more vertical height | 15 feet; |
| (14) | Any water line | 10 feet; |
| (15) | Drainage Systems: | |
| (A) | Interceptor drains, foundation drains, and storm water diversions | |
| (i) | upslope | 10 feet, |
| (ii) | sideslope | 15 feet, and |
| (iii) | downslope | 25 feet; |
| (B) | Groundwater lowering ditches and devices | 25 feet; |
| (16) | Any swimming pool | 15 feet; |
| (17) | Any other nitrification field (except repair area) | 20 feet; |

(b) Ground absorption sewage treatment and disposal systems may be located closer than 100 feet from a private water supply, except springs and uncased wells located downslope and used as a source of drinking water, for repairs, space limitations, and other site-planning considerations but shall be located the maximum feasible distance and in no case less than 50 feet.

(c) Nitrification fields and repair areas shall not be located under paved areas or areas subject to vehicular traffic. If effluent is to be conveyed under areas subject to vehicular traffic, ductile iron or its equivalent pipe shall be used. However, pipe specified in Rule .1955 (e) may be used if a minimum of 30 inches of compacted cover is provided over the pipe.

(d) In addition to the requirements of Paragraph (a) of this Rule, sites to be used for subsurface disposal for design units with flows over 3,000 gallons per day, as determined in Rule .1949 (a) or (b) of this Section, which include one or more nitrification fields with individual capacities of greater than 1,500 gallons per day, shall be located at least the minimum horizontal distance from the following:

- | | | |
|-----|---|--------------------------------------|
| (1) | Any Class I or II reservoir or any public water supply source utilizing a shallow (under 50 feet) groundwater aquifer | 500 feet; |
| (2) | Any other public water supply source, unless determined to utilize a confined aquifer | 200 feet; |
| (3) | Any private water supply source, unless determined to utilize a confined aquifer | 100 feet; |
| (4) | Waters classified as SA | 200 feet, from mean high water mark; |
| (5) | Any waters classified as WS-I | 200 feet; |
| (6) | Any surface waters classified as WS-II, WS-III, B, or SB | 100 feet; and |

(7) Any property line 25 feet.
 (e) Collection sewers, force mains, and supply lines shall be located at least the minimum horizontal distance from the following:

- | | | |
|------|---|--|
| (1) | Any public water supply source, including wells, springs, and Class I or Class II reservoirs | 100 feet, unless constructed of leakproof pipe, such as ductile iron pipe with mechanical joints equivalent to water main standards, in which case the minimum setback may be reduced to 50 feet; |
| (2) | Any private water supply source, including wells and springs | 50 feet, unless constructed of similar leakproof pipe, such as ductile iron pipe with mechanical joints equivalent to water main standards, in which case the minimum setback may be reduced to 25 feet; |
| (3) | Any waters classified as WS-I, WS-II, WS-III, B, SA, or SB | 50 feet, unless constructed of similar leakproof pipe, such as ductile iron pipe with mechanical joints equivalent to water main standards, in which case the minimum setback may be reduced to 10 feet; |
| (4) | Any other stream, canal, marsh, coastal waters, lakes and other impoundments, or other surface waters | 10 feet; |
| (5) | Any basement | 10 feet; |
| (6) | Any property line | 5 feet; |
| (7) | Top of slope of embankments or cuts of two feet or more vertical height | 10 feet; |
| (8) | Drainage Systems: | |
| | (A) Interceptor drains, storm drains, and storm water diversions | 5 feet; |
| | (B) Ground-water lowering ditches and devices | 10 feet; |
| (9) | Any swimming pool | 10 feet; |
| (10) | Any other nitrification field | 5 feet. |

(f) Sewer lines may cross a water line if 18 inches clear separation distance is maintained, with the sewer line passing under the water line. When conditions prevent an 18-inch clear separation from being maintained or whenever it is necessary for the water line to cross under the sewer, the sewer line shall be constructed of ductile iron pipe or its equivalent and the water line shall be constructed of ferrous materials equivalent to water main standards for a distance of at least ten feet on each side of the point of crossing, with full sections of pipe centered at the point of crossing.

(g) Sewer lines may cross a storm drain if:

- (1) 12 inches clear separation distance is maintained; or
- (2) the sewer is of ductile iron pipe or encased in concrete or ductile iron pipe for at least five feet on either side of the crossing.

(h) Sewer lines may cross a stream if at least three feet of stable cover can be maintained or the sewer line is of ductile iron pipe or encased in concrete or ductile iron pipe for at least ten feet on either side of the crossing and protected against the normal range of high and low water conditions, including the 100-year flood/wave action. Aerial crossings shall be by ductile iron pipe with mechanical joints or steel pipe. Pipe shall be anchored for at least ten feet on either side of the crossing.

(i) Septic tanks, lift stations, wastewater treatment plants, sand filters, and other pretreatment systems shall not be located in areas subject to frequent flooding (areas inundated at a ten-year or less frequency) unless designed and installed to be watertight and to remain operable during a ten-year storm. Mechanical or electrical components of treatment systems shall be above the 100-year flood level or otherwise protected against a 100-year flood.

*History Note: Authority G.S. 130A-335(e) and (f);
Eff. July 1, 1982;
Amended Eff. January 1, 1990; October 1, 1982.*

15A NCAC 02T .0506 SETBACKS

(a) The setbacks for irrigation sites shall be as follows:

	Spray (feet)	Drip (feet)
Each habitable residence or place of assembly under separate ownership or not to be maintained as part of the project site	400	100
Each habitable residence or place of assembly owned by the permittee to be maintained as part of the project site	200	15
Each private or public water supply source	100	100
Surface waters such as intermittent and perennial streams, perennial waterbodies, and wetlands	100	100
Groundwater lowering ditches where the bottom of the ditch intersects the SHWT	100	100
Surface water diversions such as ephemeral streams, waterways, and ditches	25	25
Each well with exception of monitoring wells	100	100
Each property line	150	50
Top of slope of embankments or cuts of two feet or more in vertical height	15	15
Each water line from a disposal system	10	10
Subsurface groundwater lowering drainage systems	100	100
Public right of way	50	50
Nitrification field	20	20
Each building foundation or basement	15	15

(b) The setbacks for treatment and storage units shall be as follows:

	(feet)
Each habitable residence or place of assembly under separate ownership or not to be maintained as part of the project site	100
Each private or public water supply source	100
Surface waters such as intermittent and perennial streams, perennial waterbodies, and wetlands	50
Each well with exception of monitoring wells	100
Each property line	50

(c) Achieving the reclaimed water effluent standards established in 15A NCAC 02U .0301 shall permit the system to use the setbacks set forth in 15A NCAC 02U .0701(d) for property lines, and the compliance boundary shall be at the irrigation area boundary.

(d) Setback waivers shall be written, notarized, signed by all parties involved, and recorded with the county Register of Deeds. Waivers involving the compliance boundary shall be in accordance with 15A NCAC 02L .0107.

(e) Setbacks to property lines established in Paragraphs (a) and (b) of this Rule shall not be applicable if the permittee, or the entity from which the permittee is leasing, owns both parcels separated by the property line.

(f) Habitable residences or places of assembly under separate ownership constructed after the non-discharge facilities were originally permitted or subsequently modified are exempt from the setback requirements in Paragraphs (a) and (b) of this Rule.

*History Note: Authority G.S. 143-215.1; 143-215.3(a);
Eff. September 1, 2006;
Amended Eff. June 18, 2011;
Readopted Eff. September 1, 2018.*

APPENDIX B

Proposed Equipment

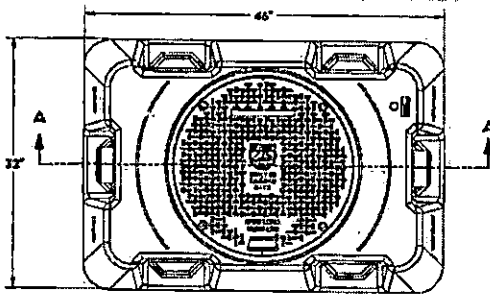
Manufacturers' Cut-Sheets

SPECIFICATION & DIMENSIONAL SHEET

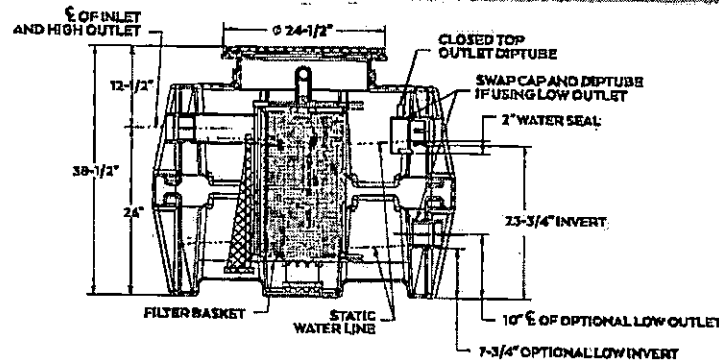
**MODEL: AA-XL
XL BASKET-STYLE SOLIDS INTERCEPTOR**

AARDVARK™ SERIES

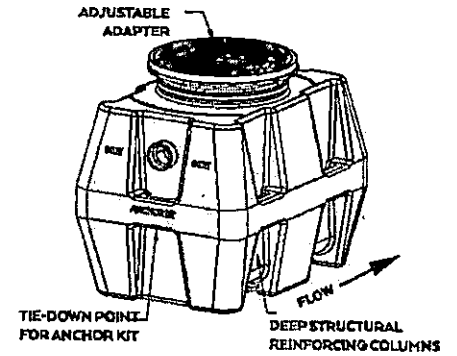
TOP VIEW



SECTION "A-A"



ISOMETRIC VIEW



RISER ORDER GUIDE		
DESIRED DEPTH	REQUIRED RISER	
	SR24	LR24
0" - 6"	INCLUDED	
> 6" - 24"	1	0
> 24" - 39"	0	1
> 39" - 43"	2	0
> 43" - 58"	1	1
> 58" - 72"	0	2

OPTIONS:

- SR-24** - ADJUSTABLE RISER (QT: 1)
- LR-24** - ADJUSTABLE RISER (QT: 1)
- 4M** - 4" MPT CONNECTIONS
- 6P** - 6" PLAIN END CONNECTIONS
- 6M** - 6" MPT CONNECTIONS
- CC24** - MEMBRANE CLAMPING COLLAR KIT
- AK1** - HIGH WATER ANCHOR KIT
- C24-HP** - H2O RATED PICKABLE CAST IRON COVER

STANDARD SPECS

- CONNECTIONS:** 4" SCH. 40 PLAIN END INLET/OUTLETS
- LIQUID CAPACITY:** < HIGH: 125 GAL.
LOW: 30 GAL.
- SOLIDS CAPACITY:** 13 GAL
- WEIGHT:** 145 LBS.
- INSTALLATION:** ABOVE OR BELOW GRADE
- SEWER GAS TRAP:** 2"
- COVER LOAD CAPACITY:** 16,000 LBS.
- MAX CONTINUOUS OPERATING TEMPERATURE:** 190°
- WALL THICKNESS:** 3/8"
- TANK MATERIAL:** SEAMLESS HIGH DENSITY POLYETHYLENE
- SCREEN PERFORATIONS:** 0.1" X 0.08"

INNOVATIONS

- 1 **Removable basket interlocks with inlet:** prevents solids from escaping basket.
- 2 **UNI-FIT™:** basket only fits in one orientation.
- 3 **All-perforated basket:** basket perforations are more than 9 times inlet opening, creating easy flow in the presence of solids, and limiting the chance for a backup.
- 4 **Optional low outlet:** if used, it allows for a temporary water surge (acts as a reservoir), as well as keeps basket dry during maintenance.
- 5 **Movable trap:** sewer gas trap can be field-installed on high or low outlet.
- 6 **Field adjustable basket handle:** handle can be extended for deeper burials.

ENGINEER SPECIFICATION GUIDE

Striem Aardvark™ solids interceptor model AA-XL shall be lifetime guaranteed and made in the USA. Tank material shall be polyethylene. Interceptor shall have removable, corrosion-resistant filter basket. Interceptor shall be equipped with high and low outlet options; with a movable sewer gas trap to be located on either outlet. Interceptor shall be furnished for above- or below-grade burial. Cover shall be water and gas tight with a minimum 16,000 lbs. load capacity. Interceptor shall be in compliance with IAPMO IGC 167-2011ae2.

Signature of Approval: _____

Company: _____

Date of Approval: _____

Specifying Engineer: _____

Engineering Firm: _____

Product is in compliance with IAPMO IGC 167-2011ae2.

3100 Brinkerhoff
Kansas City, KS 66115
PH 913-222-1500
FX 913-291-0457

STRIEMCO.COM

MADE IN THE U.S.A.



LIFETIME GUARANTEED

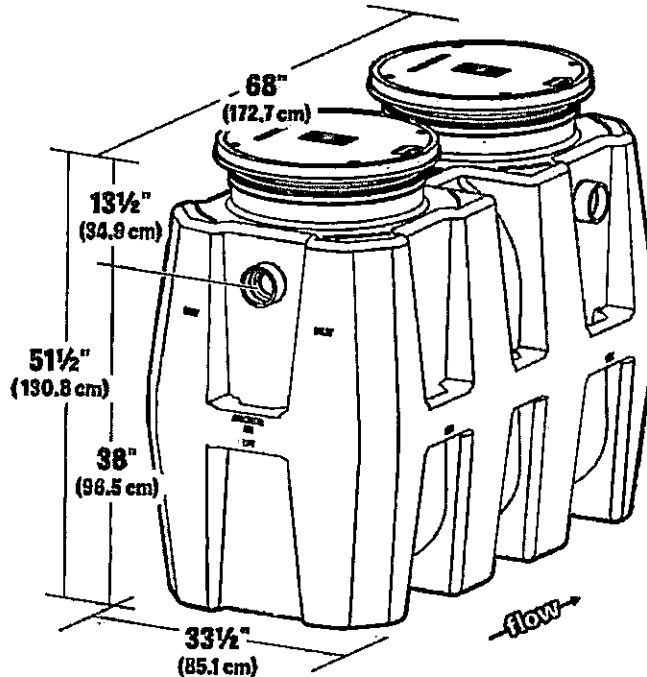
PROPRIETARY AND CONFIDENTIAL - THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF STRIEM, LLC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF STRIEM, LLC. IS PROHIBITED.

DATE: 5/10/18

GB-250

100/200 GPM
grease interceptor

Specification and Submittal



This unit is certified to ASME A1214.3 (Type C) and CSA B481.1 and includes an internal flow control. External flow control with vent not required.

SUBMITTAL

Standard

Location: indoor/outdoor
Installation: above/below grade
Flow Rates / Grease Capacities:
 100 GPM (6.3 L/s) / 1,751 lbs. (794.2 kg)
 200 GPM (12.6 L/s) / 1,196 lbs. (542.5 kg)
Solids Capacity: 21 gal. (79.5 L)
Liquid Capacity: 275 gal. (1,041 L)
Weight: 230 lbs. (104.3 kg)
Connections: 4" (100 mm) plain end inlet/outlet
Cover: bolted gas/water tight composite with 16,000 lb. load rating

Options

- 4" MPT inlet/outlet
 - 6" plain end inlet/outlet
 - 6" MPT inlet/outlet (stainless steel)
 - C24M:** Pedestrian Rated Covers - 2,000 lbs.
 - C24HP:** H2O load rated pickable cast iron covers - 16,000 lbs.
 - CC24:** integral membrane clamping collar kit
 - AKI:** High Water Anchor Kit
 - PP2:** Pumpout Port
- Field Cut Risers**
- SR24** (x2) 5" - 23"
 - LR24** (x2) >23" - 38"
 - SR24** (x4) >38" - 43"
 - SR24** (x2) + **LR24** (x2) >43" - 58"
 - LR24** (x4) >58" - 72"

Approval

Signature:	Date:	Company:
Specifying Engineer:		Engineering Firm:



MODEL NUMBER:
GB-250

DESCRIPTION: 100/200 GPM Polyethylene Grease Interceptor

PART #: 4055-001-02

DWG BY: B. Karrer

DATE: 7/20/2018

REV:

ECO:

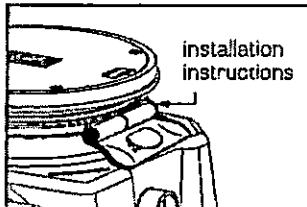


SPECIAL PRECAUTIONS

For All Schier Grease Interceptor Installations - Failure to follow this guidance voids your warranty.

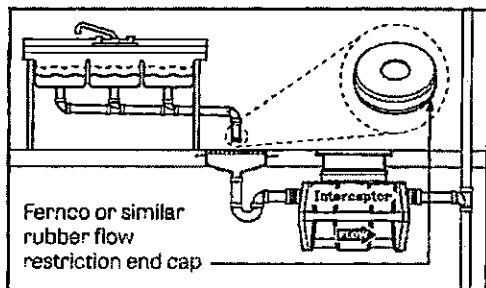
Installation Instructions

Installation instructions and additional components are included with the interceptor. Read all instructions prior to installation. This interceptor is intended to be installed by a licensed plumber in conformance with all local codes.



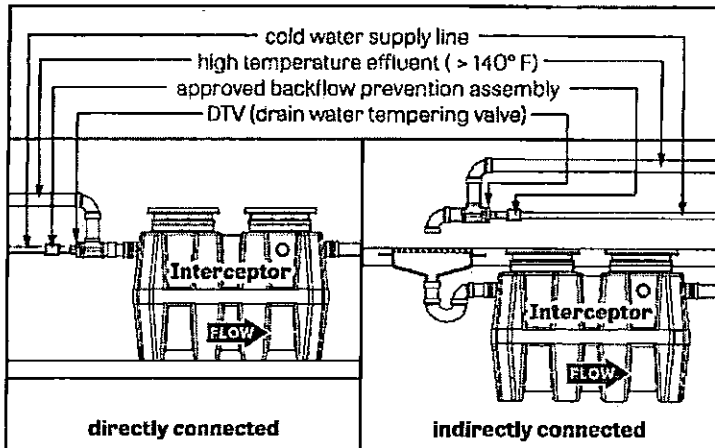
When Installing Interceptor Inside

If your dishwashing sink(s) discharges into a floor drain/sink (drain), you must regulate the flow into the drain to avoid an overflow of water onto the kitchen floor. This can be done by installing a valve or flow restriction cap on the sink piping that discharges into the drain. See drawing above for guidance. For detailed guidance on indirect connections, go to: http://webtools.schierproducts.com/Technical_Data/Indirect_Connections.pdf



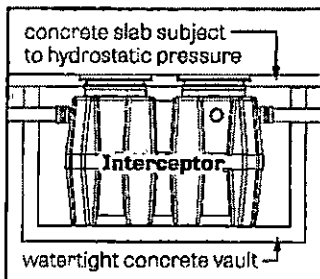
High Temperature Kitchen Water

If water is entering the interceptor at excessive temperature (over 140° F), a drain water tempering valve (DTV) and approved backflow prevention assembly must be installed. Most state and local plumbing codes prohibit water above 140° F being discharged into the sanitary sewer. Water above 140° F will weaken or deform PVC Schedule 40 pipe, poly drainage fixtures like interceptors and erode the coating of cast iron (leading to eventual failure).



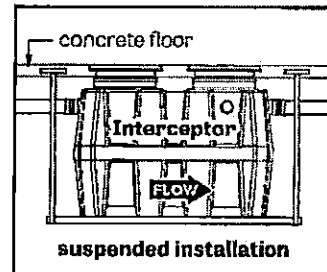
Hydrostatic Slabs (or Pressure Slabs)

When installed under a hydrostatic slab (slab designed to withstand upward lift, usually caused by hydrostatic pressure) interceptor must be enclosed in a watertight concrete vault.



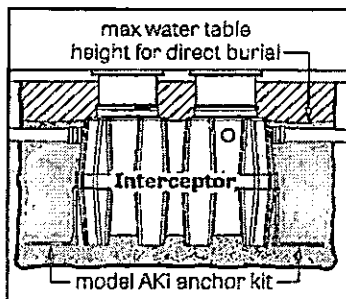
Fully Support Base of Unit

Install unit on solid, level surface in contact with the entire footprint of unit base; for suspended installations design trapeze to support the wet weight of the unit. Do not partially support unit or suspend unit using metal U-channel to create a trapeze



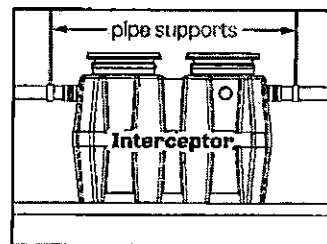
High Water Table Installations

Interceptors and risers are not designed to withstand water table height in excess of the top of the unit when buried (see figure). If it is possible for this to occur, install the interceptor and risers in a water-tight concrete vault or backfill with concrete or flowable fill (wet concrete and flowable backfill should be poured in stages to avoid crushing the interceptor). At risk areas include but are not limited to tidal surge areas, floodplains and areas that receive storm water.



Support Inlet and Outlet Piping

For above grade installations ensure heavy inlet and outlet piping (such as cast iron or long runs) is properly supported or suspended during the entire installation process to prevent connection failure or damage to bulkhead fittings.



MODEL NUMBER:
GB-250

DESCRIPTION: 100/200 GPM Polyethylene Grease Interceptor

PART #: 4055-001-02

DWG BY: B. Kattner

DATE: 7/20/2018

REV:

ECO:

SPECIFICATIONS

NOTES

- 4" plain end inlet/outlet
- Unit weight - w/composite covers: 230 lbs.; w/cast iron covers: 340 lbs. (For wet weight add 2,290 lbs.)
- Maximum operating temperature: 140° F continuous
- Capacities - Liquid: 275 gal.; @100 GPM - Grease: 1,751 lbs. @200 GPM - Grease: 1,196 lbs. Solids: 21 gal.
- Built-in Flow control. For series installations, only install flow control on the first unit in the series if necessary.
- For gravity drainage applications only.
- Do not use for pressure applications.
- Cover placement allows full access to tank for proper maintenance.
- Vent not required unless per local code.
- Engineered inlet and outlet diffusers with inspection ports are removable to inspect / clean piping. For series installations, the top of the inlet diffuser on the first unit in the series must be sealed.
- Integral air relief / Anti-siphon / Sampling access.

DIFFUSION FLOW TECHNOLOGY

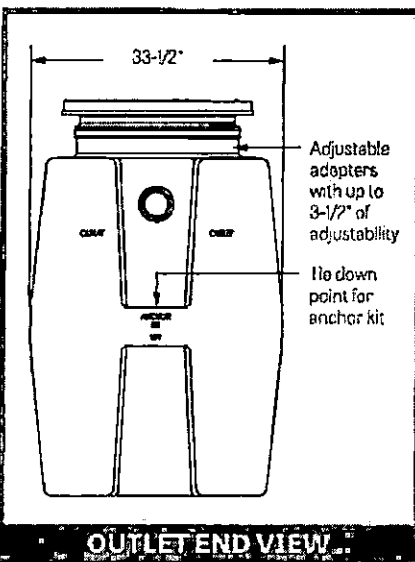
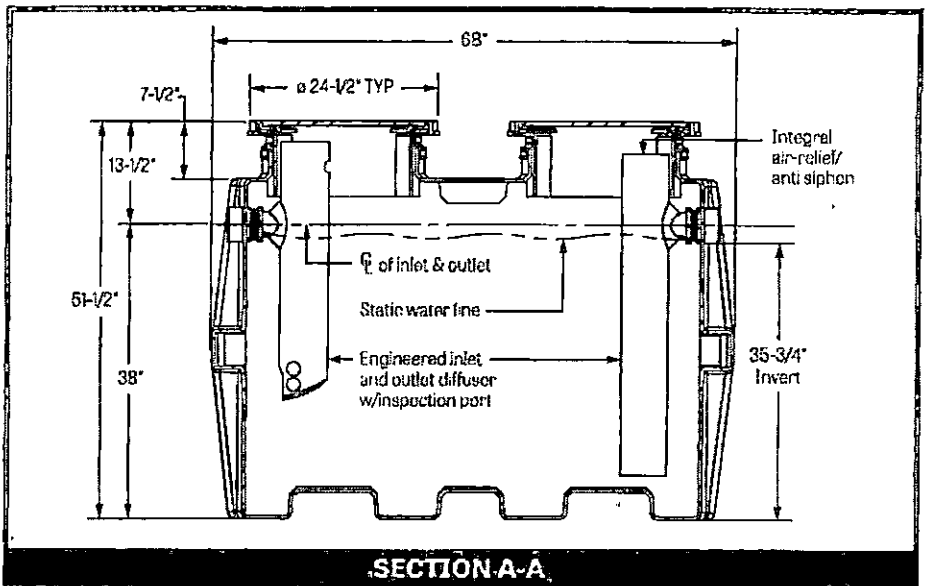
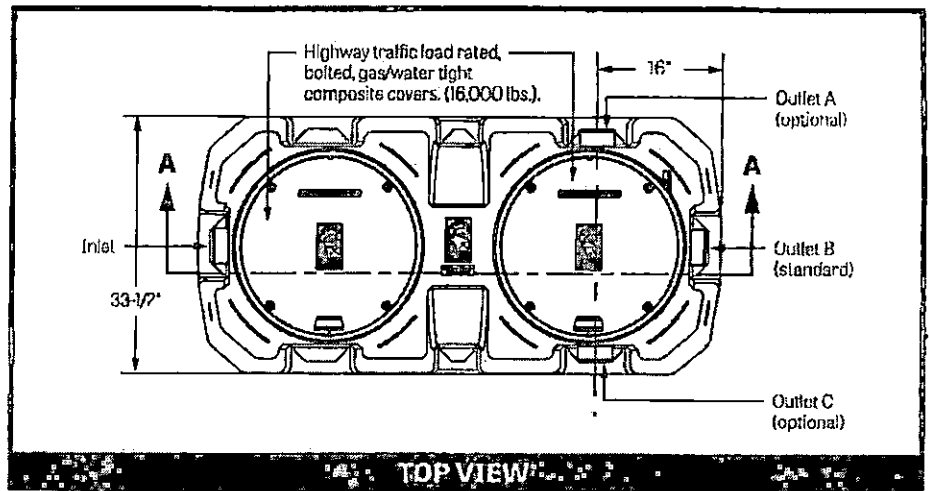
The inlet diffuser splits influent into three paths, creating laminar flow and utilizing the entire liquid volume of the tank for efficient grease separation. The calibrated openings greatly reduce effluent turbulence. The effluent enters the main chamber without disturbing the existing grease or sediment layers. The integral air relief / anti-siphon in the top of the outlet diffuser allows pressure stabilization within the unit during operation. The bottom of the outlet diffuser allows only effluent which is free of grease to exit the tank. It can easily be attached to any of the three outlets provided to ease job site piping layouts.

ENGINEER SPECIFICATION GUIDE

Schier Great Basin™ grease interceptor model # GB-250 shall be lifetime guaranteed and made in USA of seamless, rotationally-molded polyethylene. Interceptor shall be furnished for above or below grade installation. Interceptor shall be certified to ASME A112.14.3 (type C) and CSA B481.1, with field adjustable riser system, built-in flow control, built-in test caps and three outlet options. Interceptor flow rate shall be 100 or 200 GPM. Interceptor grease capacity shall be 1,751 lbs. @ 100 GPM or 1,196 @ 200 GPM. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.

CERTIFIED PERFORMANCE

Great Basin hydromechanical grease interceptors are third party performance-tested and listed by IAPMO to ASME #A112.14.3 and CSA B481.1 grease interceptor standards and greatly exceed requirements for grease separation and storage. They are compliant to the Uniform Plumbing Code and the International Plumbing Code.



Rated Grease Capacities for Units Piped in Series

No. of Units In Series	Removal Efficiency		
	100 GPM	99%*	200 GPM
2	3,613 lbs.	2,593 lbs.	2,392 lbs.
3	5,420 lbs.	3,890 lbs.	3,588 lbs.
4	7,226 lbs.	5,186 lbs.	4,784 lbs.
5	9,033 lbs.	6,483 lbs.	5,980 lbs.
6	10,839 lbs.	7,779 lbs.	7,176 lbs.
7	12,646 lbs.	9,076 lbs.	8,372 lbs.
8	14,452 lbs.	10,372 lbs.	9,568 lbs.

* Satisfies Miami DERM 99% efficiency requirements

SCHIER
LIFETIME GUARANTEED
GREASE INTERCEPTORS

MODEL NUMBER:
GB-250

DESCRIPTION: 100/200 GPM Polyethylene Grease Interceptor

PART #: 4055-001-02

DWG BY: B. Karrer

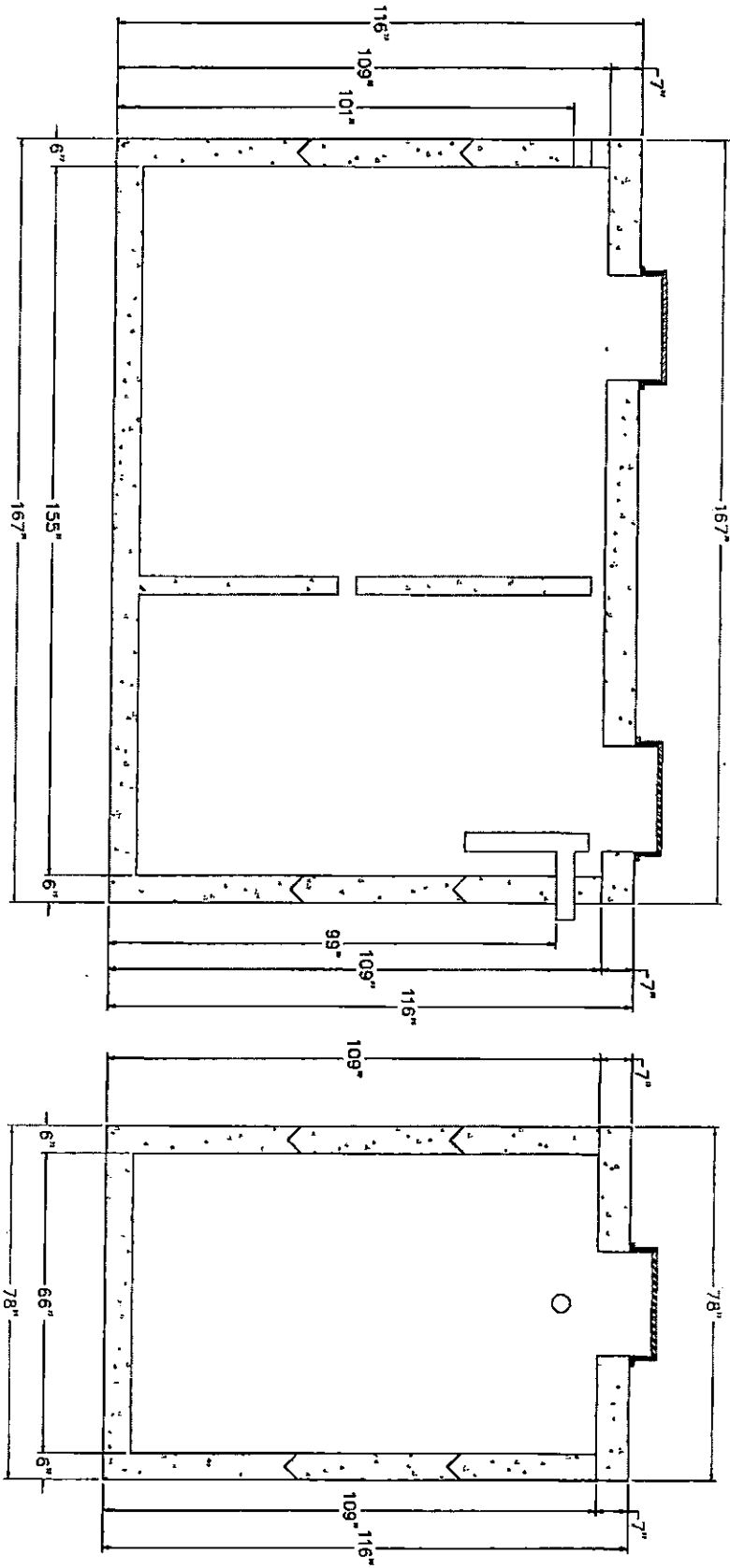
DATE: 7/20/2018

REV:

ECO:

2500 Woolford Road | Edinburg, TX 78541 | Tel: (936) 250-1111 | www.schierproducts.com

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4,000 ST H20-561
NTS

DAVID BRANTLEY & SONS

37 Pine Ridge Rd.
Zebulon, NC 27597
Office 252-478-3721
Fax 919-573-0443

installer@gmail.com

PREPARED FOR: David Brantley & Sons
37 Pine Ridge Rd.
Zebulon, NC 27597

DATE: April 11, 2014

CONTACT:
CORY BRANTLEY

REVISION NO.

Original Schedule

Revision 1

Revision 2

Revision 3

Unclear Set

DATE

April 11, 2014

BRANTLEY TANK MODEL
**4,000 ST
H20-561**

SHEET NUMBER

1 of 1

Now In: Lab Testing / pH Testing: Portable Instrumentation / Orion STAR A221 pH Meter, Hand Held Kit with Probe



[View larger image](#)

Orion STAR A221 pH Meter, Hand Held Kit with Probe

E-mail this product to a friend

- Durable and dependable—take measurements everyday, anywhere
- Waterproof IP67-rated housing

Item: 44831
Weight: 10.0 lbs

Catalog Price: \$1,109.95

Quantity: 1

These portable pH/mV meters feature Thermo Scientific Orion quality. The advanced A221 meter features a large informative screen that lets you simultaneously view the pH or mV reading, temperature, battery life and calibration status. Simple button layout and onscreen messages make calibration and setup easy and fast.

Measure in either Continuous mode or AUTO-READ™ mode that locks in the stable reading on your screen. You can record up to 50 data points. When recording data points in AUTO-READ mode, measurements are automatically stored whenever the "READY" appears.

Calibration is simplified with automatic buffer recognition of USA/NIST and DIN buffers. When taking readings, the meter displays the buffer values that were used to calibrate. The most recent calibration slope is also stored for procedure checks. Meter runs for up to 2,000 hours on included 4 AA batteries, or purchase optional AC power adapter separately. 3-year meter warranty for both meters.

Unit offers five-point calibration. Calibration date, values and slopes are stored in the Calibration Log for later review. Download up to 1,000 data points with time/date stamp to your computer or printer using RS-232 or USB. Selectable visual and audible alarms signal measurements outside your set points. The A221 has a backlit display that shows the time and date. Plain-language screen prompts are available in 6 languages.

Meter kit includes: four AA batteries, pH electrode, pH 4, 7 and 10 buffers, storage solution, cleaning solution, protective armor with electrode holder, hard carrying case, manual and CD with user reference guide.



Page 830 SDS Specs Manual

Related Accessories



Orion 900011 Fill Solution (5) 60mL Bottles (900011)

\$103.00



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