design manual for High Strength wastewater
White & Stuth Co. (1994)

Design

TREATING COMMERCIAL HIGH-STRENGTH WASTE

William L. Stuth[1]

This report is based on my findings over several years of monitoring residential and commercial sewage treatment and disposal systems.

Commercial high-strength waste is generally the result of undigested food, disinfection and grease and oil. Since most of the commercial systems I have studied are restaurants or other food processing establishments, my examples will concern themselves primarily with this type of facility.

DESIGN CONSIDERATIONS

Most wastewater treatment and disposal processes are capable of handling only residential quality waste strength. Accordingly, design standards for on-site waste systems are based upon domestic levels of waste, which typically have a BOD_5 of about 140 mg/L whereas higher-strength commercial wastewater can have BOD_5 levels in the thousands. This waste must be pre-treated to reduce its strength to domestic quality before it can be processed.

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While the blackwater side of a commercial facility may, in fact, be similar in strength to residential waste, it is the graywater side which is high-strength. If pre-treatment is provided, there are cost advantages in treating the high-strength graywater only, then co-mingling the treated graywater with the blackwater before it is sent to the disposal field.

To determine the percentages of graywater and blackwater, meter one side of the system. If metering is not possible, estimate the percentages based upon other similar facilities. I have found that restaurants with disposable tableware may generate only 25% graywater, while restaurants with washable tableware may generate up to 75% graywater.

Before designing a commercial on-site waste system, the following information is needed:

- Number of days and hours of business operation
- Flows (Gallons per day)

  Average GPD
  Peak GPD (within a 24 to 48 hr. period)
  Percent graywater vs blackwater

- Waste Strength & Characteristics

  Biochemical Oxygen Demand - 5 day test (BOD_5)
  Oil & Grease (O/G)
  Temperature
  pH
  Total Suspended Solids (TSS)
  Dissolved Oxygen (DO)

Flows

To obtain accurate design data, whenever possible, study flows from a similar facility. To determine peak flows, daily water meter readings must be taken. It is important to know the days of the week and hours of operation that the business is open, and that they are comparable to those of the facility for which the system is being designed. This will help to ensure that peak flows are adequately covered.

Average flow is usually the value used to size a system and should be a true average over a one week period or longer. Peak flow should also be taken into consideration. If 50% or more of the flow in a week's time occurs within a 48 hr. period, the septic tank or grease trap will perform better if it is sized on the basis of the peak flow.

Example:

Average flow = 1000 GPD or 7000 gals. per week
48 hr. peak flow = 4000 gals. (2000 GPD)
Septic tank should be sized to accommodate 1.5 times daily peak flow

Therefore:

2000 x 1.5 = 3000 gal. septic tank

To prevent overloading the down-stream process, a surge tank large enough to accommodate the peak flow should be installed. The surge tank must be equipped with a time control device to regulate the flow to the down-stream system in accordance with the daily flows for which it is designed.

Waste Strength

To determine waste strength, test wastewater samples through a laboratory familiar with testing commercial waste. Samples should be examined for the following:

$\underline{BOD_5}$: Biochemical Oxygen Demand (5 day test)

Determine the pounds per day of biological loading by using the following formula:

$$BOD_5 \times GPD \times .00000834 - PPD\ BOD_5$$

O/G: Oils & Grease

If grease and oils are entering the system, a grease trap should be provided with a minimum two day detention time based upon peak flow rates. If the temperature in the grease trap is below 80° F (27° C), the best results which can be anticipated will be 100 mg/L.

TSS: Total Suspended Solids

High levels of total suspended solids will shorten the life of a drainfield. TSS can be reduced by increasing the tank size, adding filter baffles and/or clarifiers.

DO: Dissolved Oxygen

It is important to know the DO levels of the water supply feeding the system. If the DO level is very low (less than .5 mg/L), the septic tank will be anaerobic or anoxic. A DO level of .5mg/L and above may create a facultative environment in the septic tank.

Temperature: Septic tank and grease traps are sensitive to extreme temperature changes. When temperatures exceed 80° F (27° C), grease trap efficiency decreases.

pH: For optimum efficiency, a sewage treatment system should maintain a neutral pH of near 7, but can operate in the range of 6 to 8. We have found pH values in septic tanks (blackwater) typically ranging from 6 to 7, while we have documented grease

trap (graywater) pH measurements ranging from 3.41 to 6.95 with a mean value of 5.17 ± 0.87.

SELECTING THE BEST PROCESS FOR A SITE

• Cost

Often, systems which are the least expensive to install prove to be the more costly system over time due to a higher cost to operate and/or maintain. This would include any system which required frequent pumping or other maintenance in order to control waste strength levels.

• Flows & Waste Strength

All approved processes today have available information concerning their flow handling capabilities in terms of gallons per square foot of area. Few processes, however, have been studied to determine their limitations concerning waste strength. Because it is a combination of hydraulic and biological factors which influence the life and effectiveness of any process, it is important to determine in addition to the total flow of the facility, the percentages of that flow that is graywater and blackwater. Once the proportions of graywater and blackwater are known, determine the waste strength of the graywater and blackwater individually and then calculate the combined waste strength in direct proportion to the percentage of graywater and blackwater flows.

PROCESS

When designing a commercial system, it is important to understand the treatment process that is selected. It may be desirable to combine two or more processes. An example of a multiple-process system is one that includes a septic tank, sand filter and drainfield. This system employs the septic tank as the primary treatment

process; the sand filter as the final treatment process; and the drainfield for disposal only. Problems can occur if the processes are not compatible with each other.

Most processes have a maximum BOD_5 which they can receive (commercial effluent may range in BOD_5 from 100 to 6000 mg/L) and limitations on the percent of BOD_5 reduction which they can achieve. The following represents the percent of BOD_5 reduction capabilities of several processes. These figures are contingent upon little or no disinfection entering the system.

Table 1

Process	Max. Influent BOD_5	Percent Reduction
Septic Tank		60 to 85%
Recirculating Gravel Filter	600 to 720 mg/L	95 to 98 %
***Sand Filter**	140 to 200 mg/L	96 to 100 %
Nibbler Aerobic Digester	3000 mg/L	90%

*Based on C-33 sand loading rate of 1.20 gal/sf.
The influent BOD_5 may be increased if the hydraulic loading of the sand is decreased. Studies are currently underway which may change the loading standards of sand filters both in terms of BOD_5 and hydraulic loading.

Package Plants And Filtration Devices

There are many package plants and filtration devices that claim to reduce BOD_5 from very high BOD_5 to levels around 10 to 30 mg/L. Before incorporating a package plant or filtration device into a design, study its BOD_5 reduction claims, actual performance case histories, and the cost to install and maintain.

Nibbler™ Aerobic Digester

Using standard-sized Nibbler tanks, it is recommended that Nibbler systems be sized to receive no more than 6.5 pounds per day (PPD) of BOD_5 per Nibbler unit when receiving metered flows from a surge tank or 3.25 PPD where no surge tank is

provided. Flows to the Nibbler should not exceed 1100 GPD per standard-sized unit. Using a simple formula, Nibbler sizing standards can be easily adapted to accommodate any sized tank.

By following the recommended Nibbler sizing standards, systems should require little or no maintenance, less frequent monitoring, and will produce minimal odor. While successful waste strength reduction can be achieved in systems receiving as much as 20 PPD, monitoring and maintenance requirements are sharply increased and significant odor may result.

Drainfields And Final Disposal

Drainfields can be damaged or destroyed by excessive BOD_5. Silty sands are particularly sensitive to BOD_5. The lower the BOD_5 discharged into a drainfield, the longer the drainfield will function satisfactorily.

Multiple Process Systems

The following are examples of multiple process sewage treatment/disposal systems in which the processes are mutually compatible. The example shown in Table 2 employs a polishing process (sand filter) between the secondary treatment process and the final disposal field due to inadequate soil conditions. Table 3 illustrates a site with good soil conditions which did not require a polishing process.

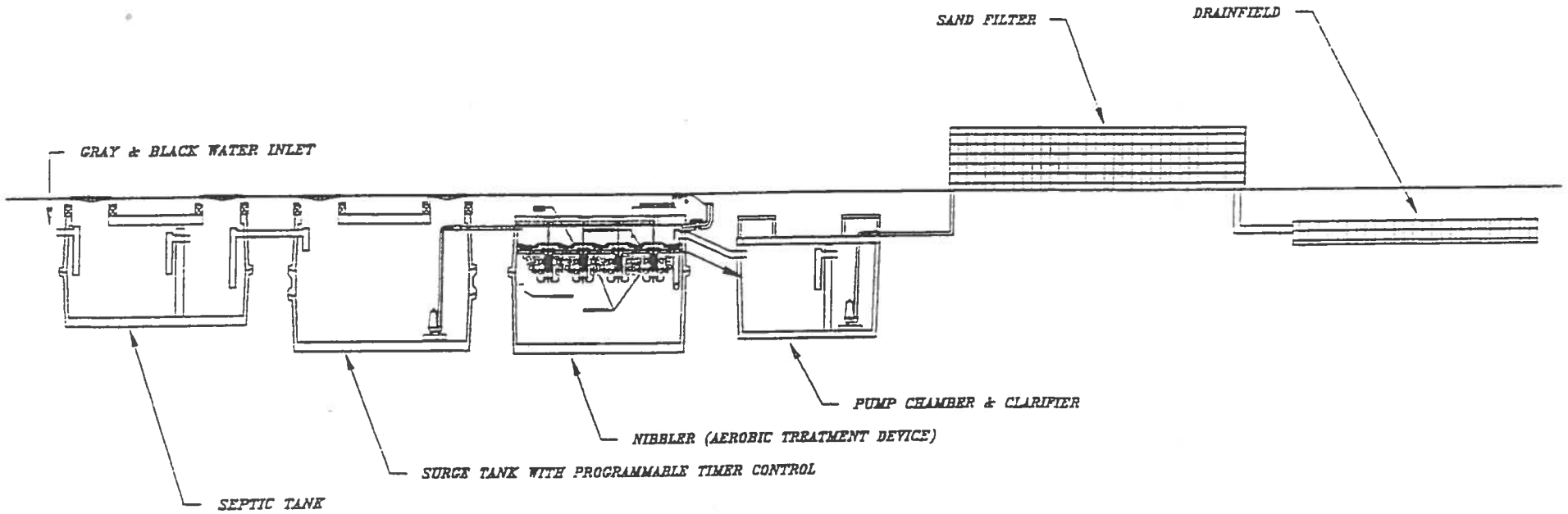
Table 2

Time Oil Co. - Jackpot Food Mart		
Eagle Creek, OR (Installed 11/91)		
Design Rates: 597 GPD 550 mg/L BOD_5		
	Treatment Process	**Effluent BOD_5**
Primary	Septic Tank	670 mg/L
Secondary	Nibbler Aerobic Digester (1 unit)	46 mg/L
Polishing	Sand Filter	0 to 3 mg/L
Final Disposal	Gravity Drainfield	

Table 3

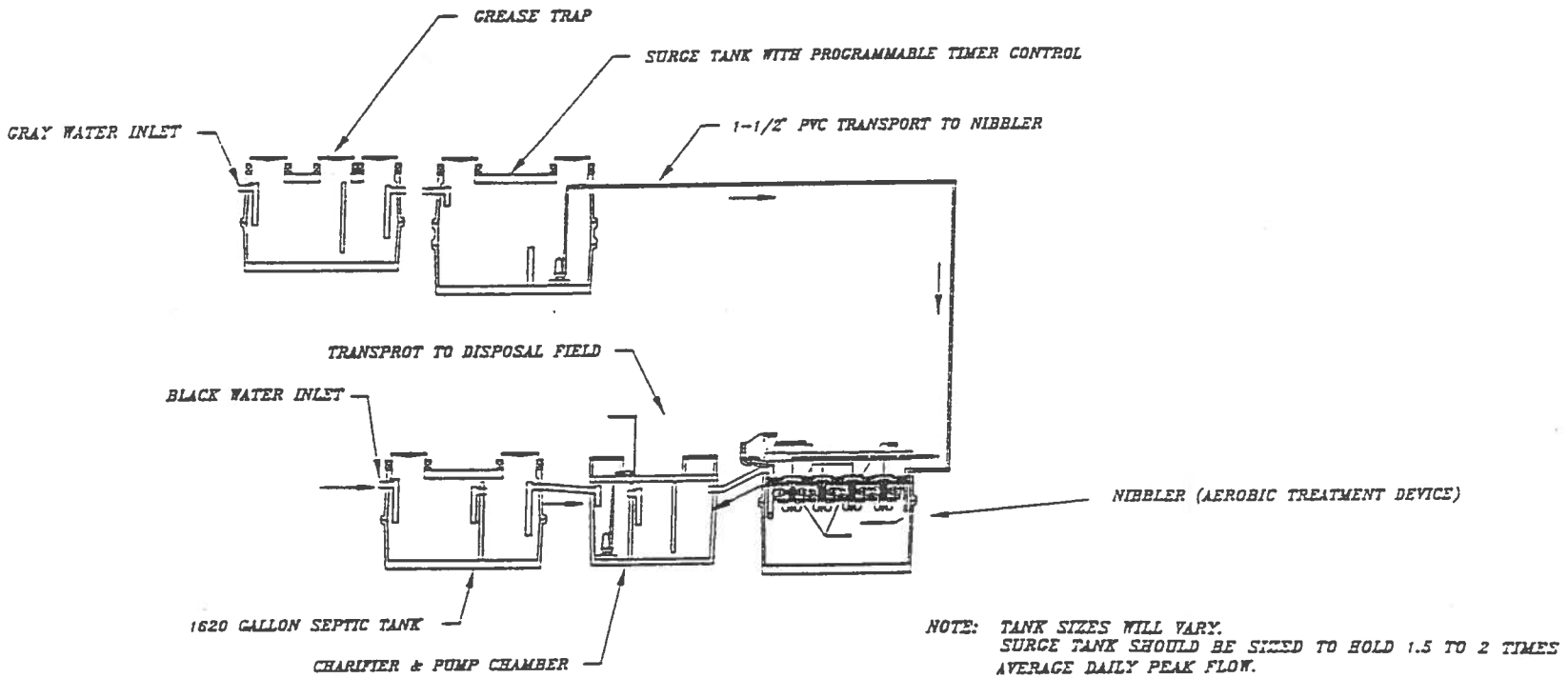
Two Rivers Restaurant		
Carnation, WA (Installed 3/88)		
Design Rates: 350 GPD 2000 mg/L BOD_5		
	Treatment Process	**Effluent BOD_5**
Primary	Septic Tank	2595 mg/L
Secondary	Nibbler Aerobic Digester (1 unit)	61 mg/L
Final Disposal	Gravity Drainfield	

Jackpot Foodmarket
Eagle Creek; OR



mg/L	Nibbler Influent (Grease Trap Effluent)	Nibbler Effluent (Effluent from Clarifier)
BOD5	434	45.3
TSS	94.6	22.4
O&G	22.8	6.04

Two Rivers Restaurant
Carnation, WA



NOTE: TANK SIZES WILL VARY.
SURGE TANK SHOULD BE SIZED TO HOLD 1.5 TO 2 TIMES AVERAGE DAILY PEAK FLOW.

mg/L	Nibbler Influent (Grease Trap Effluent)	Nibbler Effluent (Effluent from D-Box)
BOD5	1741	162
TSS	1789	90
O&G	2342	17.8

SIZING A SUPERMARKET NIBBLER TREATMENT SYSTEM

To design a system for a facility with multiple types of waste, there are several advantages in providing separate plumbing stubs for each waste type and multiple tanks.

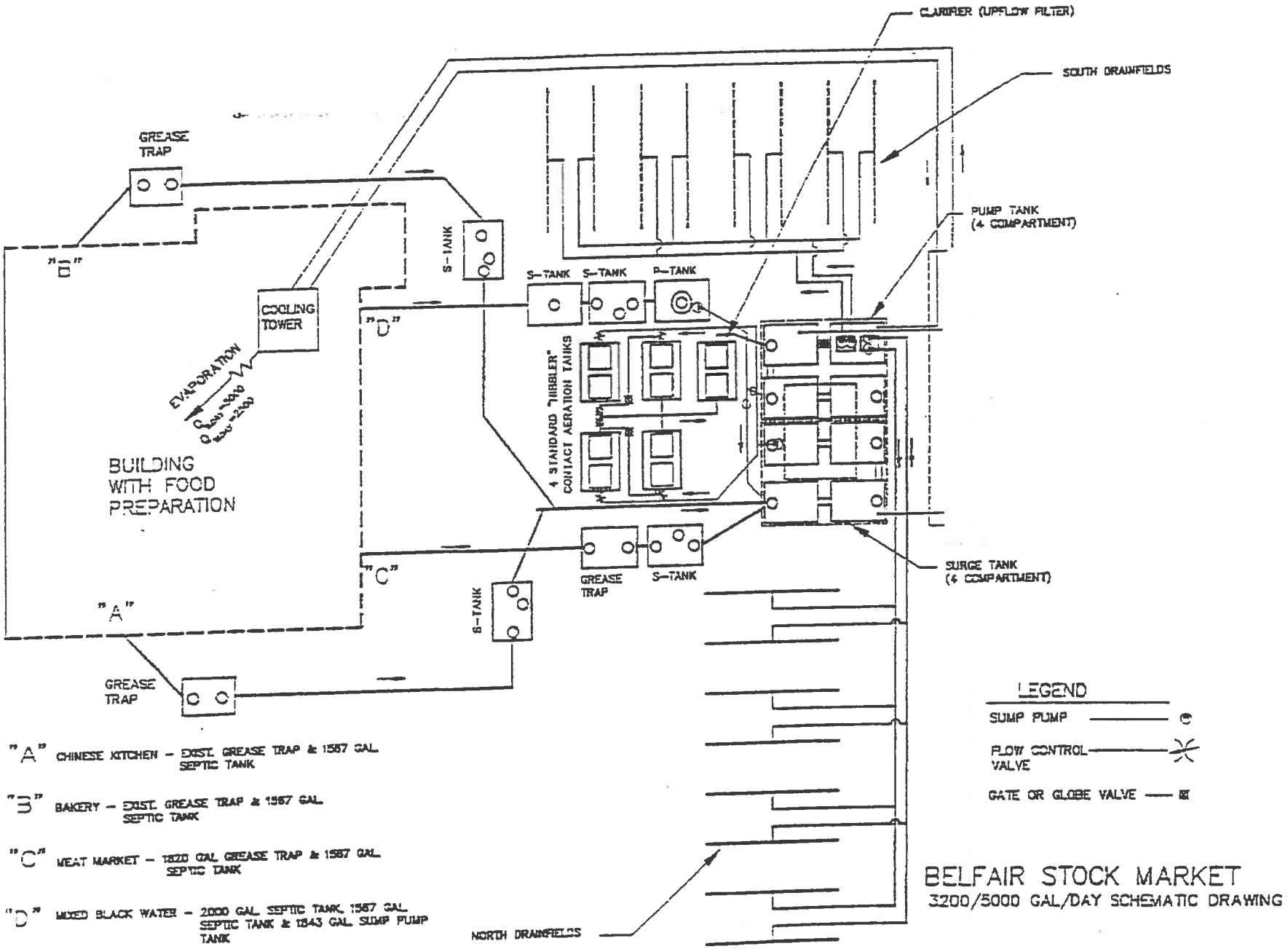
The first advantage with this design is that it makes it possible to identify individual waste characteristics. Secondly, it makes it possible to reduce the temperature of effluent by increasing the distance between tanks.

The supermarket example shown was designed to separate the different types of graywater (A, B and C) and treat them with a Nibbler after the waste has been pretreated. The waste is then co-mingled with the blackwater (D) and disposed of in a conventional drainfield.

A problem arose when the blackwater waste strength was higher than anticipated. The high waste strength was attributed to waste disposed of through the floor drains in the meat department, the mop/rinse area, and a sink in the bakery which were all incorrectly plumbed into the blackwater side of the system. This added disinfectants and undigested food to the blackwater.

To resolve the problem, the blackwater flow was diverted into the Nibbler system, resulting in reduced effluent waste strength to the drainfield.

The tables which follow illustrates the comparative waste strengths of co-mingled graywater/blackwater effluent. Samples were tested prior to diverting the blackwater through the Nibbler (Table 4) and after treating the blackwater through the Nibbler (Table 5).


CLARIFIER (UPFLOW FILTER)
SOUTH DRAINFIELDS
GREASE TRAP
"B"
COOLING TOWER
EVAPORATION
S-TANK
PUMP TANK (4 COMPARTMENT)
S-TANK
S-TANK
P-TANK
"D"
4 STANDARD "NIBBLER" CONTACT AERATION TANKS
BUILDING WITH FOOD PREPARATION
"C"
GREASE TRAP
S-TANK
SURGE TANK (4 COMPARTMENT)
"A"
S-TANK
GREASE TRAP
NORTH DRAINFIELDS
LEGEND
SUMP PUMP
FLOW CONTROL VALVE
GATE OR GLOBE VALVE
"A" CHINESE KITCHEN – EXIST. GREASE TRAP & 1567 GAL. SEPTIC TANK
"B" BAKERY – EXIST. GREASE TRAP & 1567 GAL. SEPTIC TANK
"C" MEAT MARKET – 1820 GAL GREASE TRAP & 1567 GAL. SEPTIC TANK
"D" MIXED BLACK WATER – 2000 GAL. SEPTIC TANK, 1567 GAL. SEPTIC TANK & 1843 GAL. SUMP PUMP TANK
BELFAIR STOCK MARKET
3200/5000 GAL/DAY SCHEMATIC DRAWING

higher the risk factor, the greater the monitoring frequency. Typical monitoring frequencies for a high-risk facility:

First two months of operation	Bi-weekly
Next four months	Monthly
Thereafter	Quarterly

Provisions should be made to require more frequent monitoring intervals at any point that the system fails to operate within its hydraulic and/or biological design parameters.

Inspections will include checking flows, sampling wastewater, measuring sludge levels, visually inspecting the disposal field and checking the general operation of equipment. Systems should be equipped with a flow measuring point, monitoring ports in the disposal field and sampling ports for the collection of wastewater samples.

The technician must collect wastewater samples in a manner which assures they are representative of the source. Care must then be taken to transport and store samples using established precautions to maintain their integrity.

Who Is Qualified To Monitor

Monitoring may be performed by health regulators, public utility districts, private monitoring firms or by the user and operator of the system.

To guarantee the necessary on-going monitoring of a complex system, a conditional use permit should be issued by the regulating agency with on-going review and periodic renewals. The food service operational permit may also be tied to the operation of the on-site waste disposal system to strengthen the health agency's enforcement position.

Table 4

Test Date: 7/19/92	GPD	BOD_5	TSS	O&G	Ph	TEMP
Graywater	1293	1243	78.0	13.0	4.63	21 °C
Nibbler Effluent		80.0	161	14.0	7.17	22 °C
Blackwater	3771	483	72.0	37.0	6.28	19 °C
Co-Mingle Effluent		292	124	12.0	6.65	21 °C

Table 5

Test Date: 8/2/92	GPD	BOD_5	TSS	O&G	Ph	TEMP
Graywater	1285	1204	60.0	15.0	4.49	23 °C
Blackwater	2515	535	65.0	32.0	6.26	20 °C
Nibbler Effluent (Co-Mingle Effluent)		64.0	118	19.0	7.58	22 °C

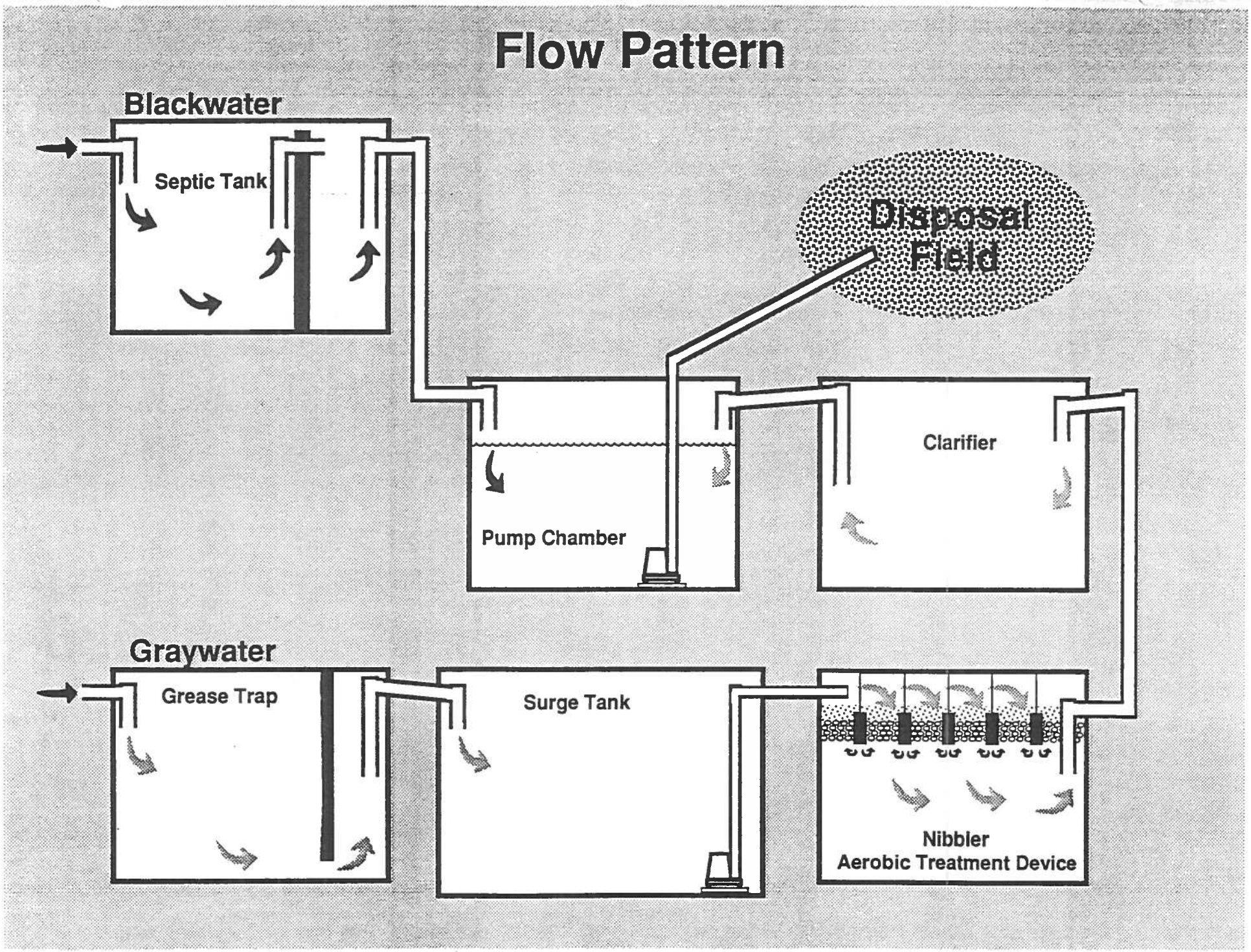
MONITORING HIGH-STRENGTH SYSTEMS

Why Monitoring Is Needed

Monitoring provides early detection of problems which might result in the failure of a wastewater system. A failure is defined as the destruction of the disposal field and/or environmental pollution. Early detection makes it possible to take remedial action before a system fails, thus minimizing the repair while protecting the environment.

How Monitoring Is Accomplished

The monitoring technician inspects a system at regular intervals, and verifies that the system is operating within its design parameters. The frequency of monitoring must be in direct relationship to the degree of risk should the system fail. High risk systems are those which have extremely high-strength waste or severe peak flows. The


Flow Pattern
Blackwater
Septic Tank
Disposal Field
Pump Chamber
Clarifier
Graywater
Grease Trap
Surge Tank
Nibbler
Aerobic Treatment Device

Grease Traps

GREASE TRAPS

Restaurants shall have an outside grease trap wherever possible. When not possible, they must have an inside grease interceptor, demonstrate that it is maintained daily, and provide a downstream monitoring port which is accessible to the sewer district.

For those restaurants which are able to install an outside grease trap, to achieve the best performance, the following factors must be considered:

Detention Time

In order to properly size the grease trap, the total shared hydraulic flow of the restaurant must be estimated. Providing this information should be the responsibility of the restaurant owner and the designer.
This estimate can be determined can be determined in one of two ways:

1.) By basing the total flow upon other comparable restaurants currently in operation where this information can easily be verified (see gathering background data).

2.) By using Uniform Plumbing Code standard methods of estimating flow.

The grease trap will receive graywater only. Graywater flow is assumed to be 50% of the total hydraulic flow.

Once the estimated graywater flow is determined, the grease trap should be sized to allow for a MINIMUM of one and one half (11/2) days detention time based upon a seven day average.

Once the restaurant is operational, the owner has an on-going duty to maintain effluent waste strength at levels which are tolerable to the sewer district. In the event effluent waste strength exceeds acceptable levels, the owner may be required to enhance the grease trap system. This can be achieved by many different methods which include, but are not limited to : addition of an inside grease interceptor, temperature controls, change in cooking and/or dish washing products and/or methods, biological additives or biological treatment systems.

Configuration

To maximize detention time and cooling:

Grease traps must consist of a minimum of two compartments, the primary compartment providing two-thirds (2/3) of the total tank capacity, the secondary chamber providing one-third (1/3) of the total tank capacity.

The length of the tank (inlet to outlet) must be two to three times greater than the tank width.

Where the required capacity of the grease trap tank exceeds 3000 gallons, the two-thirds/one-third requirement may be waived to allow for a series of single compartment precast tanks.

Where the required capacity of the grease trap exceeds 6000 gallons, a cast in place tank may be constructed. This tank must conform to the two-thirds/one-third and length to width requirements stated in this section.

Grease traps must provide for a liquid depth of four (4) to eight (8) feet.

The inlet baffle must extend downward to within six (6) to twelve (12) inches of the tank bottom.

To provide accessibility for pumping:

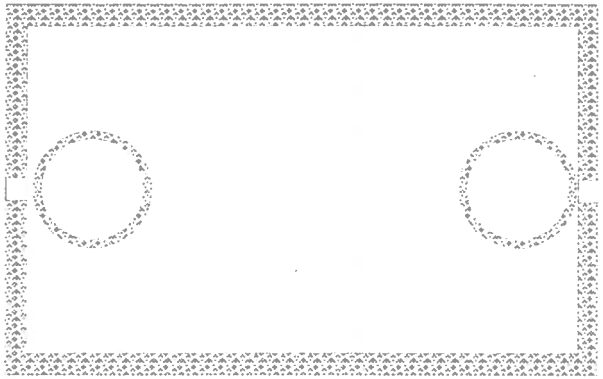
Tanks must not be installed so deep as to interfere with pumping and stirring of wastewater. If elevations require tank to be excessively deep, the entire vault lid should be raised.

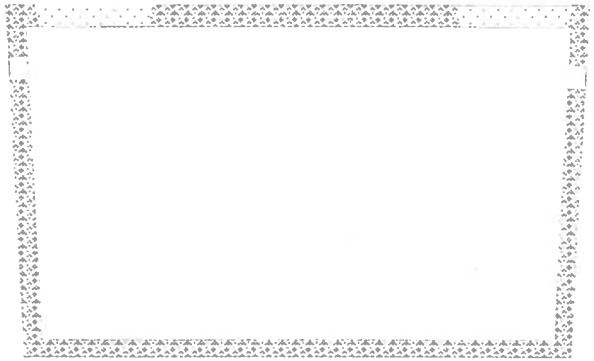
Manhole risers must not exceed 24 inches in height.

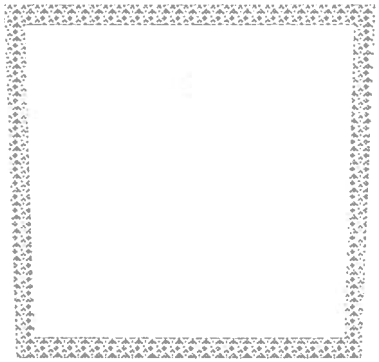
To provide effective odor control.

Vent outlets must be placed to within 6 to 12 inches of the ground surface.

The following diagrams show a couple of grease trap configurations.





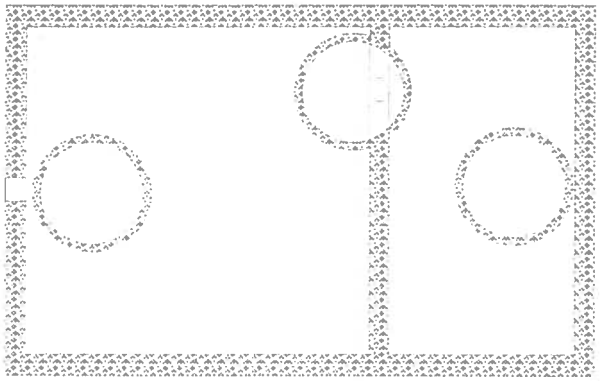


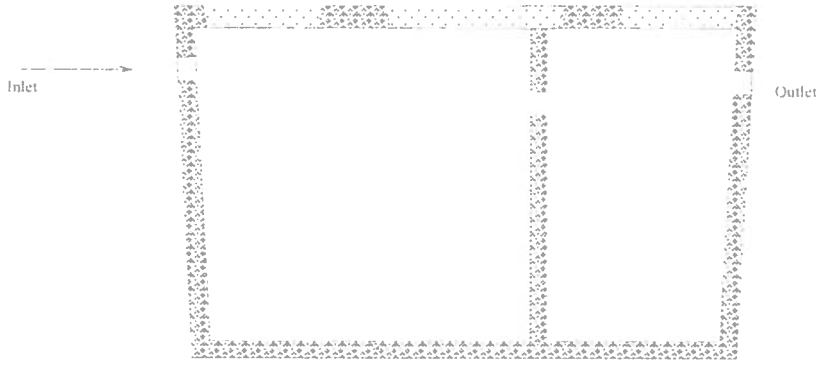
1620 gal. - Single Tank

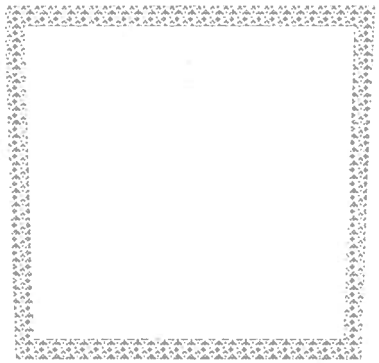
STUTH CO. INC.

28620 Maple Valley RD. S.E.
Maple Valley Wa. 98038
(206) 255-3546
FAX (206) 432-4461

Typical
1620 Single Tank
December 1, 1994





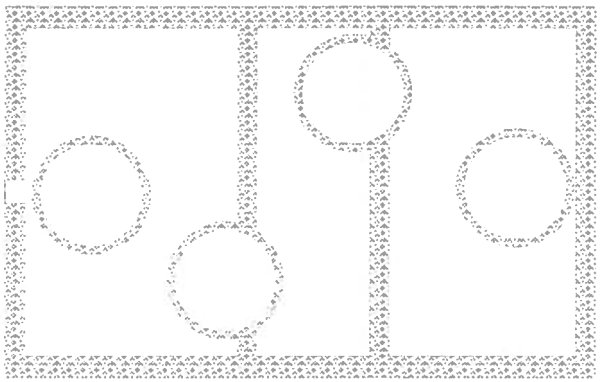


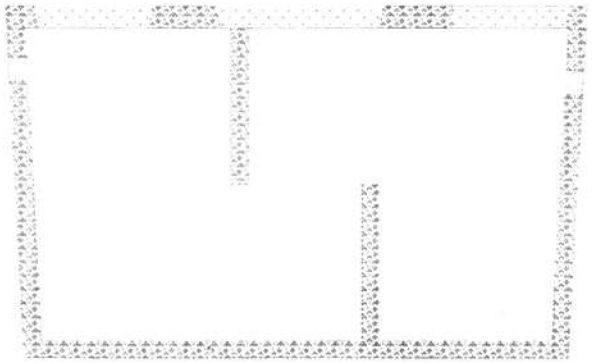
1620 gal. - Grease trap

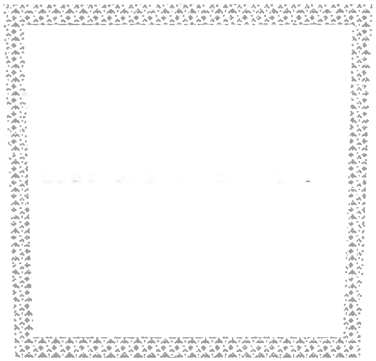
STUTH CO. INC.

28620 Maple Valley RD. S.E.
Maple Valley Wa. 98038
(206) 255-3546
FAX (206) 432-4461

Typical
1620 Grease Trap S2
December 1, 1994







1620 gal. - Grease trap

STUTH CO. INC.

28620 Maple Valley RD. S.E..
Maple Valley Wa. 98038
(206) 255-3546
FAX (206) 432-4461

Typical
1620 Grease Trap S3
December 1, 1994

Surge Tanks

Surge Tanks

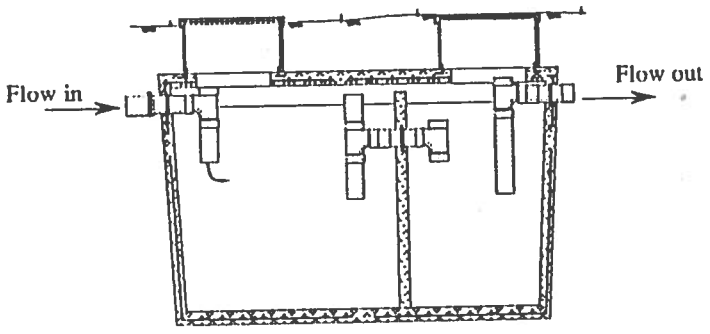
The purpose of this paper is to discuss the advantages of incorporating surge capacity in on-site wastewater treatment and disposal systems and to highlight some of the important factors which should be considered when designing, installing, and maintaining such a system.

An important aspect of every wastewater treatment system is the ability to handle peak flows. One way of compensating for peak flow is by incorporating surge capacity in the system. Some people may confuse surge capacity with detention time. However, there is a considerable difference between the two. The following example is a residential system shown with a septic tank .vs. a septic/surge system.

Residential Applications

Figure 1 shows a 1000 gallon septic tank designed to give a three day detention time for an average daily flow of 350 Gallons Per Day (GPD). This system is designed to react on demand, where flow in is generally equal to flow out.

Figure 1 TYPICAL SEPTIC TANK

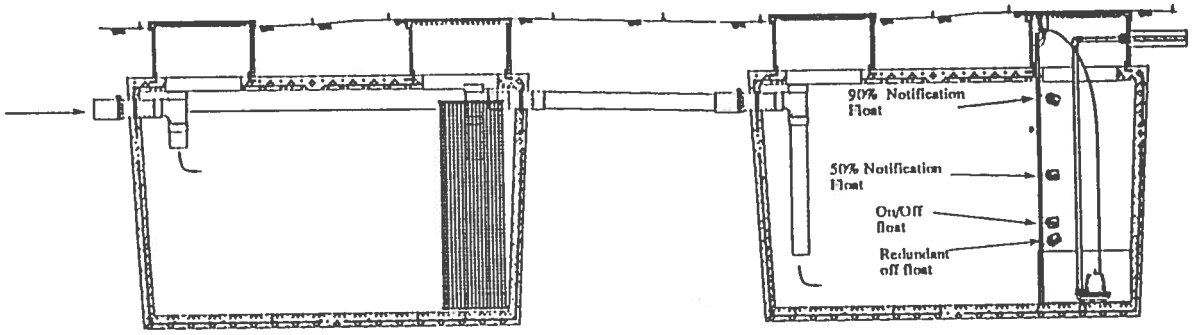


In this example weekly flows total 2450 gallons, and peak flows may hit 700-800 gallons in a day. This type of peak flow is common for a two income family where most of the laundry is done in a one or two day period. The detention time has now been reduced to less than a day and a half and there is an increased likelihood of short circuiting. This system has also dosed the

drainfield or sand filter with the same 700 to 800 gallons during an 8 to 12 hour period.

By incorporating a surge tank in this same scenario, the peak flows are reduced and the detention time is maintained. Figure 2 illustrates a dual tank system which incorporates a 1000 gal. primary tank and a 1000 gal. pump/surge tank where the discharge is controlled by a programmable timer. The timer controls the doses to the drainfield or sandfilter by staggering the design flow over a 24 hour period.

Figure 2 TYPICAL SEPTIC TANK/SURGE TANK COMBINATION



It should also be noted that a system, which is designed to handle surge capacity, does not necessarily have to be a two tank system. Washington State is currently reviewing a proposal to allow a 1500 gal. single compartment tank, design for a timed pressure dose system. Figure 3 shows this tank.

Figure 3 SINGLE COMPARTMENT SEPTIC/SURGE TANK

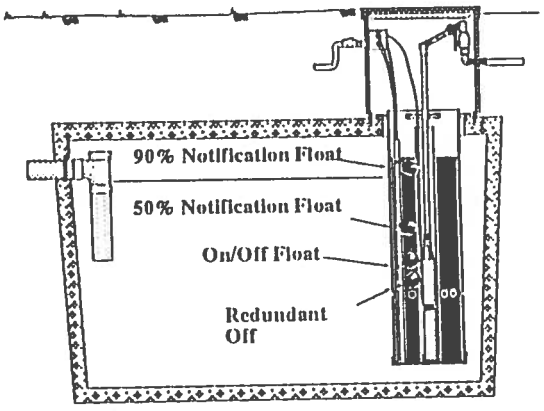


Table 1 shows an example of possible residential flows, the doses actually sent to the drainfield and the response in liquid level in the dose/surge tank.

Table 1. EXAMPLE RESIDENTIAL FLOWS AS CONTROLLED BY THE USE OF A SURGE TANK

Day	Example Flow (Gallons)	Timed Dose (Gallons)	Remaining Volume in Surge Tank (Gallons)
Sunday P.M.			1000
Monday	250	350	900
Tuesday	200	350	750
Wednesday	150	350	550
Thursday	200	350	400
Friday	250	350	300
Saturday	700	350	650
Sunday	700	350	1000

(Any system which is expected to provide this level of control and provide dosing over a 24 hour period will require a timer.)

Some experts disagree on the importance of surge capacity for a residential installation. However, as the volume of the flows increase and the likelihood of peaks in the flow increase, the importance of surge capacity also increases.

In addition to controlling the peak flows of a system, surge capacity will provide other benefits for an on-site wastewater system. One of these benefits is to detect major changes in flow patterns. A system which is designed to handle 350 GPD with a timed surge tank may indicate if the system consistently discharges more than the designed flow by activating a high water alarm. Several factors can contribute to excessive flows which may including; undersized components, leaky fixtures, and/or groundwater infiltration. Once the cause of excessive flow is determined, measures should be taken to rectify the problem thus enabling the homeowner to avoid damage to the system, which may result from long term hydraulic overloading. In one case, a leaky toilet was found to have discharged approximately 5000 gallons of water into a system over a 48 hour period. In another case a leaking sink was discharging a mere .076 Gallons Per Minute (GPM), this adds up to 109 gallons in 24 hours. Relating back to the example

of residential flow we have been using, 109 gal. amounts to a 25% increase over the design flow rate of 350 GPD.

Monitoring of flows from the surge tank may also aid in detecting a system which is leaking effluent out. A system which is designed to handle 350 GPD may show (by inspecting the pump, timer, and counters) that it is only discharging 200 GPD to the drainfield. A field technician can then perform a leak test on the individual tanks in the system and determine if the tank is leaking or if the system is simply overdesigned.

Another benefit to using this type of timed system is its ability to warn of clogging orifices in the drainfield or sand filter. A system that appears to have an overloading problem, such as described for excessive flows, may actually have a clogged orifice. This will prevent the pump from delivering its designed output. For example, a pump may be designed to deliver 30 GPM. However, as the orifices begin to clog, the actual volume delivered by the pump will decrease. Since the timer is set based on the pump delivering 30 GPM, the pump will not keep up with the system output of 350 GPD and the high water alarm will activate. A drawdown test on the pump tank will indicate if this is the problem (The drawdown test is described later in this paper). Catching clogged orifices early will increase the life of the pump, reduce the systems energy consumption, and may save the homeowner the expense of a burned out pump.

Commercial Applications

As mentioned earlier, as the size of the system increases and the likelihood of peak flows increase, the importance of surge capacity also increases. Table 2 shows the response of a surge tank in a typical restaurant application.

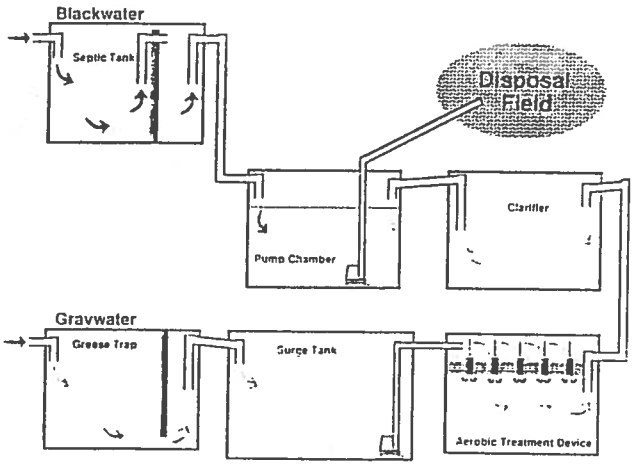
This is a common scenario with restaurants, where 80% of the business may occur in a two or three day period (Friday, Saturday, Sunday). Another example of extreme flows would be a church, or other community meeting facility where most of the flows may occur in one day.

Table 2. COMMERCIAL FLOWS AS CONTROLLED BY THE USE OF A SURGE TANK

Day	Example Flow (Gallons)	Timed Dose (Gallons)	Remaining Volume in Surge Tank (Gallons)
Sunday P.M.			3000
Monday	250	1000	2250
Tuesday	500	1000	1750
Wednesday	500	1000	1250
Thursday	750	1000	1000
Friday	1500	1000	1500
Saturday	2000	1000	2500
Sunday	1500	1000	3000

When treating a commercial or institutional type waste flow, such as a restaurant or school, the waste strength is likely to be very high. In this application active aerobic treatment is recommended to reduce the waste strength before discharging into any type of drainfield or sandfilter. The need for a surge tank in this scenario becomes critical. Figure 4 shows the system flow pattern which is recommended for this type of on-site system.

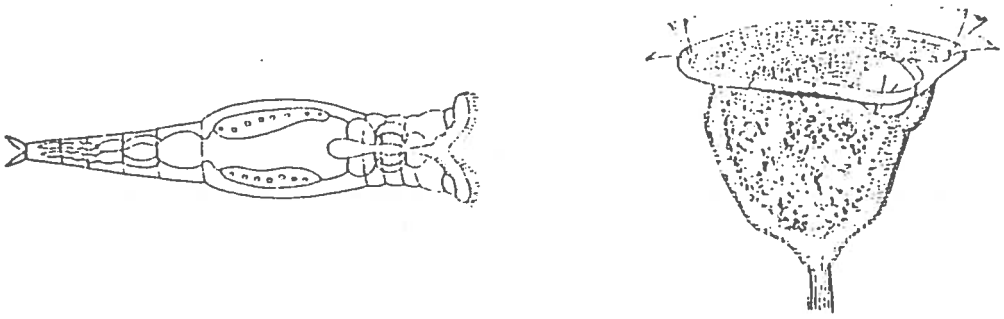
Figure 4 COMMERCIAL WASTEWATER FLOW PATTERN



Aerobic treatment of wastewater involves an extremely concentrated population of microorganisms. The rotifer and the ciliate shown in figure 5, not only require a constant source of oxygen, but also feeding on a regular basis, much like you and I.

Figure 5 A TYPICAL ROTIFER AND STALKED CILIATE FOUND IN AN ACTIVE AEROBIC WASTE STREAM

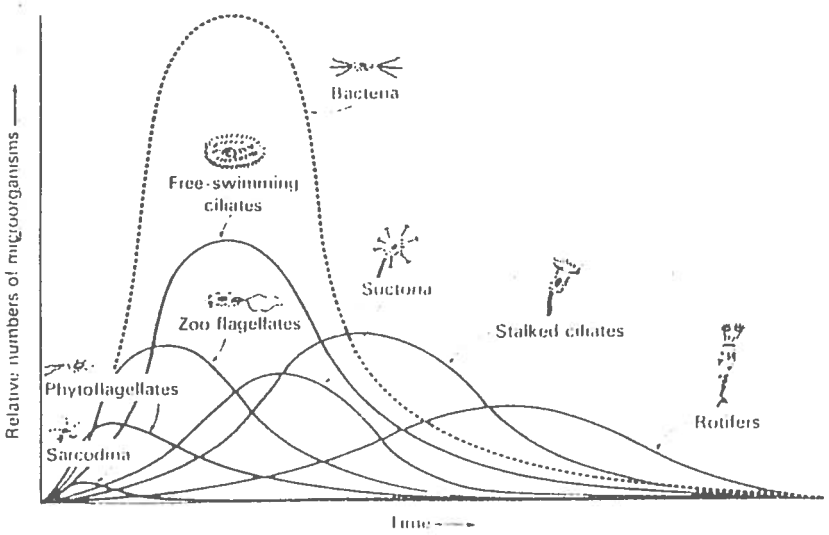
(Standard Methods – 17th Edition)

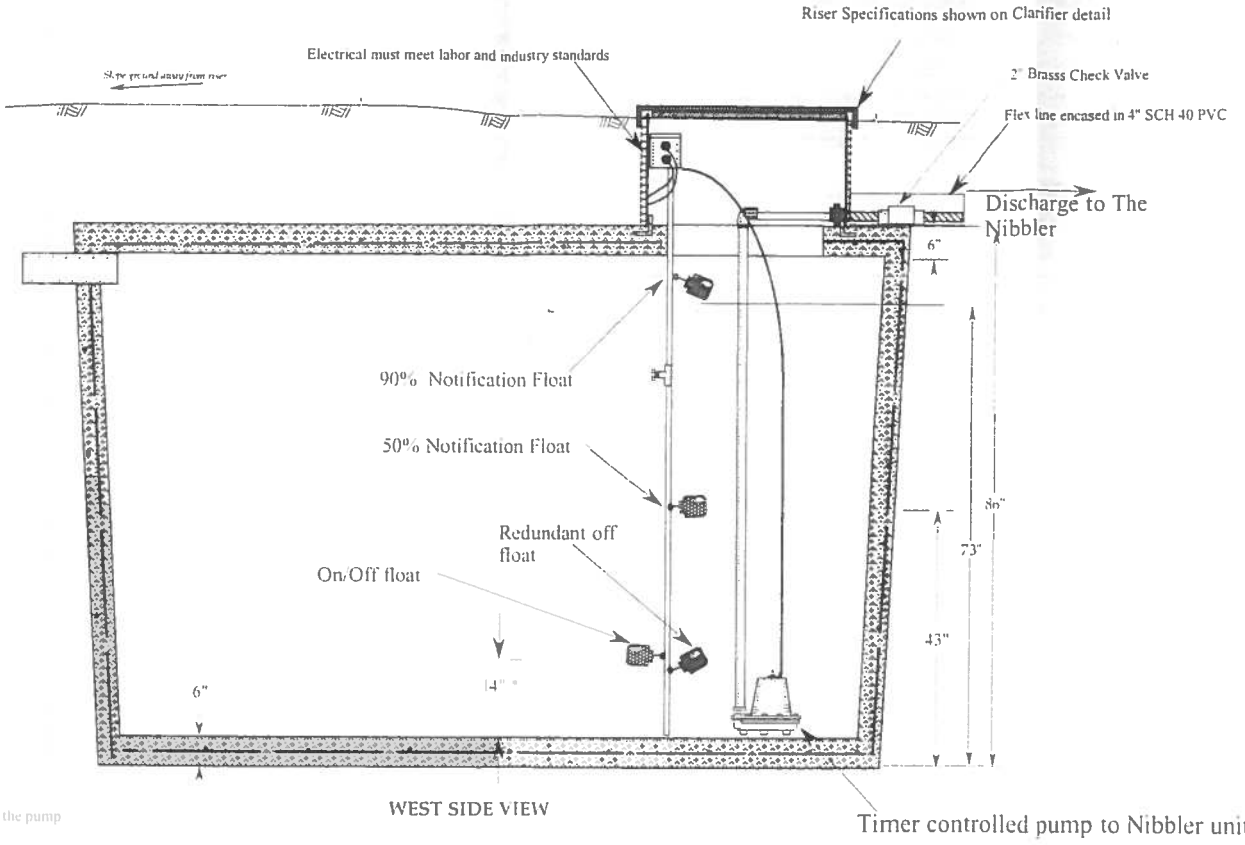


Utilizing a surge tank not only curbs the peak flow of the system, but also allows you to feed the hungry population on a regular basis thus sustaining it at a concentration capable of treating the high strength waste. Figure 6, may be a familiar diagram to you. The organisms on the right side of the diagram are the higher life forms which do not respond well to shock loading nor to periods of deprivation. They require more time to develop and a higher level of consistent care, which can be achieved through surge capacity.

Figure 6 RELATIVE GROWTH OF MICROORGANISMS STABILIZING ORGANIC WASTE IN A LIQUID ENVIRONMENT

(Wastewater Engineering, 3rd ed. Metcalf & Eddy)





Note:

* Pump vault must be deep enough for the liquid level to cover the pump at all times.

Dimensions shown on this diagram are for example only.

All holes for lines entering and exiting the septic tank are to be one inch in diameter larger than the pipe size shown.

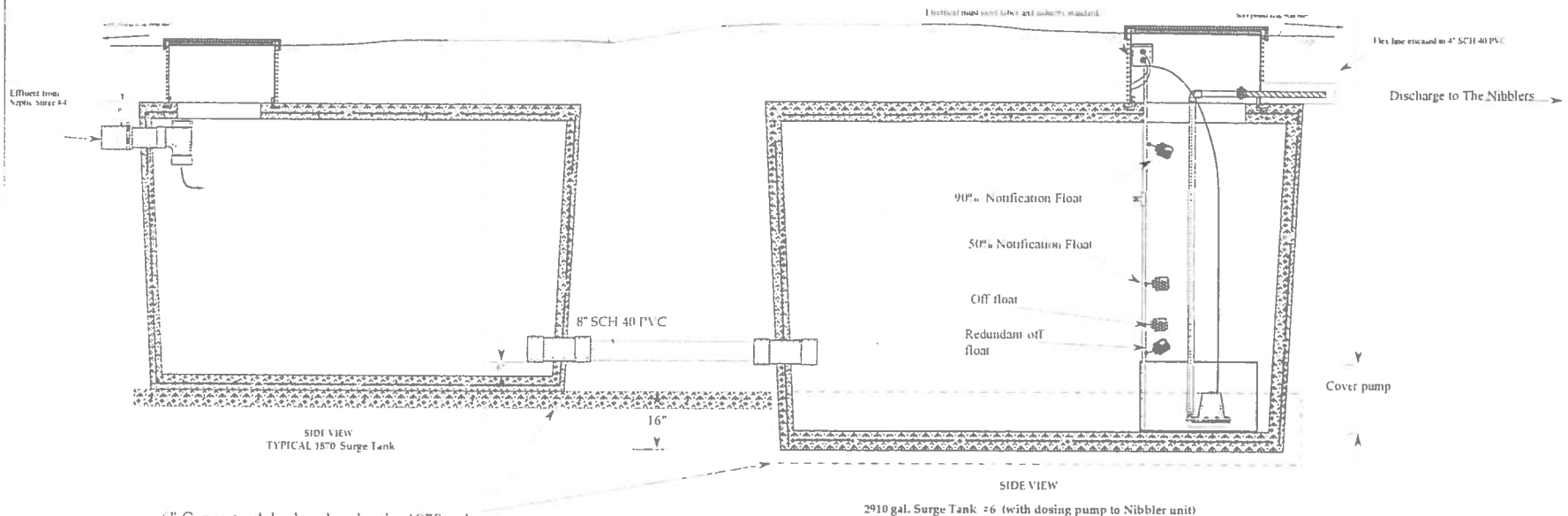
Tank must be tested and certified water tight after it is installed.

TYPICAL 2392 gal. Surge Tank (with dosing pump to Nibbler unit)

STUTH CO. INC.

28620 Maple Valley RD. S.E.
Maple Valley Wa. 98038
(206) 255-3546
FAX (206) 432-4461

Typical
Surge Tank Detail
2390 gallon single tank configuration
November 14, 1994



6" Concrete slab placed under the 1870 gal. tank and around the 2390 gal. tank*
(To place this combination set the 2390 tank first on the native ground or gravel. Next the rebar is laid for the slab under 1870 tank.. Then. pour the slab and the area around the 2390. Finally set the 1870 gal. tank while the slab is still wet.)

* Pump vault must cover the pump

Not to scale

STUTH CO. INC.
P.O. Box 950
Maple Valley Wa. 98038
(206) 255-3546
FAX (206) 432-4461

Typical Surge Tanks

1870 & 2390 gallon two tank surge comb.

Nov. 15, 1994

The Nibbler

NIBBLER™
Secondary Sewage Treatment System

DESCRIPTION

The Nibbler™ is an aerobic treatment devise consisting of one or more concrete tanks each of which is equipped with eight air pumps. The air pumps are driven by an external regenerative air blower and function as the wastewater air contactor and the liquor mixing mechanism within the system. Each Nibbler™ unit also contains buoyant media which is retained by a grid below the liquid level throughout the entire surface of the tank.

TYPE OF SYSTEM

The Nibbler™ is designed to treat high-strength wastewater to at least residential sewage septic tank effluent quality and will reduce wastewater constituents (BOD_5, TSS, and Grease and Oils) to or below those levels customarily found in residential sewage septic tank effluent.

APPLICATION

The Nibbler ™ is designed for use in locations where site conditions would permit the use of soil absorption fields as specified in WAC 248-96 or in conjunction with alternative methods of on-site disposal including, but not limited to mounds and sand filters, or in locations where public sewers are available, but the waste strength is to high to be allowed to go untreated.

DESIGN

The Nibbler ™ is designed to be installed between the grease trap and the drainfield or public sewer. if the anticipated hydraulic and waste strength loading are such that the Nibbler™ system will be working near its maximum capacity, the addition of a surge tank between the grease trap and the Nibbler™ will enhance the performance of the system, allowing for more controlled dosing rather than a purely demand dosing to the system. A clarifier will be installed between the Nibbler™ and the drainfield when this method of disposal is used.

1. STRUCTURAL CONSIDERATIONS

   a. Nibbler™ Tank

   The Nibbler™ tank is a single compartment concrete tank with a total capacity ranging from 1000 to 2300 gallons. The tank is installed so that its top is exposed at the ground surface. The top of the tank is equipped with air tight locking lids which allow for easily maintaining, sampling from, pumping and cleaning the devise. The lids can be installed at traffic bearing strength. The tank is also equipped with built-in air tight PVC fittings necessary for the plumbing of the aeration system. The concrete used in manufacturing the tank is mixed to withstand a 3000 psi crush test after 14 days of the manufacture date.

b. Buoyant Media and Retention Grid

Each Nibbler™ unit contains a specific amount of buoyant media which is critical to the successful operation of the unit. This media has a large surface area to volume ratio (38 ft^2/ft^3). The buoyant media is retained below the operating liquid level by a retention grid made out of one inch PVC pipe ribs and polyethylene fence mesh.

c. Aeration System

The Nibbler's ™ aeration system consists of a regenerative air blower (1hp per tank installed) which provides the required air flow to drive the eight air pumps. The air blower, which is the only mechanical part of this system, is housed in a separate concrete chamber protected from weather conditions. Each air pump consist of a six inch diameter PVC pipe, 24 inches long, which extends from one inch above the liquid level to 23 inches below the liquid level at eight specific locations throughout the Nibbler™ tank. Air is injected into the air pumps via a one inch PVC pipe which is sleeved inside the top of the six inch PVC pipe to a depth of 17 inches below the liquid level. These one inch PVC pipes are capped and have four 1/4 inch holes next to the cap which produces a continuous flow of air bubbles. The air pumps work by creating an air-liquor mixture inside the six inch PVC pipe which is less dense than the outside liquor. Because it is less dense, the air-liquor mixture inside of the six inch PVC pipe is displaced through the top of the six inch PVC pipe by gravity forces caused by the more dense liquor entering the bottom of the six inch PVC pipe. The air pumps produce a continuous upflow of air-liquor mixture resulting in constant mixing of liquor in the tank and in substantial diffusion of oxygen to the liquor by creating a large air-to-liquor contact surface area necessary for efficient diffusion of gases out of the liquor.

d. Control Box and Metering Devises

Each Nibbler™ system requires the installation of a control box and a metering devise. While there are several possible methods of metering the influent to the Nibbler™, including metering devices installed within the building, the most common method of metering influent employs a submersible pump, one or more float switches, cycle counters and time meters, all connected and operated through a control box. The submersible pump and its float switches are located in a pump tank or a surge tank installed between the grease trap and the Nibbler™ unit. The float switches are used to activate the submersible pump when the liquid in the pump tank rises to a certain level. When the Nibbler™ system is operated basically on a demand dosing mode, there is no need for timers in the control box, as the float switch acts as the on-off mechanism. When a surge tank is part of the Nibbler™ system, several float switch-timer combinations may be used, each activating at a given liquid level in the tank. The lower float switch-timer operates at a lower influent injection frequency than a higher float switch-timer devise, allowing for more frequent influent injections with rising liquid levels in the surge tank (i.e. higher demand). When a particular float switch is on, it activates its timer to inject one cycle with programmable "time on" and "time off" modes. In either case, the pump is calibrated for wastewater volume pumped per cycle and the cycle counter for each float switch-timer devise in the control box keeps a running count of cycles pumped. Therefore, the volume of wastewater processed by the Nibbler™ in a given period can be determined by multiplying the number of cycles in that period by the number of gallons per cycle. It is important that all electrical installations are done by qualified electricians and the control box is installed in a separate concrete chamber out of weather conditions.

2. SYSTEM PERFORMANCE

a. Mixing

The operational flow rates of the air pumps in the Nibbler™, the vertical direction of the liquor flow, and its turbulent nature combined, result in continuous and rapid mixing throughout the entire tank. As depth increases below the air pumps, turbulence decreases, hence mixing decreases. Exceptions to the rule of complete mixing are evident when settleable solids (sludge) is present at the bottom of the tank . The density difference between the liquor and the sludge impedes mixing and the sludge is usually anaerobic. Air flow through the air pump can be regulated to increase or decrease liquor flow to maximize or minimize mixing and oxygen diffusion to the liquor.

b. Oxygen Diffusion

The dissolved oxygen concentration of the liquor in an operating system is normally well below its saturation level. The amount of surface area for air-liquor contact generated in the air lift pump, the air-liquor contact time through the air pump and the splashing at the surface of the tank provide for diffusion of gases into and out of the liquor. The efficiency of oxygen diffusion will depend upon the difference between the actual dissolved oxygen concentration of the liquor and the oxygen saturation level for that particular system's liquor temperature and composition. The amount of oxygen diffusion can be regulated by increasing or decreasing air flow through the air pumps.

c. Microbial Oxygen Uptake

By virtue of its design, oxygen diffusion in the Nibbler™ occurs in the upper levels of the tank (air pumps and air-liquor interface). The direction of the liquor flow in the tank is downwards. Microbial oxygen uptake occurs at every point in the liquor's downward path. Therefore, in an active Nibbler™ system, higher dissolved oxygen concentrations are observed at the top of the tank and dissolved oxygen concentration decreases with increasing liquor depth. The dissolved oxygen concentration at any point in the Nibbler™ tank is dynamic and will depend upon the liquor's temperature, influent waste strength and volume, frequency of influent injection and time elapsed between influent injections.

d. Dissolved Oxygen Profile: The Facultative Capability

Because dissolved oxygen concentration decreases with increasing liquor depth, the Nibbler™ exhibits three different zones with relation to dissolved oxygen concentration. The uppermost mixing zone, which employs most of the tank's volume, is the aerobic zone. The transition between the aerobic and the anaerobic zones (zone of least mixing) constitutes the facultative zone. The lowest portion of the tank, where solids settle (sludge), constitutes the anaerobic zone (zone of no mixing). The actual formation of these three zones in any system depends upon the system's age, hydraulic and waste strength loading, and mixing and oxygen diffusion characteristics of the system. A system operating near its maximum capacity will contain these three zones once sludge begins to accumulate at the bottom of the tank. An underloaded system will take longer to accumulate sludge and therefore to form these three zones. The air flow in these underloaded systems can be down-regulated to allow for less mixing which will accelerate the formation of these three zones.

e. Denitrification

Biological denitrification (removal of nitrites and nitrates) begin at low dissolved oxygen concentrations (equal to or less than 1 mg/L) and requires a carbon source. The carbon source present in the Nibbler™ is in the organic matter being biodegraded. For efficient biological denitrification, a system must exhibit the three zones described above. Therefore, air flow regulation and adjustment is important to ensure a complete treatment of wastewater.

f. Input and Output Characteristics

In this report we present data for the five experimental Nibbler™ systems. Data presented in this report include: Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), Grease and Oils (G&O), pH and temperature. For 1989, nitrite and nitrate data is also presented for four of the systems. This nitrogen data is a single data point and not an average of data points.

The following is a summary of the performance of five experimental Nibbler™ systems. Laboratory analyses performed by Aqua Test, Inc.

Criteria for analysis:

Residential wastewater strength in this report is considered to be:
$BOD_5 = \leq 230$mg/L, TSS = ≤ 150 mg/L, G&O = ≤ 30 mg/L.

RESULTS

The results of our experimental program follows. 1990 test results were averaged to the month of September.

EXPERIMENTAL SYSTEM # 1
Ken's Truck Town, North Bend, WA.

System design data:

Number of units installed	2 (double pass - 2 tanks installed in series)
Gallons per day (234 per tank)	468 GPD
Maximum Influent BOD_5	2000 mg/L
Tank capacity (1000 gal. each)	2000 gallons total

1989 AVERAGE DATA

Average influent flow = 493 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent
BOD_5 (mg/L)	1291	263	63
TSS (mg/L)	514	199	70
G&O (mg/L)	283	31	18
Nitrite as N (mg/L)			0.011
Nitrate as N (mg/L)			<0.2

1990 AVERAGE DATA

Average influent flow = 1018 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent
BOD_5 (mg/L)	1243	192	71
TSS (mg/L)	188	145	59
G&O (mg/L)	99	25	39

Conclusion - system # 1:

Experimental unit # 1 utilizes a double pass Nibbler™ system. The above data indicates that with an influent flow of 211% of its design rate for 1989, 435% in 1990 and with influent BOD_5 of 65 % of maximum design rate for 1989 and 62% of maximum in 1990, the first unit effluent, in this double pass system, meets the established criteria for treatment of high-strength wastewater treatment. This finding suggests that the original design criteria for the Nibbler™ system was conservative.

EXPERIMENTAL SYSTEM # 2 - Two Rivers Restaurant & Lounge, Carnation, WA.

System design data:

Number of units installed	1
Influent gallons per day	350 GPD
Maximum influent BOD_5	2000 mg/L
Tank capacity	1680 gallons

1988 AVERAGE DATA

Average influent flow = 338 GPD

	Influent	Effluent
BOD_5 (mg/L)	2274	203
TSS (mg/L)	1169	138
G&O (mg/L)	789	19
pH	4.63	6.71
Temp (^{0}C)	26.4	21.7

1989 AVERAGE DATA

Average influent flow = 302 GPD

	Influent	Effluent
BOD_5 (mg/L)	2657	200
TSS (mg/L)	1709	164
G&O (mg/L)	951	23
pH	4.72	7.15
Temp (^{0}C)	25	18
Nitrite as N (mg/L)		0.026
Nitrate as N (mg/L)		<0.2

1990 AVERAGE DATA

Average influent flow = 280 GPD

	Influent	Effluent
BOD_5 (mg/L)	2827	112
TSS (mg/L)	2760	75
G&O (mg/L)	1685	21
pH	5.41	7.37
Temp (^{0}C)	25	18

Conclusion - system # 2:

The influent flow for the three years this system was studied, was equal to or somewhat lower than the original design rate, however, the BOD_5 was 14% over its design rate for 1988, 33% over for 1989 and 41% over for 1990. With flow rates equal to the design flow rate and with excess influent BOD_5, the laboratory analyses performed on this system indicate that the effluent from this system meets all the criteria established for treatment of high strength wastewater by an alternative proprietary aerobic treatment devise.

EXPERIMENTAL SYSTEM # 3
Maple Glen Center, Kent, WA.

System design data:

Number of units installed	3 (triple pass - 3 tanks operating in series)
Influent gallons per day (234 per tank)	702 GPD
Maximum Influent BOD_5	2000 mg/L
Tank capacity (1000 gal. each)	3000 gallons total

1989 AVERAGE DATA

Average influent flow = 199 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent	3rd Unit Effluent
BOD_5 (mg/L)	374			12
TSS (mg/L)	82			10
G&O (mg/L)	30			19
pH	6.43			8.39
Temp (°C)	17			17
Nitrite as N (mg/L)				0.014
Nitrate as N (mg/L)				7.2

1990 AVERAGE DATA

Average influent flow = 302 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent	3rd Unit Effluent
BOD_5 (mg/L)	365	92	42	2
TSS (mg/L)	153	49	30	11
G&O (mg/L)	16	--	--	--
pH	6.21	7.14	7.43	8.30

Conclusion for system # 3:

This system was designed to receive much more waste than it is currently receiving. This experimental unit shows that even at this low waste strength, the Nibbler™ system can reduce waste strength by 75% after passing through only one tank.

EXPERIMENTAL UNIT # 4
Toll Towne Center, Carnation, WA.

System design data:

Number of units installed	4
Number of units operating	2
Influent flow - gallons per day per unit	363 GPD
Maximum influent BOD_5	1800 mg/L
Tank capacity (each tank)	1680 gallons

1988 AVERAGE DATA

Average influent flow = 234 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent
BOD_5 (mg/L)	82	8	4
TSS (mg/L)	55	10	6
G&O (mg/L)	16	12	8
pH	6.49	6.37	6.28
Temp. (^{0}C)	16.7	17.3	18.4

1989 AVERAGE DATA

Average influent flow = 180 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent
BOD_5 (mg/L)	88	8	3
TSS (mg/L)	51	12	9
G&O (mg/L)	20	14	17
pH	6.83	6.24	5.53
Temp. (^{0}C)	12	13	14
Nitrite as N (mg/L)			0.72
Nitrate as N (mg/L)			71.0

1990 AVERAGE DATA

Average influent flow = 434 GPD

	Influent	1st Unit Effluent	2nd Unit Effluent
BOD_5 (mg/L)	29	9	3
TSS (mg/L)	25	31	6
G&O (mg/L)	6	10	17
pH	8.00	6.30	5.80

Conclusion for system # 4:

This system is very much like system # 3. Both systems behave similarly and have similar performance characteristics.

EXPERIMENTAL SYSTEM # 5

The Last Resort, Roslyn, WA.

System design data:

Number of units installed	1
Influent gallons per day (GPD)	700 GPD*
Maximum influent BOD_5	1800 mg/L
Tank capacity	1680 gallons

* The addition of a 2000 gallon surge tank allows the system to handle a higher total daily influent volume. The ability to spread out the dosing of the influent allows the system to more efficiently process the influent, increasing the system's processing capability.

1989 AVERAGE DATA

(Note: This system was installed November 5, 1989)

Average influent flow = 494 GPD

	Influent	Effluent
BOD_5 (mg/L)	573	132
TSS (mg/L)	113	55
G&O (mg/L)	33	14
pH	6.64	7.78
Temp (^{0}C)	16	16

1990 AVERAGE DATA

Average influent flow = 974 GPD

	Influent	Effluent
BOD_5 (mg/L)	953	133
TSS (mg/L)	321	52
G&O (mg/L)	47	12
pH	6.00	7.00
Temp (^{0}C)	15	15

Conclusion - System # 5:

This system is operating at its designed influent flow (GPD), which is much higher than other similar systems with equal tank size. The waste strength of the influent entering this system is, on the average, lower than its design rate. There were a couple of sampling periods where the system operated at higher than average flows and waste strength. In those instances, the system appears to have improved processing efficiency. More detailed studies concerning the relationship between hydraulic loading, waste strength loading and operational efficiency will be available in the near future.

e) Temporary Shut Down of System.

Experimental system # 1 has experienced frequent power outages ranging in time from a few hours to a couple of days. With power outages of a few hours, the system does not exhibit any detrimental effect. With power outages of a couple of days, the system shows signs of biological damage, however, it has proven to recuperate within a period of two to three days to a fully operational mode, much quicker than the start up period.

4. DESIGN OF DISPOSAL SYSTEM

While the manufacturer does not design disposal systems, the Nibbler™ can be sized and modified to accommodate the specific requirements of any disposal system to be implemented.

5. PERFORMANCE MONITORING

Monitoring of flow rates and waste strength and composition, should be done once per month at approximately regular intervals during the first three months of operation of the Nibbler™ system, or in response to complaints or problems. If during the first three months of such monitoring, the measured parameters are consistently at or below allowable residential septic sewage effluent levels, then the monitoring frequency will shift to quarterly intervals (four times per year). However, if upon monitoring, any of the above parameters exceeds allowable level,s the monitoring entity must notify the owner of the facility employing a Nibbler™ system and the permit issuing agency of such findings. The monitoring entity shall, within seven calendar days conduct a complete investigation of the causes of excess flow or waste strength and shall report in writing to the owner and the permit issuing agency the apparent causes of such excesses, along with recommendations for alleviating the problem.

MAINTENANCE AND OPERATION

Septic tank and clarifier maintenance

Continuous maintenance and operation monitoring shall be provided for the life of the system by a qualified monitoring entity (one acceptable to both manufacturer and the permit issuing agency). Such entity shall be responsible for performing waste strength testing (BOD_5, TSS, G&O), keep accurate records of influent flow and other pertinent operational information, as well as physical inspection of the disposal system. It is important that the monitoring entity be qualified to perform inspections on the variety of disposal systems used and be able to recognize malfunction in such systems. This monitoring and maintenance entity shall submit an annual evaluation to the owner of facility employing a Nibbler™ system and to the local permit issuing agency.

Owner's manual to follow

3. SYSTEM RELIABILITY

Stress testing regime

Different stress testing was performed in different systems. For the purpose of this report, stress tests include the following: a) overloading, b) underloading, c) shock loading, d) temperature variations and f) temporary shut down of system.

a) Overloading

a-1) hydraulic

Hydraulic overloading is observed in Experimental System # 1. This system operated with 211% of its designed hydraulic loading in 1989 and with 435% in 1990. In both years, the effluent from the first unit in a series of two units met the criteria for aerobic treatment of high-strength wastewaters.

a-2) waste strength

Waste strength overloading is observed in Experimental System # 2. In 1988, 1989 and 1990 this system operated with influent BOD_5 of 114%, 133% and 141% of its design rate respectively. In all three years, this unit's effluent met all the criteria for aerobic treatment of high-strength wastewaters.

b) Underloading

Experimental system # 3 operated with an underloaded hydraulic and waste strength influent for two consecutive years, 1989 and 1990. Similarly, experimental system # 4 operated with an underloaded hydraulic and waste strength influent for 1988, 1989 and 1990. Both experimental systems exhibited satisfactory performance.

c) Shock Loading

With frequent monitoring of these systems, it has been observed that Experimental System # 2 receives 50% of its weekly flow during the weekend. Therefore the average GPD for this system is somewhat misleading as cycle counter readings were made weekly. Even with the evident shock loading, this system always exhibited satisfactory effluent quality. This situation is also apparent in Experimental System # 5.

d) Temperature Variations

All systems included in this report exhibited a certain degree of operating temperature variation. With operating temperatures ranging from 11°C to 26°C throughout the year, these systems produced effluent of satisfactory quality. Experimental System # 5 is a particularly good example of temperature stress. This system is located in Roslyn, WA. at an altitude of 2200 feet. In February, 1990, when ambient temperatures fell well below freezing levels, the air supply for the air blower was changed from the kitchen to outside air with no significant change in liquor temperature.

NIBBLER SIZING STANDARDS

Nibblers are sized to accommodate an established amount of pounds per day (PPD) of BOD_5 loading which is determined by the following method:

PPD Formula: GPD x BOD_5 x .00000834 = PPD BOD_5
Example: 1000 GPD x 1500 BOD_5 x .00000834 = 12.51 PPD

Nibbler systems are sized to receive no more than 6.5 PPD per standard (2140 gal.) Nibbler unit when receiving metered flows from a surge tank.

Where there is no surge tank to ensure an even flow to the Nibbler system, sizing should not exceed 3.25 PPD per standard Nibbler unit.

Each standard Nibbler tank holds eight pods which contain buoyant media. When Nibbler systems are constructed using tanks other than standard-sized units, they should be sized to contain a proportionate number of pods.

Therefore:

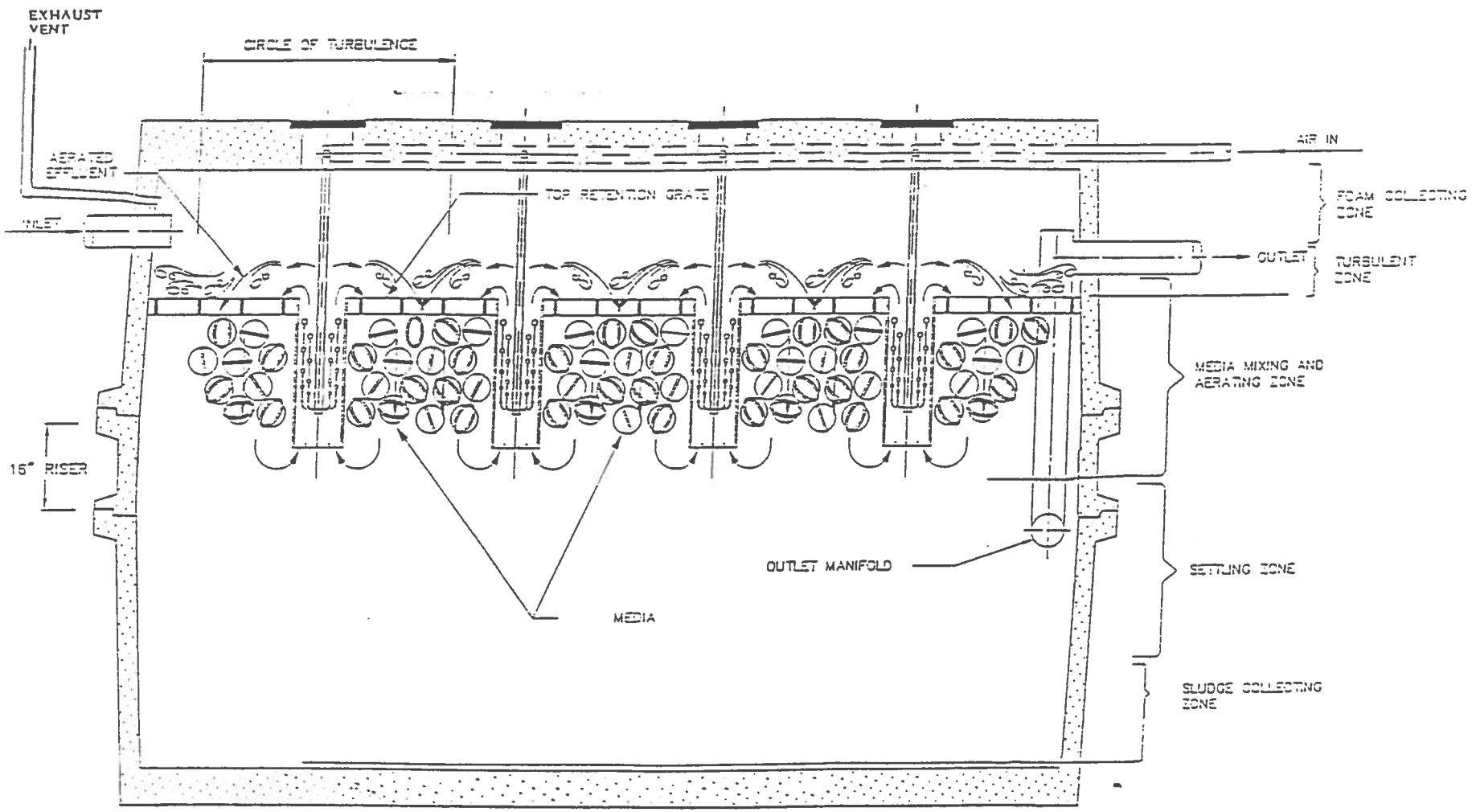
Systems using a surge tank should be sized to receive .81 PPD per pod.
6.5 PPD ÷ 8 pods = .81 PPD per pod

Systems with no surge tank should be sized to receive .41 PPD per pod.
3.25 PPD ÷ 8 pods = .41 PPD per pod

The following example demonstrates acceptable ranges of biological loading compatible with a 1000 GPD design rate in a 2 Nibbler system. The higher and lower flows are shown to demonstrate the relationship between GPD and BOD in determining PPD of loading. If the GPD decreases, the system can tolerate a higher BOD loading factor and if the GPD increases, the tolerable BOD loading factor decreases.

GPD	BOD	PPD	PPD/6.5	# NIBS	GPD/UNIT	PPD/UNIT
1000	1000	8.34	1.28	2	500	4.17
1000	1500	12.51	1.92	2	500	6.26
1000	1558	1299	2.00	2	500	6.50
750	2075	12.98	2.00	2	375	6.49
1500	1040	13.01	2.00	2	750	6.51

By following the recommended Nibbler sizing standards, systems should require low maintenance, less frequent monitoring, and will produce minimal odor. While successful waste strength reduction can be achieved in a single unit receiving as much as 15 PPD, monitoring and maintenance requirements are sharply increased and significant odor will result.

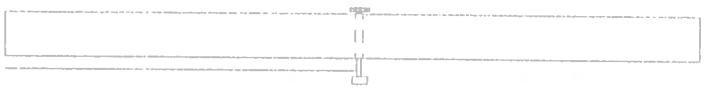


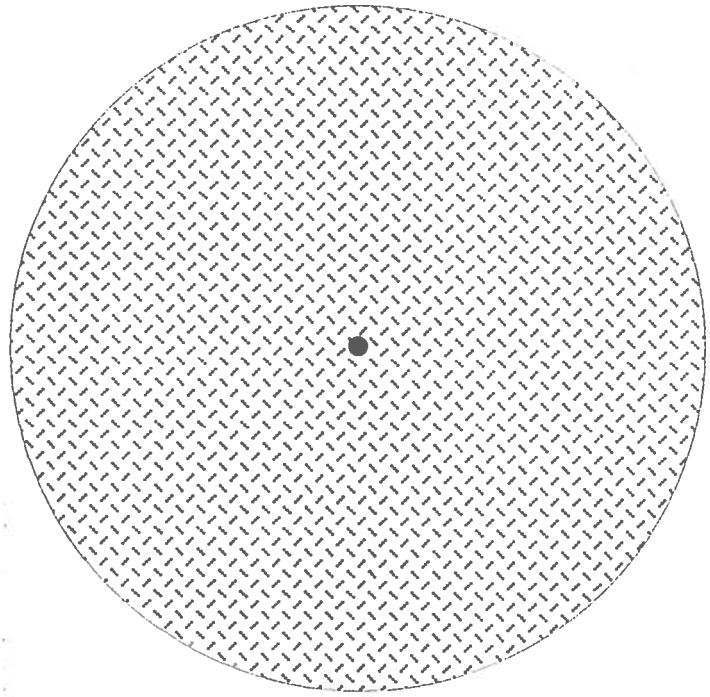
SECTION: A – A
"AIR PUMP" DETAIL

SCALE: 1" = 0' – 6"

THE STUTH COMPANY

AEBLER





STUTH CO. INC.

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98038
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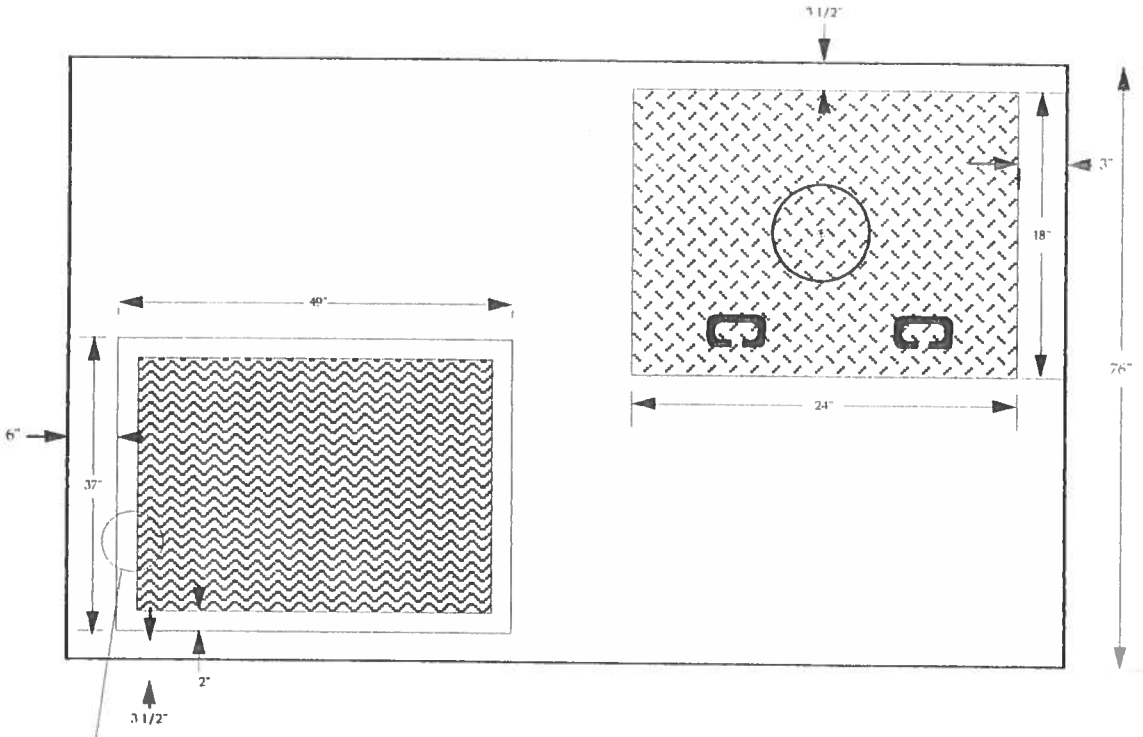
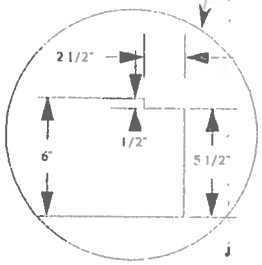
Typical

18" Nibbler Access Cover

December 6, 1994



Detail A



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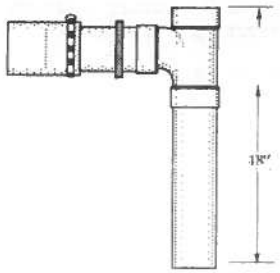
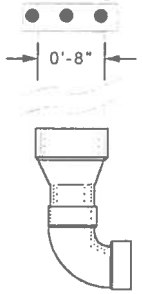
Nibbler Lid Detail
Typical
May 19, 1994

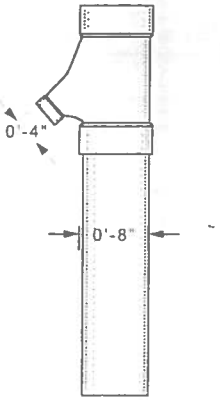
Inlet



Top of stack is approximatly
10' above the ground

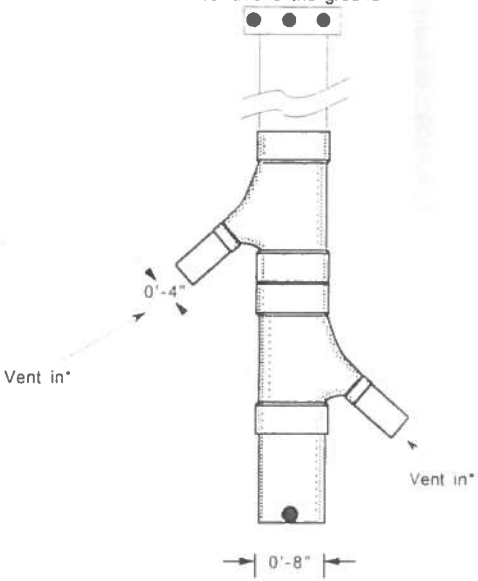


Vent Stack "90"



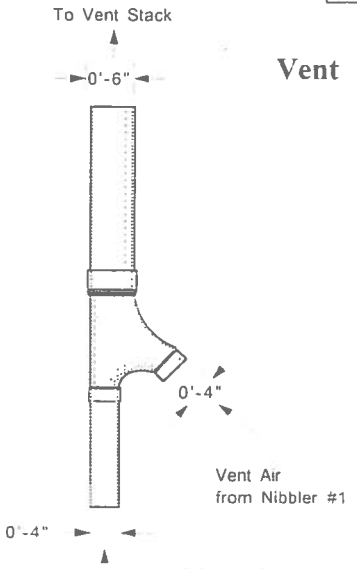
Vent Stack "Y"

Top of stack is approximatly
10' above the ground



Vent Stack Double "Y"

To Vent Stack



Vent Stack "Y"
(4" to 6")

*Vent lines are 4" diameter PVC from each Nibbler unit to the vent stack. The Vent stack is 8" PVC with a vented cap. The vent line **must** run at a minimum slope of 1% so that any water which may accumulate in the line will drain back to the Nibbler unit. It is critical that no sags occure in this line after installation and potential settling occures

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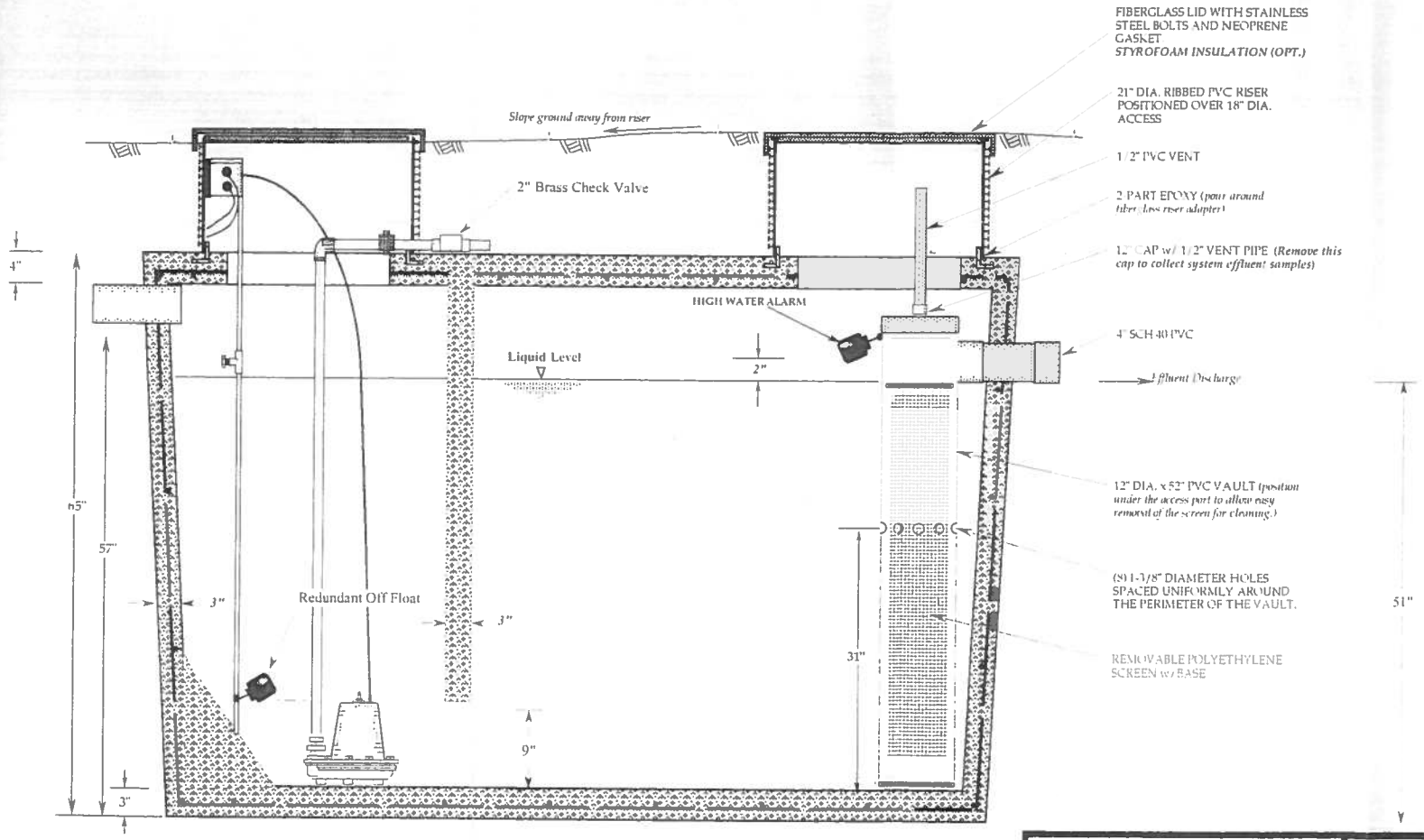
Typicals
Vent Stack Details & Inlet Details
December 6, 1994

Clarifier



SIDE VIEW

TYPICAL 1000 Gal. CLARFIER TANK w/ EFFLUENT FILTER AND RISER

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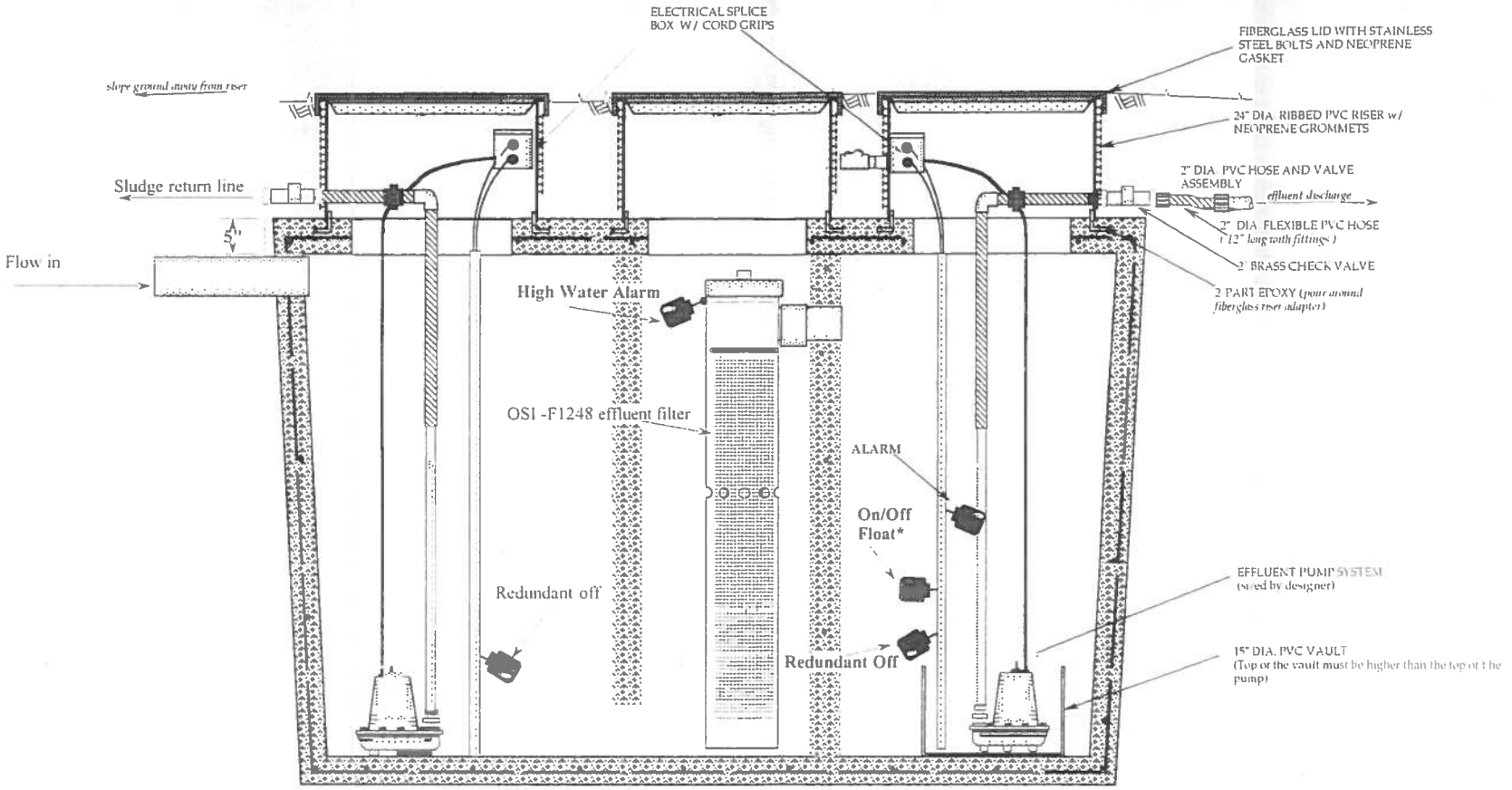
FAX (206) 432-4401

Typical Clarifier Detail

1000 gal. two compartment clarifier

November 14, 1994



Clarifier/Dosing tank

SIDE VIEW TYPICAL 1620 GALLON TANK, CONTROL FLOAT ASSEMBLY AND LOW HEAD-HIGH FLOW EFFLUENT PUMPS.

All holes for the lines entering and exiting the tank are to be one inch in diameter larger than the pipe size shown.

Tank compartment sizes are: Inlet=547 gal.. Center=343 gal.. Outlet=710 gal.

Tank risers are offset from each other

Tank must be tested and certified water tight after it is installed.

STUTH CO. INC.

28620 Maple Valley RD. S.E.
Maple Valley Wa. 98038
(206) 255-3546
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Typical Clarifier/Dosing Tank

1620 gal. three comp. single tank configuration

November 15, 1994

Example Systems

Collecting Data

GATHERING BACKGROUND DATA

There are two primary sources of information for onsite wastewater treatment design. The first and best is information collected at the facility in question. If the facility you are designing for exists, and this is a repair or modification, you should try and collect as much information as possible at the facility. The second source of information is collected from similar facilities or comparative data. The information you are looking for includes:

- Average daily flows (Gallons Per Day - GPD)
- Peaks in the flow and a basic understanding of the weekly and/or seasonal changes in the flow pattern.
- Waste strength - samples should be analyzed for: BOD_5 (Bio-Chemical Oxygen Demand - 5 Day Test), TSS (Total Suspended Solids), O&G (Oil & Grease), pH , D.O. (Dissolved Oxygen) & Temperature.
- Plumbing - can the blackwater & greywater be separated? Treating the greywater only saves money.

Flow data

Water Meters: The most obvious way to gather information on flows volume is by taking water meter readings. However, you must be careful when using this information. Water meters can be inaccurate and may include water which does not go to the septic system (outdoor use, leaks, cooling water which may be sent to a different drain, water leaving the facility as food or drinks being sold).

Counters/Hour Meters: If the system on the facility you are repairing has a pump you can measure the flows by installing a cycle counter and/or hour meter. See the control/calibration section for more information on getting flow information this way.

Pump Outs: Some repairs are at a point where the system requires continuous pumping. In this case you can use the pump out volumes to get an idea of flow volume. Be careful when using this information for design because a facility which is being pumped will generally be using less water than they would if they had a system which is operating properly. Another consideration when using pump-out data is the possibility that the pumpers records are in error (not intentionally, of course).

Peaks in the flow: If meter/counter data do not give you the peak flow information you need, you can get an idea of the time and magnitude of the peaks by talking to the facility manager. He can give you information on the busiest times and/or the highest water use times and how long they last. This information can be roughly interpreted to plan for peak flows. An example of this would be a restaurant which has 60% of its business on a Friday & Saturday. If the facility has an average daily flow of 1000 GPD your peak flows may be 2100 GPD on Friday & Saturday (60% of the total weekly flow in two days). This technique also brings the owner and/or manager into the design process, which can also give her/him a better understanding of the system.

Waste Strength: If you are designing for an existing facility it is always a good idea to get a couple of representative samples and analyze them for waste strength. Samples should be collected from the outlet baffle (near the surface) or from the pump chamber*. The idea when taking a sample is to get a result which is representative of what would feed into the surge tank of your Nibbler design. If the facility has multiple lines and tanks you may want to collect several samples to help you decide what needs to be treated (Nibbled) and what doesn't.

* - When taking a sample from a pump chamber the sample should be collected just prior to a pump cycle. Once the pump runs the remaining effluent is turbulent and is not representative of the effluent quality. Be careful when collecting any sample not to bump the sides or create any turbulence.

Comparative

Flow Volume: If you are designing a new facility or cannot get the data you need for the facility you are working on, you will need to get your information by comparing it to a similar facilities. The data base which follows this section is set up for this purpose. Other sources for comparative data are limited to flow volumes (EPA manual, Various text book). Remember that any source of data you use can be in error, so its not a bad idea to look at a couple of sources and see what kind of range you have. Pay particular attention to the components or practices at your facility which will contribute to the flows - low flow fixtures, water cooled machines, bathroom use (extra - like at highway interchange) showers, laundry, kitchen practices, garbage disposal, salad bar, ect.

Waste Strength: When it comes to evaluating comparative waste strength for a commercial system very little data exists. The EPA manual recommends collecting waste strength characterization data from a similar facility in the area, but does not provide any guidance for commercial waste strengths. The book Waste Water Engineering (McGraw/Hill) only references untreated domestic waste water. Therefore, the only data base available for commercial strength waste is in the attached Data Base.
If a similar facility exists in the area, we recommended getting a sample for comparative information. When sampling an existing system be aware of the detention time for that system. A short detention time will give a false high reading. Samples should be analyzed for BOD_5, TSS, O & G, pH, Temp. and D.O.

Nibbler Sizing Checklist

Facility _____ **Date** _____

Avg. GPD _____ **Peak GPD** _____

Sized For _____ **GPD** **Co-Mingled Flow** yes no

Type of Facility

____ Restaurant
____ Mini Mart
____ Golf Course
____ Truck Stop
____ RV Park
____ School
____ Supermarket
Other _____
____ Processing / Factory
____ Strip Mall
____ Bed & Breakfast

Special Considerations

____ Private
____ Public
_____
____ Lounge
____ Banquet Room

Public Restrooms: yes no
Seasonal

Other _____
_____

Hours B L D

____ Weekdays only
____ Weekdays & Weekends

Hours _____ to _____
Other _____

Seating Total Seating _____ Dining _____ Lounge _____ Banquet _____

Type of Service

____ Fast Food
____ Full Service
____ Self Serve (Smorg)
____ Deli
____ Cafeteria
____ Take Out / Delivery

Other _____
_____

Type of Menu

____ American
____ Ethnic _____

____ Salad Bar
Other _____

Meals Served Per Day

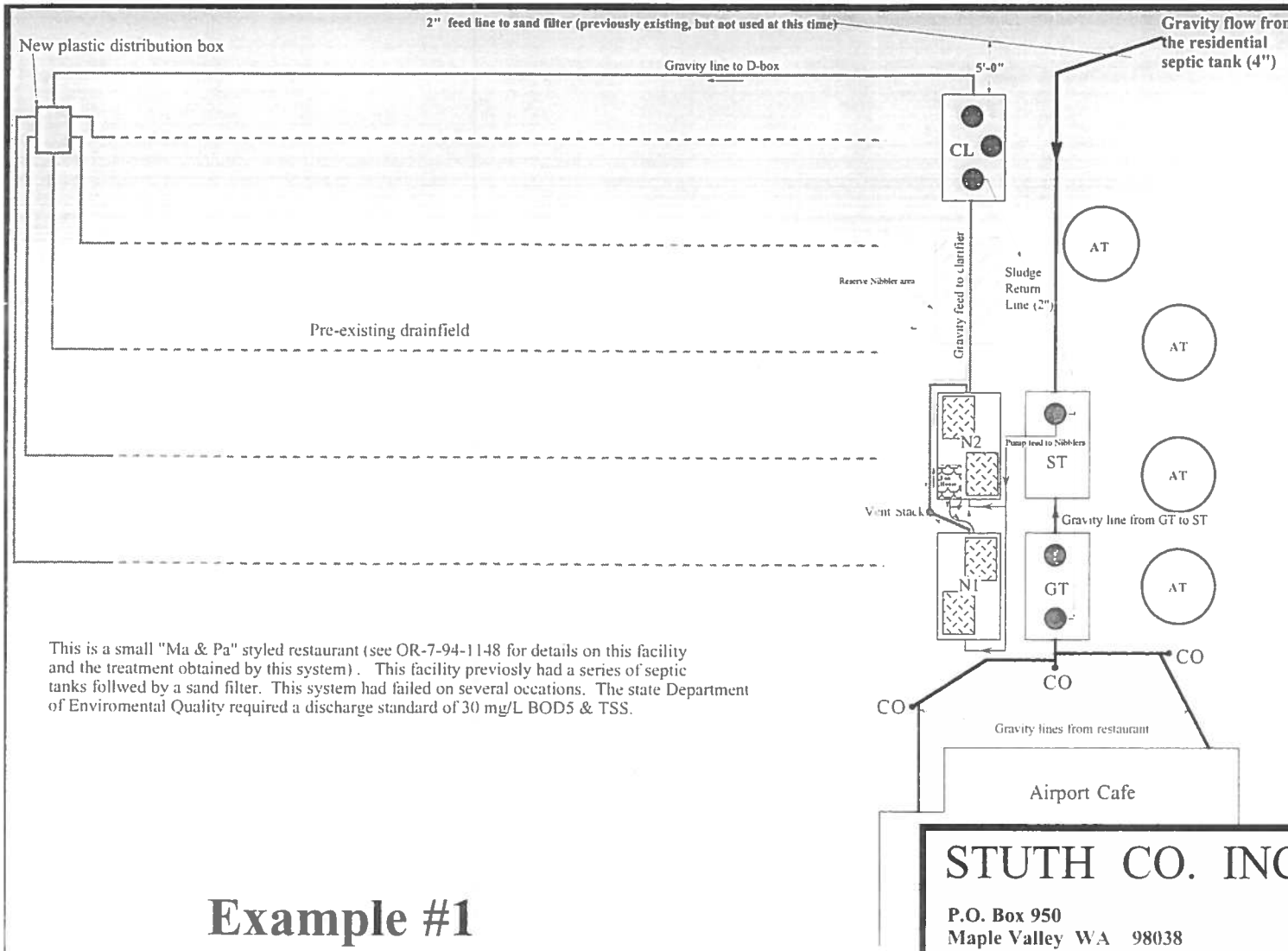
Weekdays _____ Friday _____ Saturday _____ Sunday _____

Tableware ____ Disposable ____ China ____ Other _____

Dishwasher ____ Hot Water Rinse (180°) ____ Chemical Rinse (120°)

Data Base

ID #	DB	Name of Facility and Location		Classification
OR-7-94-1148	•	Airport Cafe - Mulino, OR	1	Restaurant
OR-9-91-1025	•	Arrowhead Golf Course Molalla, OR	2	Golf Course
WA-1-92-1029	•	Back Bay Inn - Vashon, WA	3	Restaurant & Inn
WA-1-94-1124	•	Backwoods Cafe - Darrington, WA	4	Restaurant
WA-4-92-1050	•	Bethel Jr. High #4 - Graham, WA	5	School
WA-8-92-1069	•	Broetje Orchard Prescott, WA	6	Mini Mall/ Camp
WA-7-93-1107	•	The Bush House Index, WA	7	Restaurant & Inn
WA-3-93-1097	•	Camlann Medieval Village Carnation, WA	8	Restaurant
WA-5-91-1019	•	Camp Arnold - Eatonville, WA	9	Camp
WA-4-94-1135	•	Cascade Deli Mart - Snohomish, WA	10	Mini Mart
WA-3-93-1094	•	Casey's Grocery Store - Langley, WA	11	Supermarket
WA-7-93-1108	•	Clearview Cafe - Snohomish, WA	12	Restaurant
WA-7-94-1150	•	Clearview Plaza - System #1 Al.- Snohomish, WA	13	Supermarket
WA-7-94-1155	•	Clearview Plaza - System #2 Mc. Snohomish, WA	14	Fast Food
WA-9-91-1023	•	Country Corner Inn - Anacortes, WA	15	Restaurant
WA-2-93-1093	•	Dairy Queen - Clinton, WA	16	Fast Foo
OR-11-93-1114	•	Dairy Queen - Damascus, OR	17	Fast Food
WA-4-92-1054	•	Dairy Queen - Rochester, WA	18	Fast Food
WA-3-92-1043	•	Echo Falls Golf & Country Club - Snohomish, WA	19	Golf Course
WA-2-92-1036	•	Farmhouse Inn Rest. - Anacortes, WA	20	Restaurant
WA-10-94-1151		Floatation Device Pub - Purdy, WA	21	Restauran
WA-6-92-1059	•	Gaffney Suppliers Inc. - Puyallup, WA	22	Industrial
WA-10-94-1152		Getchel Station - Lake Stevens, W	23	Mini Mar
FL-4-94-1131	•	Hardees 30671 High Springs, FL	24	Fast Food
NC-10-94-1150		Hardees 0568 - Laurel Hill, N	5	Fast Food
TN-9-94-1148		Hardees 0569 - Seymour, TN	26	Fast Food
WA-4-88-1003	•	The Holstein Diner - Carnation, WA	27	Restaurant
WA-6-92-1057	•	Jackpot Foodmarket #1-058 - Burbank, WA	28	Mini Mart
WA-10-90-1012	•	Jackpot Foodmarket #164 - Clearview, WA	29	Mini Mart
OR-11-91-1028	•	Jackpot Foodmarket #3-056 - Eagle Creek, OR	30	Mini Mart
WA-8-94-1120		Jackpot Foodmarket #365 - Hadlock, WA	1	Mini Mart
OR-6-92-1058	•	Jackpot Foodmarket #3-015 - Hermiston, OR	32	Mini Mart
WA-6-94-1119	•	Jackpot Foodmarket #375 - Tenino, WA	3	Mini Mar
WA-10-91-1027	•	Jackpot Foodmarket #1-377 - Winlock, WA	34	Mini Mart
WA-4-91-1018	•	Jade Greens Golf Course - Auburn, WA	35	Golf Course
WA-10-92-1081	•	Jimmy D's Rest. - Port Orchard, WA	36	Restaurant
WA-10-92-1085	•	Ken's Korner - Clinton, WA	7	Mini Mal
WA-1-86-PROTO	•	Ken's Truck Town - North Bend, WA	38	Restaurant
WA-8-93-1109	•	Lake Limerick Golf Club - Shelton, WA	39	Golf Course
WA-2-91-1013	•	Lake Tapps Deli & Grocery - Sumner, WA	40	Mini Mart
WA-11-89-1011	•	The Last Resort Roslyn, WA	41	Restaurant
WA-6-88-1008	•	Maple Glen Center - Kent, WA	42	Mini Mall
WA-2-93-1091	•	Mar-Kum-Inn - Marquam, OR	43	Restaurant
WA-12-93-1122	•	Meriwether National Golf Course Hillsboro, OR	44	Golf Course
WA-3-92-1047	•	Mountain Deli Mart - Gold Bar, WA	45	Mini Mart
WA-5-93-1101	•	Mt. St. Helens Visitor Center - Castle Rock, WA	46	Restaurant



This is a small "Ma & Pa" styled restaurant (see OR-7-94-1148 for details on this facility and the treatment obtained by this system). This facility previosly had a series of septic tanks follwed by a sand filter. This system had failed on several occations. The state Department of Enviromental Quality required a discharge standard of 30 mg/L BOD5 & TSS.

Notes:

GT - 1620 gal. Grease Trap

ST - 2140 gal. Surge Tank

N1, N2 - Nibbler units 1 and 2

CL - 1620 gal. 3 compartment Clarifier

CO - Clean Outs

AT - Abandoned Tanks backfilled in place

1 - Sample location for Nibbler influent

2 - Sample location for Nibbler effluent

This system can be set up to run the Nibbler units in series or in parallel To run the system in parallel a cap must be placed on the 4" influent line to Nibbler #2 and the cap must be taken off the second feed line into the Clarifier. Reverse this order to have the Nibblers run in series.

This system has the option of returning the clarifier sludge to the Surge Tank or Grease Trap. This option is controlled by valves in the riser of the Surge Tank and Grease Trap.

Example #1

STUTH CO. INC.

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Maple Valley WA 98038
(206) 255-3546
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Restaurant - OR-7-94-1148
Site Plan (as-built)
July 14, 1994

Notes:

GT - 1620 gal. Grease Trap

ST - 2140 gal. Surge Tank

N1, N2 - Nibbler units 1 and 2

CL - 1620 gal. 3 compartment Clarifier

CO - Clean Outs

1 - Sample location for Nibbler influent

2 - Sample location for Nibbler effluent

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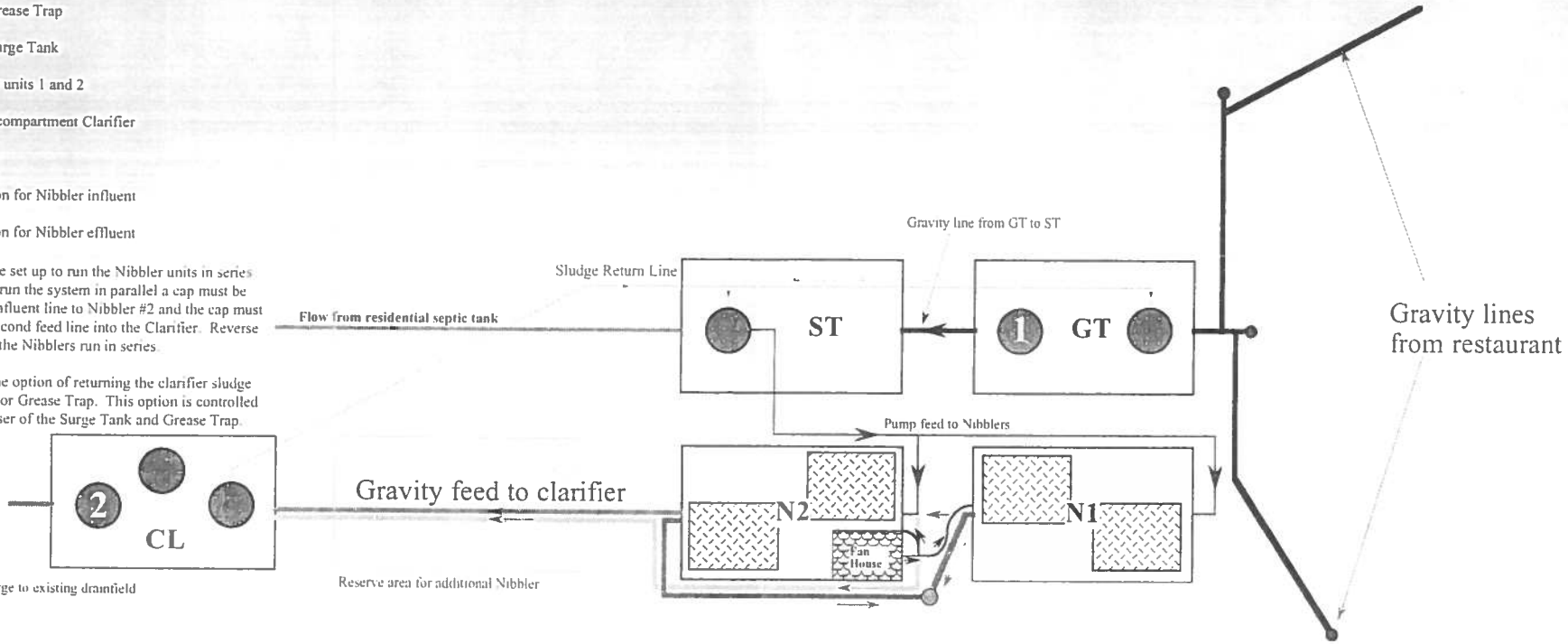

Example 1 (cont.)

STUTH CO. INC.

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(206) 255-3546
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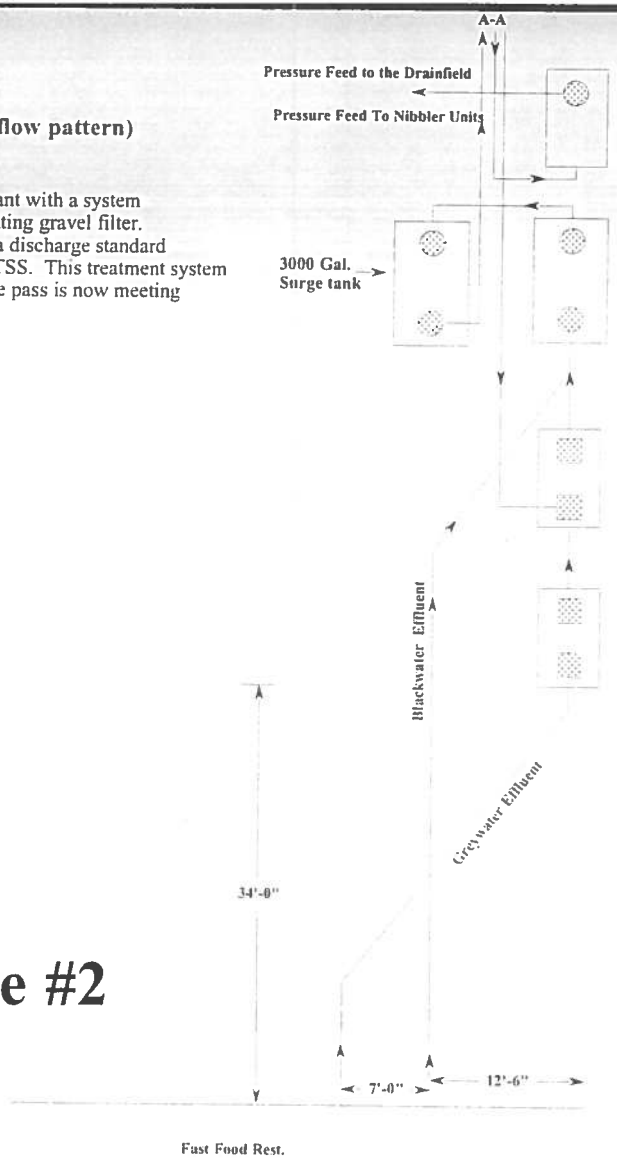
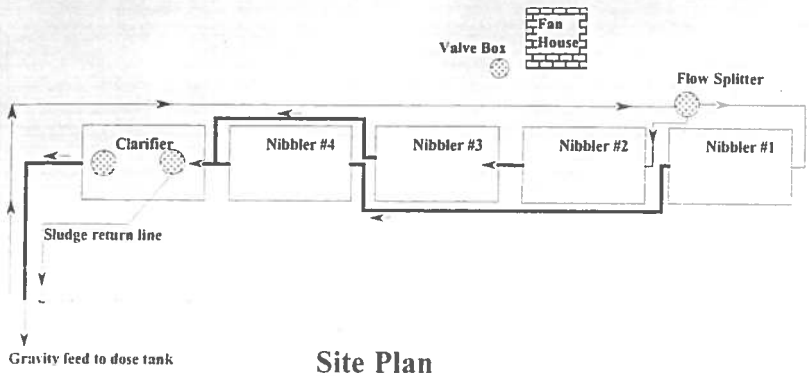
Restaurant
OR-7-94-1148
Flow Detail (as-built)
July 14, 1994

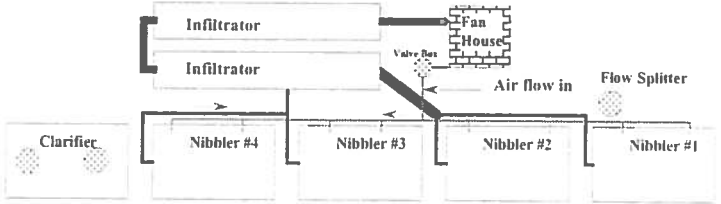
Site Plan
(Primary treatment flow pattern)

This is a fast food restaurant with a system which had failed recirculating gravel filter. The State DEQ required a discharge standard of 30 mg/L for BOD5 & TSS. This treatment system which is set up as a double pass is now meeting this standard.





Site Plan
(Secondary & Tertiary treatment flow)



Site Plan
(Air Flow Pattern)

Example #2

STUTH CO. INC.

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(206) 255-3546
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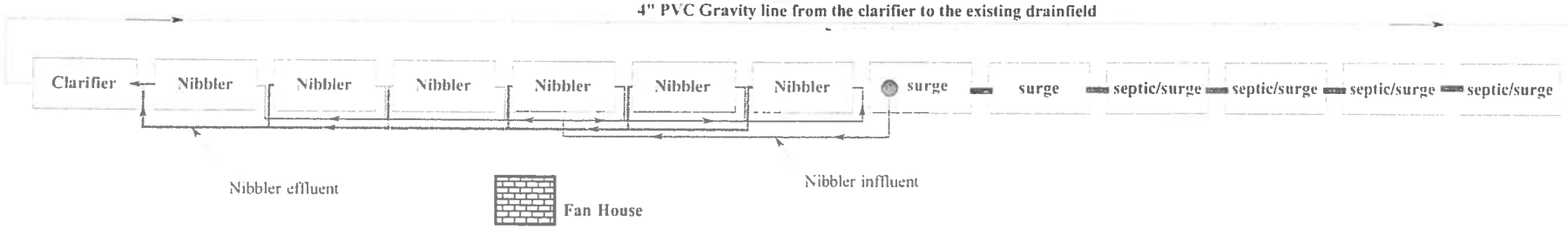
Rest. Fast Food
OR-11-93-1114
Site Plan - As Built
April 21, 1994



*** Pump Distribution to six Nibbler units, as shown on the Nibbler layout detail**

This is a large Supermarket which is followed by a gravity drainfield.
See WA-5-94-1142 for more details on this system.

Example #3

STUTH CO. INC.

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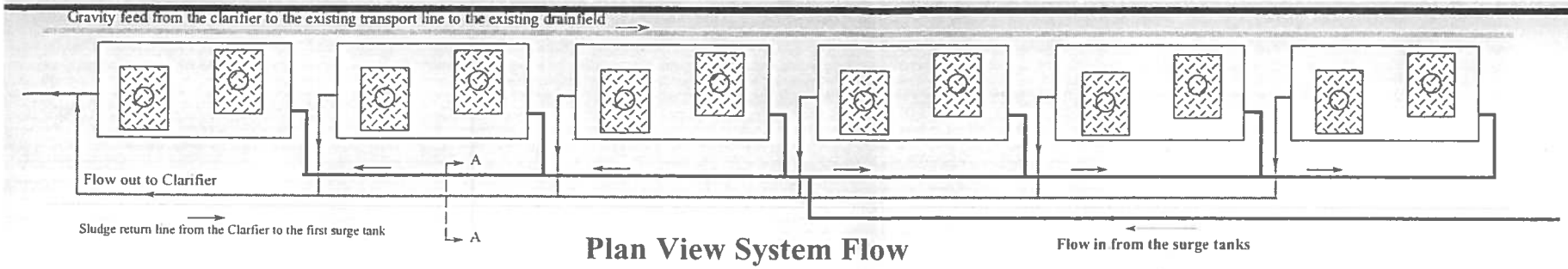
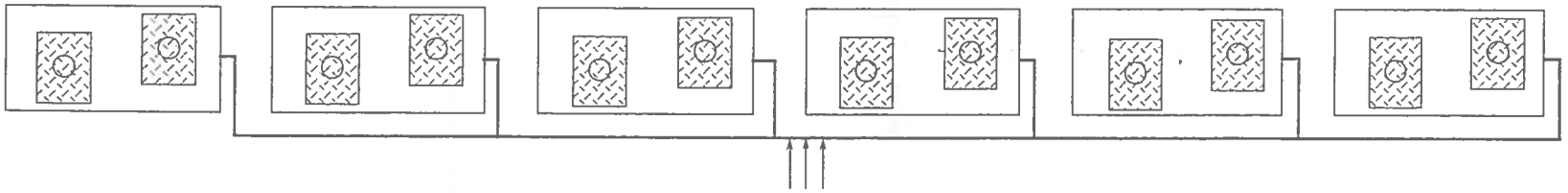
Supermarket
WA-5-94-1142
Flow plan, As-built
May 18, 1994

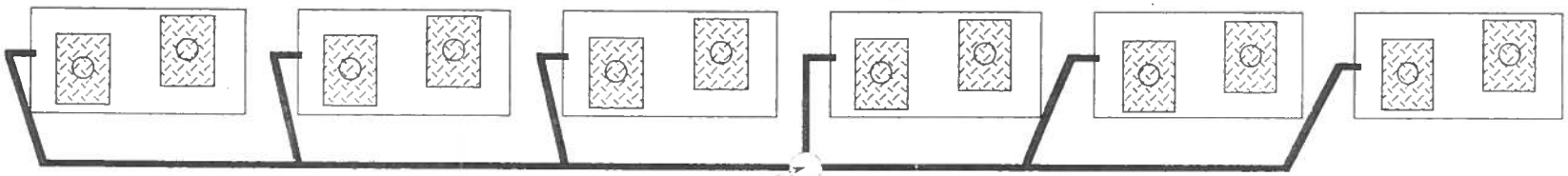


Plan View System Flow

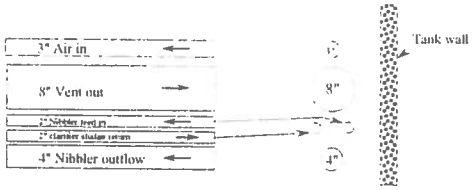


Plan View Air In

From Fan/Pump House
(3- 2 1/2 hp regenerative blower fans)



Plan View Air Out



Pipe Profile Section A-A

End View Section A-A

Notes:

This drawing is not to scale and is only intended to show the major components of the system. Additional pipe lengths and fittings will be required to complete this installation.

STUTH CO. INC.

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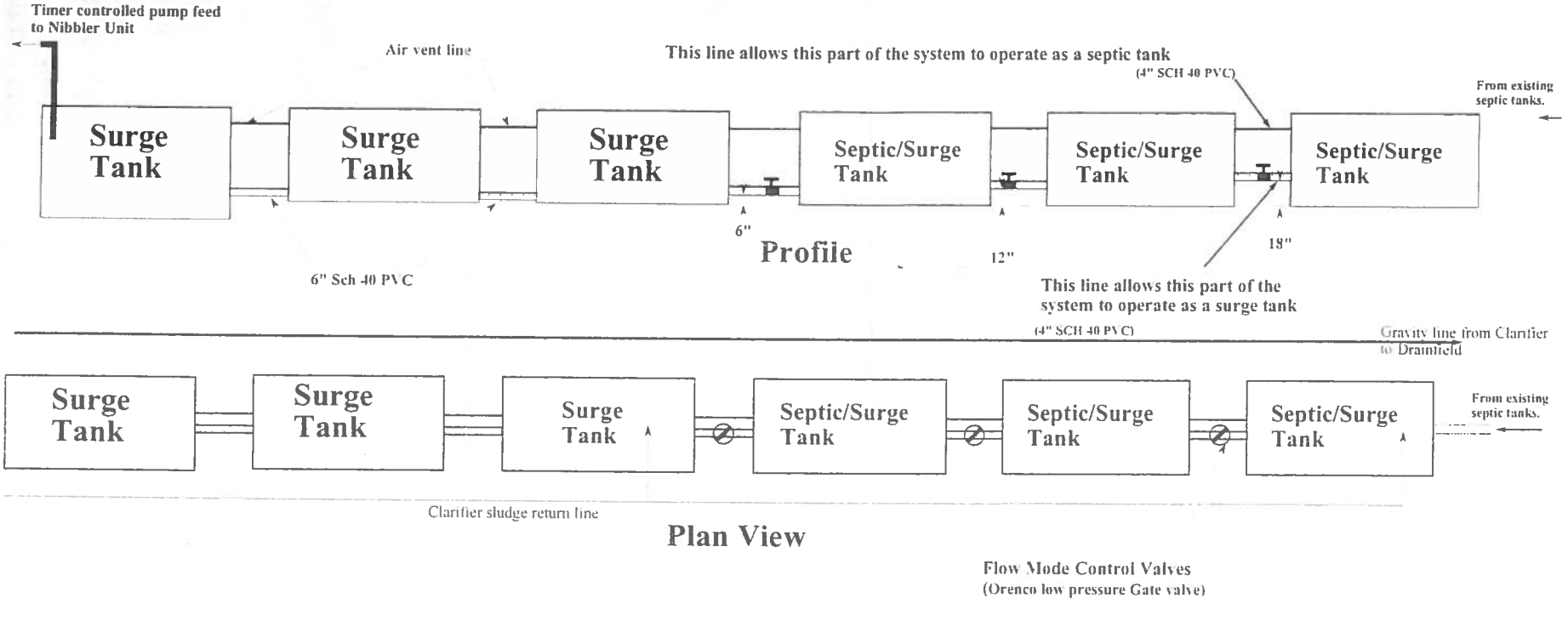
Supermarket, WA-5-94-1142
Nibbler Layout and
Flow Distribution Diagram
As-Built
May 18, 1994



Profile

Plan View

Flow Mode Control Valves
(Orenco low pressure Gate valve)

Notes:

All of the tanks shown are 1620 gallon single compartment concrete tanks except the final surge tank which is a 2140 gallon single compartment concrete tank.

All of the tanks used must be water tight.

STUTH CO. INC.

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(206) 255-3546
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Supermarket
WA-5-94-1142
Septic / Surge tank Diagram
May 18, 1994

Gas Station / Mini Mart, WA-10-90-1012

Basis for design:

The design was based on data collected during a nine month monitoring program which collected both flow volume and waste strength information. The design flow for this system was 700 GPD with a maximum BOD_5 of 1113 mg/L.

System Characteristics:

Hours
Weekdays & Weekends 24 hours

Type of service
Deli, Burgers, Fries, Soups

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Dishes are washed in the sink.

Tableware is disposable.

Gas Station / Mini Mart, WA-10-90-1012

System Performance:

(8 pod system treating the grey & blackwater flow)
(System has been in operation for 4 1/2 years)

INFLUENT - PUMP TANK AT STORE

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	653.9	267.4	93.2	30	6.6	15.1
Num. of Samples	52	25	28	28	28	17
High	1110*	685	368			

* - High Average

EFFLUENT - PUMP TANK TO MOUND

	BOD	TSS	O&G	pH	TEMP
Averages	41.6	22.0	9.3	7.3	13.1
Num. of Samples	27	29	22	29	20

BOD, TSS and O&G reported as mg/L

Percent Reductions	84	76	69		

Special Notes:

Nibbler system is followed by a mound

Recommended design:

Total Flow Based on this information this system should be designed to handle 800 GPD with a maximum BOD5 of 400 mg/L.

Gas Station / Mini Mart, OR-11-91-1028

Basis for design:

The design was based on two waste strength samples and a comparison to similar facilities. The design flow for this system was 597 GPD with a maximum BOD_5 of 550 mg/L.

System Characteristics:

Hours

M-Th	4am-11pm
Fri.	4am-midnight
Sat.	5am-midnight
Sun.	6am-10pm

Type of service

Deli, Burgers, Fries,

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Dishes are washed in the sink.

Tableware is disposable.

Gas Station / Mini Mart, OR-11-91-1028

System Performance:

(8 pod system treating the grey & blackwater flow)
(This system has been in operation for 3 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	519.5	411	86	27	7.1	15.4
Num. of Samples	17	7	7	7	7	7
High	616*	670	144	52.4		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	35.3	13.2	4.3	7.5	14.8
Num. of Samples	14	14	14	14	14

BOD, TSS and O&G reported as mg/L

Percent Reduction	91	85	84		

Special Notes:

Recommended Design:

Grey & Black water flow

Based on this information , we recommend design parameters of 600 GPD with a maximum BOD5 of 600 mg/L, for a similar facility.

Gas Station / Mini Mart, OR-6-92-1058

Basis for design:

The design was based on two waste strength samples and a comparison to similar facilities. The design flow for this system was 500 GPD with a maximum BOD_5 of 1100 mg/L.

System Characteristics:

Hours
Weekdays & Weekends 24 hrs.

Type of service
Burgers, Fries, Brooster

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	N/A

Dishes are washed in the sink.

Tableware is disposable.

Gas Station / Mini Mart, OR-6-92-1058

System Performance:

(8 pod system treating the grey & blackwater flow)
(System has been in operation for 2 1/2 years)

	NIB GPD	NIBBLER INFLUENT (SURGE TANK TO NIBBLER) BOD	TSS	O&G	pH	TEMP
Averages	526.2	221.3	67.5	15.9	6.9	25.8
Num. of Samples	18	4	4	4	4	4
High	738*	302	103	20.3		

* - High Average

	NIBBLER EFFLUENT (PUMP TANK TO DRAINFIELD) BOD	TSS	O&G	pH	TEMP
Averages	24.0	17.0	6.5	7.6	18.8
Num. of Samples	12	12	12	12	12

BOD, TSS and O&G reported as mg/L

Percent Reductions	89	75	59

Special Notes:

None

Recommended Design:

Total Flow Based on this data this system should be designed to handle 700 GPD with a maximum BOD5 of 300 mg/L

Gas Station / Mini Mart, WA-10-91-1027

Basis for design:

The design was based on two waste strength samples and a comparison to similar facilities. The design flow for this system was 500 GPD with a maximum BOD_5 of 1100 mg/L.

System Characteristics:

Hours
Weekdays & Weekends from 5:00 am to 11:00 pm

Type of service
Deli, Soups

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine'?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Dishes are washed in the sink. Dishes are rinsed in a continuous flow of water.

Tableware is disposable.

Gas Station / Mini Mart, WA-10-91-1027

System Performance:

(8 pod system treating the grey & blackwater flow)
(System has been in operation for 3 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	234.3	415.0	53.2	25.3	6.8	14.9
Num. of Samples	17	8	8	8	8	8
High	378*	635	84.2	35.1		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP
Averages	22.4	24.0	6.2	7.0	13.2
Num. of Samples	15	15	15	16	16

BOD, TSS and O&G reported as mg/L

Percent Reductions	95	55	75

Special Notes:

None

Recommended Design:

Grey & Black water flow

Based on this information this system should be desgned to handle 400 GPD with a maximum BOD5 of 600 mg/L.

Gas Station / Mini Mart, WA-3-92-1047

Basis for design:

The design was based on a comparision to similar facilities. The design flow for this system was 562 GPD with a maximum BOD_5 of 1000 mg/L.

System Characteristics:

Hours
Weekdays & Weekends 24 hour per day

Type of service
Deli, Burgers, Fries, Soups

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Dishes are washed in the sink.

Tableware is disposable.

Gas Station / Mini Mart, WA-3-92-1047

System Performance:

(8 Pod System treating the Grey & Blackwater flows)
(This system has been in operation for 2 1/2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	588.7	219.5	47.0	23.5	7.1	21.5
Num. of Samples	14	4	4	4	4	4
High	1023*	318	85.8	39.1		

* - High Average

NIBBLER EFFLEUNT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	65.2	63.0	15.8	7.6	17.7
Num. of Samples	11	11	11	11	11

BOD, TSS and O&G reported as mg/L

Percent Reductions	70	-34	33

Special Notes:

None

Recommended Design:

Grey & Black water flow — Based on this data this system should be designed to handle 700 GPD with a maximum BOD5 of 350 mg/L.

Gas Station / Mini Mart, WA-4-94-1130

Basis for design:

The design was based on water meter readings from this facility and BOD_5, TSS and O&G data from several other similar facilities. The design flow for this system was 700 GPD with a maximum BOD_5 of 1114 mg/L.

Hours

Open 7 days per week from 5:30 am to 10:00 pm

Type of service

This facility has a Deli.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is disposable

Dishes are done by hand in the sink.

Gas Station / Mini Mart, WA-4-94-1130

System Performance:

(8 pod system treating the grey & blackwater flow)
(This system has been in operation for 6 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	367.0	716.7	97.0	67.9	6.1	21.0
Num. of Samples	6	3	3	3	3	3
High	463*	900	107	70.1		

* - High Average

NIBBLER EFFLUENT
(PUMP CHAMBER TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP
Averages	51.5	64.3	5.3	7.8	21.2
Num. of Samples	5	5	5	5	5

BOD, TSS and O&G reported as mg/L

Percent Reductions	93	34	92

Special Notes:

This is a fairly BOD5 for a Mini Mart.

Recommended design:

Grey & Black water flows

Based on this data this system should be designed to handle 500 GPD with a maximum BOD5 of 900.

Mini Malls

Mini Mall / Grocery, WA-3-93-1094

Basis for Design:

The information used for the design flow volume was not available. The waste strength was based on a single sample collected from the existing system. The design flow for this system was 3000 GPD with a maximum BOD_5 of 780 mg/L.

System Characteristics:

Hours
N/A

The grocery store has produce and meat cutting areas.

Other stores include a small cafe, flower shop and carpet store.

Does this facility have a salad bar?	N/A
Does this facility have a deep fat fryer?	N/A
Does this facility have an ice cream or yogurt machine?	N/A
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	N/A
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	N/A

Mini Mall / Grocery, WA-3-93-1094

System Performance:

(24 pod Nibbler system treating a grocery, cafe, flower shop and carpet store (Grey & Blackwater flows))
(This system has been in operation for 1 1/2 years)

NIBBLER INFLUENT
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	2314	459	124	79.7	6.3	18.8
Num. of Samples	14	8	8	8	8	8
High	3726*	604	227	163		

* - High average

NIBBLER EFFLUENT
(CLARIFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	50	54	8.4	7.6	19.6
Num. of Samples	12	12	12	12	12

BOD, TSS and O&G reported as mg/L

Percent Reductions	89	56	89

Special Notes:

None

Recommended design:

Grey & Black water flows

Based on this data this system should be designed to handle 3000 GPD with a maximum BOD5 of 600 mg/L.

Mini Mall / Supermarket / Fast Food Rest, WA-7-94-1150-1160

Basis for Design:

See the following sheets for Fast food rest & Supermarket. The other businesses at this site (retail space) were sized for 8.0 gallons per 100 sq ft. A bank at this site was sized at 6 employees @ 20 GPCD plus a safety factor of 100 GPD. The total Nibbler design flow is 7000 GPD with a maximum BOD5 of 1115 mg/L. The retail flows will only be treated by the Nibbler if the flows from the supermarket and fast food restaurants stay under their respective design parameters. The re-circulating sand filter is designed to handle the flow from the Nibbler units and the retail space.

System Characteristics:

Hours

Varies by business

The following sheets outline the relevant information from the supermarket and the fast food restaurant.

Mini Mall / Supermarket / Fast Food Rest., WA-7-94-1150 - 1160

System Performance:

(80 pod Nibbler system serving a large supermarket, fast food restaurant and several small businesses. This data represents the effluent after polishing by a re-circulating gravel filter)

CO-MINGLE PUMP TANK
(EFFLUENT FROM RECIRC. FILTER TO MOUNDS)

	TOTAL GPD	BOD	TSS	O&G	pH	TEMP
Averages	2981	14.6	10.7	3.5	7.2	19.3
Num. of Samples	5	3	3	3	3	3
High	3470*	19.5	24	5.1		

* - High average

BOD, TSS and O&G reported as mg/L

Special Note:

This data represents the effluent from the fast food restaurant and supermarket after treatment by the Nibbler and a recirculating sand filter.

This is a very small data base and may not be truely representative of the flows expected from this complex.

Supermarket, WA-7-94-1150

Basis For Design:

This system design was based on flow volumes and waste strength data from simular facilities. The design flow for this system was 3500 GPD with a maximum BOD_5 of 1115 mg/L.

Types of Service

The building is 50,000 sqft

Deli, Meat cutting, Produce & Bakery

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	N/A
Does this facility have an ice cream or yogurt machine?	N/A
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system? Two ice machines.	YES

Supermarket, WA-7-94-1150

System Performance:

(40 pod system treating the greywater flows from supermarket)
(This system has been in operation for 4 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1250	1860	251	86.7	4.87	23
Num. of Samples	5	1	1	1	1	1
High	2540*					

* - High average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	33.2	21.0	2.6	7.9	21.3
Num. of Samples	2	3	3	3	3

BOD, TSS and O&G reported as mg/L

Percent Reduction	98	92	97

Special Notes:

This facility has just opened and this data may not be representative of a large supermarket doing a good business.

Recommended design:

Greywater

This system is just getting started and may not represent the true flows for this facility. Therefore we do not recommend designing a system based on this data. Recommend using other comparative data.

Blackwater

No data available. The BOD5 for a blackwater flow is generally 200 to 250 mg/L. This can vary with low flush fixtures.

Restaurant / Fast Food, WA-7-94-1155

Basis for design:

This system design was based on estimates for simular facilities. At the time of this design the type of fast food restaurant which would occupy this site was not known. The design flow for this system was 3500 GPD with a maximum BOD5 of 1115 mg/L.

System Characteristics:

Hours
Weekdays & Weekends from 6:00 am to 11:00 pm

Seating (capacity)
Total Seating 56

Average Number of Meals Served Per Day
Weekdays 646 Friday N/A Saturday N/A Sunday N/A

The primary cuisine is american fast food; burgers, fries, sodas etc.

This facility serves breakfast, lunch and dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow bathroom fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system.	NO

Tableware is disposable.

Dishes are washed by hand in a sink.

Restaurant / Fast Food, WA-7-94-1155

System Performance:

(40 pod Nibbler system treating the blackwater and greywater flows from the fast food and some of the blackwater from the supermarket)
(This system has been in operation for 2 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1749	676	96.9	36.5	5.9	21
Num. of Samples	5	2	2	2	2	2
High	2393*	1028.0	97.0	27.0		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	47.2	25	11.5	7.5	20.7
Num. of Samples	3	3	3	3	3

BOD, TSS and O&G reported as mg/L

Percent Reduction	93	74	68

Special Notes:

This system was sized to handle the greywater and blackwater flow from a popular fast food restaurant.

Recommended design:

This system is just getting started and may not represent the true flows for this type of facility. Therefore we do not recommend designing a system based on this data. Recommend using other comparative data.

Mini Mall, WA-6-88-1008

Basis for Design:

The design flow volume and waste strength for this facility was estimated by comparing to similar facilities. The design flow for this system was 702 GPD with a maximum BOD_5 of 2000 mg/L.

System Characteristics:

Hours

Seven days a week from 11 am to Midnight

This site has a mini mart / gas station, restaurant and hairdresser.

This facility is a full service restaurant. The menu is primarily Mexican.

Total Seating 75

Average Number Of Meals Served Per Day N/A

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

Dishwasher is hot water rinse (180°).

Mini Mall, WA-6-88-1008

System Performance:

(18 pod system treating the Grey & Blackwater flow)
(This system has been in operation for 6 years)

NIBBLER INFLUENT
(PUMP TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	208	372	92.2	29.3	6.4	18.0
Num. of Samples	60	47	52	47	51	41
High	411*	652	395	102		

* - High Average

3RD UNIT EFFLUENT
(EFFLUENT TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP
Averages	13.8	10.2	13.0	8.3	17.3
Num. of Samples	47	52	38	54	45

BOD, TSS and O&G reported as mg/L

Percent Reductions	96	89	56

Special Notes:

This system was a prototype with, three - 6 pod - 1000 gallon Nibbler units which are set up to operate in series. The 3rd unit effluent sample represents the flow in the third unit.

The restaurant at this mall has not been open for most of the life of this system.

Recommended Design:

Grey & Black water flow Based on this data this system should be sized to handle 400 GPD with a maximum BOD5 of 500 mg/L.

Industrial

Industrial / Egg Processor, WA-6-92-1059

Basis for design:

Original water meter readings showed a water use of approximately 16,000 GPD. Two system samples were collected and revealed a BOD_5 of 2400 mg/L and 4322 mg/L. This would have required a Nibbler system with between 395 and 580 pods which would have been cost prohibitive. It was decided to cut back on water usage, improve the operational practices and attempt to treat the flows with an 80 pod system. The design flow for this system was 3500 GPD with a maximum BOD_5 of 2226 mg/L.

System Characteristics:

Days/Hours of operation
Open for processing 5 - days per week, from 5:30 am to 4:30 pm

15 - employees

This is an egg processing facility, eggs are broken and the egg whites and yolks are separated and packaged. Waste water is generated in the general clean-up and sanitation of the facility and the process components.

Water usage can fluctuate with the egg market.

Industrial / Egg Processor, WA-6-92-1059

System Performance:

(80 pod system treating facility waste water)
(This system has been in operation for 2 1/2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Average	3169	4204	1338	1529	6.8	21
Num. of samples	78	50	50	27	50	50
High	4057*	7575	3597	7853		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Average	1213	1089	217	7.8	18
Num. of Samples	57	57	36	57	57

BOD, TSS and O&G reported as mg/L

Percent Reductions	71	19	86

Special Notes:

This system is severely under-designed and requires an additional five to ten Nibbler units to reduce this waste strength to residential levels. At the present this system is removing approximatly 80 pounds of BOD5 per day.

Recommended design:

Total Flow: Based on this information this system should be designed to handle 4000 GPD with a maximum BOD5 of 4500 mg/L.

Misc. Businesses

Business / Camp - WA-5-91-1019

Basis for design:

EPA manual Table 4-8. The system was designed to handle 244 campers and 116 staff and guests. The total design flows were negotiated down from 17,060 GPD to 13,910 GPD. The greywater flows were negotiated down from 8568 GPD to 6009 GPD. The design flow for this system was 6009 GPD with a maximum BOD_5 of 550 mg/L.

System Characteristics:

Hours - 24 during camp

Number of Guests or Campers
Capacity - 325
Ave. Occupancy (In-Season) - 275

Number of Staff
In-Season - 55
Off-Season - 7

Type of Facilities
Showers, Cafeteria, Laundry (10 machines)

Cafeteria Seating N/A

Average Number of Meals Served Per Day
Weekdays - 250 Friday - 250 Saturday - 250 Sunday - 250

Misc. Data

Food is prepared at this facility.

Dishes are done at this facility.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	YES
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is Standard & Disposable

Dishwasher is Chemical Rinse (140°)

All showers and sinks are rated as low flow.

Facilities include; Dinning Hall, Laundry, Pool/Gym, Concessions, 12 - A-frames, 4 - Bathhouses, 10 Misc. residences, & 34 - RV sites.

Business / Camp, WA-5-91-1019

System Performance:

(32 pod Nibbler system treating the greywater only)
(This system has been in operation for 3 1/2 years)

	IN-SEASON GREYWATER FLOW	DINING HALL GREYWATER (NIBBLER INFLUENT)				
	GPD	**BOD**	**TSS**	**O&G**	**pH**	**TEMP**
Averages	1789.2	184.5	47.4	25.5	7.5	22.2
Num. of Samples	13	4	4	4	5	5
High	2809*	284.0	71.5	52.1		

* - High average

	NIBBLER EFFLUENT (PUMP CHAMBER INFLUENT)				
	BOD	**TSS**	**O&G**	**pH**	**TEMP**
Averages	10.8	5.5	7.0	7.6	20.0
Num. of Samples	4	4	4	6	6

BOD, TSS and O&G reported as mg/L

Percent Reductions	94	88	73

	TOTAL FLOW	CO-MINGLE EFFLUENT (EFFLUENT TO DRAINFIELD)				
	GPD	**BOD**	**TSS**	**O&G**	**pH**	**TEMP**
Averages	4602.1	53.4	22.8	6.7	7.8	18.8
Num. of Samples	15	9	9	9	9	9
High Average	6938					

Special Note:

This system was originally designed "by code" to handle 13,910 GPD or 38.6 GPCD. This facility actually produces a total flow of approximatly 4600 GPD (13.9 GPCD) with a peak In-season average of 6938 GPD (21 GPCD).

Recommended design:

Greywater Based on this data this system should be designed to handle 3000 GPD greywater with a maximum BOD5 of 300 mg/L.

Grey & Black water flows: Based on this data this system should be designed to handle 7000 GPD grey & black water with a maximum BOD5 of 200 mg/L.

Senior Center, WA-10-92-1080

Basis for design:

The flows for this system were based on water meter readings and comparisons to similar facilities. This facility is a meeting place for seniors. Lunch is served 4 times a week to about 40 - 60 and dinner about once a month. The design flow for this system was 585 GPD with a maximum BOD_5 of 1350 mg/L.

System Characteristics:

Hours - 8:30 am to 4:30 pm M-F, Some Weekends

Number of Guests
Capacity - 250
Ave. Occupancy (In-Season) - 50

Number of Staff
In-Season - 12 (There is only one full time employee.)
Off-Season - 7

Type of Facilities
Cafeteria, Laundry (1 machine)

Cafeteria Seating 150

Average Number of Meals Served Per Day
Weekdays - 30 Friday - 15 Saturday - 0 Sunday - 0

Misc. Data

This is a meeting place which serves lunch. The menu varies.

Is food prepared at this facility?	YES
Are dishes done at this facility.	YES
Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room during the summer months.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a chemical rinse (140°) unit.

Senior Center, WA-10-92-1080

System Performance:

(8 pod system treating the grey & blackwater flow)
(This system has been in operation for 8 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	157.9	238.3	155.3	35.9	7.4	16.7
Num. of Samples	8	6	6	6	6	6
High	196*	325	340	93		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	16.6	10.8	5.0	7.4	16.0
Num. of Samples	8	8	8	8	8

BOD, TSS and O&G reported as mg/L

Percent Reductions	93	93	86		

Special Notes:

none

Recommended Design:

Grey & Black water flow

Based on this data this system should be designed to handle 300 GPD with a maximum BOD5 of 500 mg/L.

WA-4-94-1133	•	Mt. View Diner - Gold Bar, WA	47	Restuarant
OR-2-94-1126	•	My Place Tavern - Dexter, OR	48	Restuarant
OR-3-92-1045	•	Oasis Rest. - Milton-Freewater, OR	49	Restuarant
~~OR-5-93-EXP1~~	~~•~~	~~ODOC--South Fork Prison Camp--Tillicum, OR~~	~~50~~	~~Camp~~
BC-2-94-1125	•	Olde Mill Rest. - Victoria, BC Canada	51	Restaurant
OR-4-92-1048	•	Oregon Golf Club - West Linn, OR	52	Golf Course
WA-10-92-1078	•	Oyster Creek Inn, Bow, WA	53	Restaurant
WA-12-93-1121	•	Pat's Little Red Barn - Belfair, WA	54	Restaurant
~~WA-9-94-1121~~		~~Pleasant Beach Grill--Bainbridge Island, WA~~	~~55~~	~~Restaurant~~
~~WA-5-93-1098~~	~~•~~	~~Preston Retail Center--Preston, WA~~	~~56~~	~~Mini Mall~~
OR-5-93-1104	•	Pumpkin Ridge GC (Witch) - Cornelius, OR	57	Golf Course
OR-5-92-1055	•	Pumpkin Ridge GC (Ghost) - Cornelius, OR	58	Golf Course
OR-9-92-1071	•	Safeway #521 - Damascus, OR	59	Supermarket
WA-4-92-1030	•	Safeway #522 - Puyallup, WA	60	Supermarket
WA-5-94-1142	•	Safeway #547 - Graham, WA	61	Supermarket
~~ID-9-93-1112~~	~~•~~	~~Seattle Ridge Lodge--Sun Valley, ID~~	~~62~~	~~Restaurant~~
WA-3-94-1128	•	Seven Lakes Tavern - Stanwood, WA	63	Restaurant
WA-10-92-1080	•	Sno Valley Seniors - Carnation, WA	64	Camp
WA-3-91-1014	•	Stockmarket Foods - Belfair, WA	65	Supermarket
WA-3-94-1127	•	Subway - Belfair, WA	66	Fast Food
~~WA-5-94-1136~~	~~•~~	~~Summit Grocery--Puyallup, WA~~	~~67~~	~~Supermarket~~
~~WA-9-94-1123~~		~~Course @ Taylor Creek--Maple Valley, WA~~	~~68~~	~~Golf Course~~
WA-4-94-1130	•	Texaco - Woodinville, WA	69	Mini Mart
WA-10-92-1083	•	Thumbo's Rest. - Lake Stevens, WA	70	Fast Food
WA-5-88-1004	•	Tolt Towne Center - Carnation, WA	71	Mini Mall
~~WA-10-92-1085~~	~~•~~	~~Victoria's at Robinhood--Union, WA~~	~~72~~	~~Restaurant~~
WA-5-94-1118	•	Zeke'sDrive Inn - Gold Bar, WA	73	Fast Food
		NON - NIBBLER		
~~WA-NON-001~~	~~•~~	~~Pheasant Ridge RV Park--Wilsonville, OR~~	~~74~~	~~RV Park~~
~~WA-NON-002~~	~~•~~	~~Tolt SR & JR High School--Carnation, WA~~	~~75~~	~~School~~
~~WA-NON-003~~	~~•~~	~~Swinomish Bingo Hall--Anacortes, WA~~	~~76~~	~~Restaurant~~
~~WA-NON-004~~	~~•~~	~~Stillwater Elem. School--Carnation, WA~~	~~77~~	~~School~~
~~WA-NON-005~~	~~•~~	~~Preston Industrial Park--Preston, WA~~	~~78~~	~~Industrial~~
~~WA-NON-006~~	~~•~~	~~Leisure Time Resort--Snoqualmie, WA~~	~~79~~	~~Camp~~
~~WA-NON-007~~	~~•~~	~~Laurel Hills Home Owners Asso. - Woodinville, WA~~	~~80~~	~~Residential~~
WA-NON-008	•	Ken's Truck Town - North Bend, WA	81	~~Showers~~
~~WA-NON-009~~	~~•~~	~~Denny's Rest. - Fife, WA~~	~~82~~	~~Restaurant~~
WA-NON-010	•	Casetta Lago Shopping Center - Redmond, Wa	83	Mini Mall
~~WA-NON-011~~	~~•~~	~~Bethel Chapel - Fedral Way, WA~~	~~84~~	~~Church~~
WA-NON-012	•	Country Corner Inn - Anacortes, WA	85	Restaurant
WA-NON-013	•	Clearview Plaza - Disposal System - Snohomish, WA	86	Shopping Center
DB - In Data Base	•			

Using The Data Base

This data base represents 8 years of monitoring conducted by Aqua Test Inc. This information is provided as a guide to assist you in designing commercial wastewater treatment systems. All of the facilities are existing and monitoring of these facilities continues. As more data is collected this data base will be expanded. Our intent is to update this base once every two years. The following information is provided to assist you in using this information.

The **Basis for design** is a short summary of the information used to size the original system at this site. In some cases this information was not available. Also under the basis for design are the design flow volumes and waste strength. This may or may not represent the recommended design. Since a standard Nibbler unit has 8 pods, the biological capacity of each unit is 6.5 pounds. Therefore the design BOD_5 may not reflect the expected BOD_5 for this type of facility. An example of this is a Mini Mart which is expected to have a flow of 500 GPD and a waste strength of 500 mg/L. The design flow may show 500 GPD with a BOD_5 of 1558 mg/L, which computes to a 6.5 lb/day.

The basis of design is to show you what this system has, not to recommend a design. That information is given later under Recommended Design.

The **System Characteristics** section is an outline of the existing system. The intent here is to give you the information which will most effect the waste flow volume and strength at that type of facility. This information varies with each facility and is very important to your design.

Under **System Performance** you will find the number of pods in each system. Each pod is capable of handling 0.81 pounds of BOD_5 per day. Most of the Nibbler units contain 8 pods, however, this does change.
When more than one Nibbler is used they are generally plumbed in parallel, however, a few units are plumbed in series to provide additional treatment. This is done when regulatory or site conditions require additional treatment prior to discharge to the soil/environment. Other options for additional treatment include Intermittent Sand Filters (ISF), Re-circulating Gravel Filters (RGF), and various proprietary devices.

The time frame on each system varies. The oldest system is WA-1-86-PROTO this system has been in operation for 8 years. Under the system performance you will find the age of the system you are looking at.

The **Percent Reductions** represent the average data presented.

The **Recommended Design** is a sizing guideline for the data presented. This can vary based on the individual characteristics of the system you are working on.

Averages	Data has been collected over the life of the system. Site visits were conducted at intervals from two weeks to three months. Data was collected during the site visits and used to calculate the average water usage (GPD) since the last site visit. This information was then averaged over the life of the system to provide the average GPD you see in the table. The average BOD_5, TSS, O&G, pH, and Temperature represent grab samples collected during the site visits. The results of this analysis are averaged over the life of the system to produce the average in the table.
• **High**	The high GPD is the highest individual **average** flow recorded. It is important to remember that this is an average and does not represent a peak flow. The high BOD_5, TSS, O&G, pH and Temperature represents the highest individual sample collected during the site visits. This may or may not represent the peak concentration.
Blackwater	Represents flows from bathroom fixtures (sink, toilets and urinals)
BOD_5	**B**iochemical **O**xygen **D**emand over a five day test period. This is presented in mg/L (parts per million - ppm).
Double Pass	A double pass system is one which has the Nibbler units plumbed so that the flow passes through two units in series before discharging to the clarifier.
Graywater	Graywater represents the flows from sources other than bathroom fixtures
GPD	**G**allons **P**er **D**ay
GPCD	**G**allons **P**er **C**apita **D**ay (gallons per person per day)
Num. of samples	Number of samples or readings recorded
N/A	**N**ot **A**vailable
O&G	**O**il and **G**rease measured in mg/L (parts per million).
RGF	**R**ecirculating **G**ravel **F**ilter
TSS	**T**otal **S**uspended **S**olids measured in mg/L (parts per million).

Restaurants

Full Service

Restaurant / Full Service, OR-7-94-1148

Basis for design:

This system design was based on two system effluent samples and a comparison to other similar systems. The design flow (black & greywater) for this system was 1050 GPD with a maximum BOD_5 of 750 mg/L.

System Characteristics:

Hours
Open seven days per week from 6:00 am to 9:00 pm

Seating (capacity) Total Seating 65, Dining 45, Banquet 20

Average Number of Meals Served Per Day
Weekdays 40 - 50 Friday 90 Saturday 90 Sunday 90

This is a full service restaurant with an American menu?

This facility serves breakfast, lunch and dinner?

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a chemical rinse (140°).

Restaurant / Full Service, OR-7-94-1148

System Performance:

(16 pod Nibbler system treating the black & greywater flow)
(This system has been in operation for 6 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	560.3	260	127	29	6.90	22
Num. of Samples	4	1	1	1	1	1
High	602*					

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	28.7	10.0	3.6	7.8	20
Num. of Samples	5	5	5	5	2

BOD, TSS and O&G reported as mg/L

Percent Reductions	89	92	88

Special Notes:

This system is set-up to operate the two Nibblers in series or in parallel. This data represents The system running in the parallel configuration. This system had a sand filter which failed due to high waste strength and hydraulic overloading. The hydraulic overload is due to ground water infiltration. The sandfilter is currently disconnected but may be hooked back up at a later date.

The BOD5 influent sample may not be representaive. Only one sample has been collected from this site and it appears extreemly low. The BOD5 for this site should be closer to 1000 mg/L.

Recommended design:

Grey & Black water flows

Based on this data this system should be sized to handle 750 GPD with a maximum BOD5 of 1000 mg/L. However this system is in an area of clayey soils and high ground water. The Oregon state DEQ put a discharge limitation of 30 mg/l BOD5 on the system effluent. Therefore an additional Nibbler unit has been installed to act as a polishing unit. If necessary the sand filter unit may be restarted.

Restaurant / Full Service, WA-1-94-1124

Basis For design:

This design was based on water meter readings and two samples collected and analysed for BOD_5, TSS, and O&G. This information was then compared to other restaurants we had studied. The design flow for this system was 400 GPD with a maximum BOD_5 of 1949 mg/L.

System Characteristics:

Hours
Seven days per week from 7am to 9pm

Seating Total Seating - 80

Average Number of Meals Served Per Day
Weekdays - 100 Friday - 200 Saturday - 200 Sunday - 200

This facility is a full service restaurant which also includes self serve smorgasbord and take-out. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is Chemical Rinse (140°).

This facility is subject to seasonal changes.

Restaurant / Full Service, WA-1-94-1124

System Performance:

(8 pod Nibbler system treating the grey & blackwater flows)
(This system has been in operation for 9 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	505.9	1019	233.4	144.5	5.9	14.8
Num. of Samples	9	8	8	8	8	8
High	1009*	1200	507	345		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	133	146.5	20.5	7.6	13.4
Num. of Samples	8	8	8	8	8

BOD, TSS and O&G reported as mg/L

Percent Reduction	87	37	86

Special Note:

Based on the EPA manual this system would have been sized to handle 408 GPD.

Recommended Design:

Grey & Black water flows — Based on this data this system should be designed to handle 700 GPD with a maximum BOD5 of 1000 mg/L

Restaurant / Full Service, WA-7-93-1107

Basis For design:

This design was based on water meter readings. The total flows were split 70/30% to compensate for the Bed & Breakfast and blackwater flows. This information was then compared to other restaurants we had studied. The design flow for this system was 790 GPD with a maximum BOD_5 of 990 mg/L.

System Characteristics:

Hours

Seven days per week from 7 am to 9 pm

Seating Total Seating - 75 Dinning - 50 Lounge - 25

Average Number of Meals Served Per Day

Weekdays - N/A Friday - N/A Saturday - N/A Sunday - N/A

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Full Service, WA-7-93-1107

System Performance:

(8 pod system treating the restaurant greywater only)
(This system has been in operation for 1 year)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	390.7	566	131.1	83.3	5.6	16.7
Num. of Samples	10	7	7	7	7	7
High	755*	770	226	122		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	81.7	57.1	22.3	7.2	13.4
Num. of Samples	9	9	9	9	9

BOD, TSS and O&G reported as mg/L

Percent Reductions	86	56	73		

Special Notes:

System treats the greywater only. This facility also has a bed & breakfast and a cabin which are not on the Nibbler system and are not represented in this data base.

Recommended Design:

Greywater Based on this data this system should be designed to handle 500 GPD with a maximum BOD5 of 700 mg/L.

Blackwater No data available for the blackwater side of this system. The BOD5 for blackwater flows is generally around 200 to 250 mg/L. This can vary with low flush fixtures.

Restaurant / Full Service, WA-7-93-1108

Basis For design:

This design was based on water meter readings and two samples collected and analysed for BOD_5, TSS, and O&G. This information was then compared to other restaurants we had studied. The design flow for this system was 600 GPD with a maximum BOD_5 of 1298 mg/L.

System Characteristics:

Hours

Seven days per week 6am to 9pm, The bar stays open until 11:00 pm.

Seating Total Seating - 52 Dinning - 36 Lounge - 16

Average Number of Meals Served Per Day

Weekdays - 125 Friday - 150 Saturday - 150 Sunday - 125

This facility serves breakfast, lunch & dinner.

This is a full service restaurant with an American menu.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	YES
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is Chemical Rinse (140°).

This facility has an under-the-sink grease separator.

Restaurant / Full Service, WA-7-93-1108

System Performance:

(8 pod Nibbler system treating the grey & black water flows)
(This system has been in operation for 1 1/2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	604	1700	863	919	5.5	27
Num of Samples	18	13	13	13	14	14
High	719*	3375	3662	4972		

* - High Average

NIBBLER EFFLUENT
(1ST D-BOX EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	201	186	29	7.0	18
Num of Samples	17	17	17	17	17

BOD, TSS and O&G reported as mg/L

Percent Reduction	88	78	97		

Special Notes:

This system is under-designed and should have an additional Nibbler installed.

Recommended design:

Grey & Black water flows

Based on this information this system should be designed to handle 700 GPD with a maximum BOD5 of 2000 mg/L

Restaurant / Full Service, WA-9-91-1023

Basis for Design:

This design was based on cycle counts of the existing calibrated pump system and two samples which were analysed for BOD_5, TSS and O&G. The greywater side of this system was designed to handle 1300 GPD with a BOD_5 of 800 mg/L. The blackwater side of this system was previouisly existing.

System Characteristics:

Hours
Seven days a week, from 6 am to 9 pm.

Seating
Total Seating 125 Dining 75 Lounge(bar) 50
(capacity)

Average Number of Meals Served Per Day
Weekdays 175 Friday 275 Saturday 275 Sunday 275

This facility is a full service restaurant. The menu isAmerican.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from just using the restroom.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

The kitchen crew makes an effort to scrape and wipe all of the dishes prior to washing and the dishewasher is only run with a full load.

Restaurant / Full Service, WA-9-91-1023

System Performance:

(16 pod system treating the grey & blackwater flows)
(This system has been in operation for 3 years)

INFLUENT TO NIBBLER
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP°C
Averages	720.2	1053.2	209.9	244.8	5.6	20.4
Num. of samples	29	9	9	9	9	9
High	1127*	1597	600	1717		

* - High Average

EFFLUENT FROM NIBBLER
(EFFLUENT TO PUMP TANK)

	BOD	TSS	O&G	pH	TEMP°C
Averages	168.9	100.6	18.4	7.3	17.5
Num. of samples	20	20	20	20	20

BOD, TSS and O&G reported as mg/L

Percent Reduction	84	52	92		

Special Notes:

This system prevoiusly had a mound which had failed on several occations. This system had an additional problem related to the distance the effluent was being transported to the drainfield. When effluent is transported a long distance directly to the drainfield or sand filter the transport pipe has a tendancy to act as a growth media. The biological growth which takes place on the interior of the pipe will slough off at times causing clogging in the drainfield/sandfilter orifices. This can be remedied by placing a tank at the drainfield. This problem is affected by waste strength, dose volume, transport distance and type of distribution.

Recommended design:

Greywater Based on this data this systen should be designed to handle 1100 GPD with a maximum BOD5 of 1100.

Blackwater Data not available. Blackwater generally has a BOD5 of approximately 200 to 250 mg/L.

Restaurant / Full Service, WA-2-92-1036

Basis for design:

This system design was based on an extensive review of the system, which included the installation of a small system which treated a portion of the flow. The design flow for this system was 5289 GPD with a maximum BOD_5 of 995 mg/L.

System Characteristics:

Hours

Open seven days per week from 7 am to 9:00 pm (M-F), 7 am to 10 pm (Sat & Sun)

Seating (capacity) Total Seating 340, Dining 200, Lounge 80, Banquet 60

Average Number of Meals Served Per Day

Weekdays 500 Friday 800-900 Saturday 1000 Sunday 1100

This is a full service restaurant, serving an American menu

This facility serves breakfast, lunch and dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard

Dishwasher is Chemical Rinse (140°).

Restaurant / Full Service, WA-2-92-1036

System Performance:

(80 pod system treating the greywater flow from the restaurant)
(This system has been in operation for 2 1/2 years.)

	GREYWATER FLOW	GREYWATER (NIBBLER INFLUENT)				
	GPD	**BOD**	**TSS**	**O&G**	**pH**	**TEMP**
Averages	5382	912.8	185.2	206.8	5.5	29.1
Num. of Samples	41	22	23	22	23	23
High	7321*	1800	774	378		

* - High average

	NIBBLER EFFLUENT (CLARIFIER)				
	BOD	**TSS**	**O&G**	**pH**	**TEMP**
Averages	118.1	94.9	15.7	7.5	24.8
Num. of Samples	7	8	7	8	8

BOD, TSS and O&G reported as mg/L

Percent Reduction	87	49	92

	FLOW TO MOUNDS	CO-MINGLE PUMP CHAMBER (EFFLUENT TO MOUNDS)				
	GPD	**BOD**	**TSS**	**O&G**	**pH**	**TEMP**
Averages	7904.1	125.8	86.6	12.7	7.5	21.9
Num. of Samples	17	14	15	14	15	14
High Average	9840					

Special Notes:

This system design was produced by putting in a partial system to monitor the flows.
Prior to installing the Nibbler system the facility had a failure of a mound and a Rock/Marsh filter.

Recommended design:

Greywater Based on this data this system should be deigned to handle 6500 GPD with a maximum BOD5 of1200 mg/L.

Blackwater Based on the flow data available for this system the blackwater system should be designed to handle 2500 GPD. Blackwater BOD5 is generally around 250 mg/L.

Restaurant / Full Service, WA-4-88-1003

Basis for design:

This system design was based on water meter reading from this facility and waste strength data from similar facilities. This system was designed to handle 350 GPD with a maximum BOD_5 of 2000 mg/L.

System Characteristics:

Hours
Open seven days per week from 6 am to 11:00 pm

Seating (capacity)
Total Seating 75, Dining 55, Lounge 20

Average Number of Meals Served Per Day
Weekdays 75 Friday 95 Saturday 150 Sunday 150

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Full Service, WA-4-88-1003

System Performance:

(8 pod system treating the greywater only)
(System has been in operation for 6 1/2 years)

NIBBLER INFLUENT
(PUMP TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	297.9	2470.3	1309.3	1170.8	4.9	25.5
Num. of Samples	111	82	92	87	89	82
High	491*	6085	13,928	7398		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT TO CO-MINGLE PUMP TANK)

	BOD	TSS	O&G	pH	TEMP
Averages	191.7	146.1	24.6	7.1	19.5
Num. of Samples	102	110	92	106	109

BOD, TSS and O&G reported as mg/L

Percent Reduction	92	89	98		

Special Note:

This facility has changed hands 6 times since the installation of the Nibbler system. Despite this fact, the waste strength has remained high and the flow volumes remain low.

Recommended design:

Greywater Based on this information, we recommend design parameters of 450 GPD with a maximum BOD5 of 2500 mg/L, for a similar facility.

Blackwater Blackwater flow volume information, collected on one occasion, indicates a 60% - 40% split (Black/Grey). No samples of the blackwater from this system have been analyzed. Based on the information available, the blackwater flow is expected to be approximately 600 GPD with a BOD5 of 200 mg/L.

Restaurant / Full Service, WA-10-92-1081

Basis for design:

This system design was based on water meter reading from this facility and waste strength data from similar facilities. The design flow for this system was 1150 GPD with a maximum BOD_5 of 1355 mg/L.

System Characteristics:

Hours
Open seven days per week from 6 am to 12 pm

Seating (capacity) Total Seating 88. Dining 62. Lounge 26

Average Number of Meals Served Per Day
Weekdays N/A Friday N/A Saturday N/A Sunday N/A

This facility is a full service restaurant. The menu is primarily American (Steak House).

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is chemical rinse (140°).

Restaurant / Full Service, WA-10-92-1081

System Performance:

(16 pod system treating the grey & black flow)
(System has been in operation for 2 years)

INFLUENT TO NIBBLER
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	875.8	921.0	260.1	135.1	5.6	16.7
Num. of Samples	19	9	9	9	10	10
High	1082*	1226	883	343		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER INFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	106.1	105.7	13.1	7.4	15.9
Num. of Samples	14	14	14	15	15

BOD, TSS and O&G reported as mg/L

Percent Reductions	88	59	90		

Special Notes:

None

Recommended Design:

Grey & black water flow

Based on this information this system should be designed to handle 1100 GPD with a maximum BOD5 of 1200 mg/L.

Restaurant / Full Service, WA-11-89-1011

Basis for design:

This system design for the greywater side of the system was based on calculations which factored in; dishwasher cycles vs gallons per cycle, Pan washing at 200 gal/48hr., for an estimate of 354 GPD. The flows for the blackwater side of the system were not calculated. The design flow for this system was 700 GPD with a maximum BOD_5 of 1100 mg/L.

System Characteristics:

Hours

Open seven days per week from 7 am to 9 pm

Seating (capacity) Total Seating 150, Dining 80, Lounge 30, Banquet 40

Average Number of Meals Served Per Day

Weekdays 50 Friday 100 Saturday 100 Sunday 100

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES (dishwasher)
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

The dishwasher is a Chemical rinse (140°).

Restaurant / Full Service, 11-89-1011

System Performance:

(8 pods treating the greywater and part of the blackwater)
(This system has been in operation for 5 years)

INFLUENT TO NIBBLER

	GPD	BOD	TSS	O&G	pH	TEMP °C
Averages	701	1126.2	493.6	107.4	6.0	19.1
Num. of Samples	33	21	22	20	24	19
High	1790*	2,850	1,725	448		

* - High Average

NIBBLER EFFLUENT

	BOD	TSS	O&G	pH	TEMP °C
Averages	115.2	62.0	17.2	7.3	17.8
Num. of Samples	31	31	30	31	27

BOD, TSS and O&G reported as mg/L

Percent Reductions	90	87	84

Special Notes:

This system treats the entire greywater flow and portion of the black water flow. The percentage of blackwater being treated varied.

This system was sized prior to the development of the .81 pound per day per pod loading standard.

Recommended Design:

Greywater Based on this data this system should be designed to handle 800 GPD with a maximum BOD5 of 1500 mg/L

Restaurant / Full Service, WA-1-86-PROTO

Basis for design:

This system design was based on a review of the system. The design flow for this system was 468 GPD with a maximum BOD_5 of 2000 mg/L.

System Characteristics:

Hours
Open seven days per week 24 hours per day

Seating (capacity) Total Seating 204, Dining 170, Lounge 34

Average Number of Meals Served Per Day
Weekdays 900 Friday 1500 Saturday 1500 Sunday 1500

This is a full service restaurant with a buffet. The menu is American.

This facility serves breakfast, lunch and dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using the bathroom.	YES
Does this facility have low flow fixtures?	N/A
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Full Service, WA-1-86-PROTO

System Performance:

(12 pod system treating the greywater only)
(This system, which has been in operation for 8 years, was the first prototype.)

INFLUENT

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	768	1212	515.7	303.0	5.1	31.0
Num. of Samples	79	65	68	68	63	51
High	3045*	2537	2832	1854		

* - High Average

	BOD	TSS	O&G	pH	TEMP
Averages	34.4	30.9	7.1	7.3	16.3
Num. of Samples	13	15	15	15	14

BOD, TSS and O&G reported as mg/L

Percent Reductions	97	94	98

Special Notes:

This was the first unit installed.

Recommended Design:

Greywater Based on this data this system should be designed to handle 1000 GPD with a maximum BOD5 of 1500

Blackwater The blackwater flow at this facility averaged 2115 GPD with an average BOD5 of 217 mg/L. Based on this information this system should be sized to handle 2500 GPD with an average BOD5 of 250 mg/L.

Restaurant / Full Service w/ Bar, OR-2-93-1091

Basis for design:

This system design was based on water meter readings from this facility one waste strength sample taken from this facility and waste strength data from similar facilities. This system is designed to handle 1150 GPD with a maximum BOD_5 of 767 mg/L.

System Characteristics:

Hours
Open seven days per week from 11 am to 10:00 pm

Seating (capacity) Total Seating 85, Dining N/A, Lounge N/A

Average Number of Meals Served Per Day
Weekdays 150 Friday N/A Saturday N/A Sunday N/A

This is a full service restaurant, serving an American menu (Steak House).

This facility serves lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard

Dishwasher is Chemical Rinse (140°).
A de-greaser is used.

Restaurant / Full Service w/Bar, OR-2-93-1091

System Performance:

(16 pod system treating the greywater and part of the blackwater flow)
(This system has been in operation for 1 1/2 years)

GREYWATER INFLUENT (SURGE TANK EFFLEUNT)

	NIB GPD	SF GPD	BOD	TSS	O&G	pH	TEMP
Averages	1221	1219	829.9	484.5	379.4	6.0	20.9
Num. of Samples	19	19	9	9	9	9	9
High	1825*		1760	1892	1215		

* - High Average

NIBBLER EFFLUENT (CLARIFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	84.7	65.8	4.0	7.6	17.5
Sample Points	9	9	9	9	8

BOD, TSS and O&G reported as mg/L

Percent reductions	90	86	99		

DISPOSAL FIELD INFLUENT (SAND FILTER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	12	17.2	4.0	6.4	15.0
Num. of Samples	6	6	6	6	6

Special Notes:

This system is designed to handle the greywater flows for this facility. The system is plumbed so that the flows from both the blackwater and the greywater can be directed through the Nibbler system. This system had all or most of the blackwater flows diverted through the Nibbler during this time frame. This sytem is followed by a sand filter which treats the total flow prior to discharge in the drainfield.

Recommended Design:

Grey & Black water flow Based on this data this system should be designed to handle 1500 GPD with a maximum waste strength of 1000 mg/L

Restaurant / Visitors Center, WA-5-93-1101

Basis for Design:

This system was designed by comparing the kitchen facility to similar facilities. This provided a design flow of 1500 GPD with a maximum BOD_5 of 1500 mg/L. The Grease Trap and Surge Tank were sized to handle 3 days total flow in order to handle the weekend peaks.

System Characteristics:

Visitors center with 800,000 visitors per year (Seasonal)

Hours
Open seven day's per week from 10 am to 5 pm

Seating
Total Seating 175

Average Number of Meals Served Per Day
Weekly Average 770 (Summer), Weekly Average 100 (Winter)

This is a cafeteria style restaurant with an American menu.

This facility serves lunch.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Dishes are washed in the sink.

Tableware is disposable.

Restaurant / Visitors Center, WA-5-93-1101

System Performance:

(24 pod system designed to handle the greywater flows only)
(This system has been in operation for 1 1/2 years)

NIBBBLER INFLUENT
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	476.2	769.8	89.9	50.2	5.2	17.0
Num. of Samples	11	8	8	8	8	8
High	707*	1110.0	143	73.4		

* - High Average

NIBBLER EFFLUENT
(FINAL GREYWATER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	28.2	18.0	2.6	8.0	15.4
Num. of Samples	11	11	11	11	11

BOD, TSS and O&G reported as mg/L

Percent Reductions	96	80	95		

BLACKWATER EFFLUENT
(TO CO-MINGLE)

	BOD	TSS	O&G	pH	TEMP
Averages	204.7	42.8	12.2	8.6	16.3
Num. of Samples	9	9	9	9	9

Special Notes:

Although this facility is open the year round it has seasonal swings in business. This system is desigened with extra capacity in the grease trap and surge tank to handle the peak flows associated with the weekend peak loads.

Recommended Design:

Greywater Flow Based on this data this system should be designed to handle 1000 GPD with a maximum BOD5 of 1000 mg/L.

Blackwater Flow The flow volume data for this facility is not available. The blackwater waste strength is 205 mg/l.

Restaurant / Full Service, WA-4-94-1133

System Performance:

(16 pod system treating the Grey & Blackwater flows)
(This system has been in operation for 6 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1191	690.0	75.6	69.1	5.4	22.0
Num. of Samples	4	1	1	1	1	1
High	1565*					

* - High average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	69.6	34.3	4.6	7.6	25.8
Num. of samples	3	4	4	4	4

BOD, TSS and O&G reported as mg/L

Percent Reductions	90	55	93

Special Notes:

This is a new system and this is a very limited data base.

Recommended design:

Grey & Black water flows

Based on this data this system should be designed to handle 1500 GPD with a maximum BOD5 of 1100 mg/L.

Restaurant / Full Service, WA-4-94-1133

Basis for Design:

This system was originally designed to handle 1200 GPD with a maximum BOD_5 of 1300 mg/L. This was based on water meter readings and samples collected from an existing facility operated by the same owner. The county required 1500 GPD based on a 30 gallon per seat requirement for the proposed 49 seats. The BOD_5 requirement was then reduced to 1045 mg/L. Therefore the design flow for this system was 1500 GPD with a maximum BOD5 of 1045 mg/L.

System Characteristics:

Hours

Open seven day's per week from 6:00 am to 9:30 pm

Seating

Total Seating 49

Average Number of Meals Served Per Day

Weekdays 110 Friday 175 Saturday 200 Sunday 200

This is a full service restaurant. The menu is American.

This facility serves breakfast , lunch and dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room during the summer months.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

The tableware is standard.

The dishwasher is a chemical rinse (140°) unit.

An ice machine is plumbed to send waste water to the septic system. This machine has recently been changed to an air cooled machine and a reduced flow has been noticed.

Restaurant / Full Service w/Bar, OR-2-94-1126

Basis for design:

This system design was based on a comparison to similar facilities. The design flow for this system was 800 GPD with a maximum BOD_5 of 974 mg/L.

System Characteristics:

Hours

Open seven days per week from 6 am to 10:00 pm

Seating (capacity)

Total Seating N/A, Dining N/A, Lounge N/A

Average Number of Meals Served Per Day

Weekdays N/A Friday N/A Saturday N/A Sunday N/A

This is a full service restaurant. The menu is American.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a Chemical rinse (140°).

Restaurant / Full Service w/Bar, OR-2-94-1126

System Performance:

(8 pod system treating the greywater only)
(This system has been in operation for 9 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	440.0	855.0	110.5	49.5	6.4	20.0
Num. of Samples	3	2	2	2	2	2
High	460*	1110	148	52.9		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	54.4	70.9	6.5	6.8	20.7
Num. of Samples	3	3	3	3	3

BOD, TSS and O&G reported as mg/L

Percent Reductions	94	36	87

Special Notes:

This system is followed by a sand filter and shallow trench disposal field.

Recommended Design:

Greywater Based on this data this system should be designed to handle 600 GPD with a maximum BOD5 of 1000 mg/L.

Blackwater No information was available for this system. Blackwater flow strengths are generally around 250 mg/L. The Blackwater strength at this facility would be lower because of the bar sinks being plummed into the blackwater side of the system.

Restaurant / Full Service w/Bar, OR-3-92-1045

Basis for Design:

This system design was based on water use information provided by the owner, a waste sample collected and a comparison to similar facilities. This system was designed to handle 1750 GPD with a maximum BOD5 of 800 mg/L.

System Characteristics:

Hours
Open seven day's per week from 9 am to 2 am

Seating
Total Seating 200

Average Number of Meals Served Per Day
Weekdays 100-150 Friday 300-400 Saturday 300-400 Sunday N/A

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	YES
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

Dishwasher is Chemical Rinse (140°).

This facility is subject to seasonal changes.

Restaurant / Full Service w/Bar, OR-3-92-1045

System Performance:

(16 pod system treating the Grey & Blackwater flows)
(This system has been in operation for 2 1/2 years)

INFLUENT TO NIBBLER
(SURGE TANK EFFLEUNT)

	GPD	BOD	TSS	O&G	pH	TEMP°C
Averages	1673	1020	353.4	244.5	5.6	26.8
Num. of Samples	21	5	5	5	4	4
High	3577*	1239	562	376		

CLARIFIER EFFLUENT
(EFFLUENT TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP°C
Averages	125.2	77.8	26.1	7.1	20.7
Num. of Samples	7	7	7	6	6

BOD, TSS and O&G reported as mg/L

Percent Reductions	88	78	89

Special Notes:

This system has been operating at its maximum design load. An additional Nibbler will be added to this system to allow for additional flows.

Recommended Design:

Grey & Black water flows

Based on this information this system should be designed to handle 1800 GPD with a maximum BOD5 of 1200 mg/L.

Restaurant / Full Service, BC-2-94-1125

Basis for Design:

This system design was based on water use information provided by the owner, a waste sample collected and a comparision to similar facilities. This system was designed to handle 2200 GPD with a maximum BOD5 of 1165 mg/L.

System Characteristics:

Hours
Open seven day's per week from 11 am to 11 pm

Seating
Total Seating 104

Average Number of Meals Served Per Day
Weekdays 170 Friday 400 Saturday 400 Sunday 250

This facility is a full service restaurant . The menu is primarily American.

This facility serves lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is Hot water Rinse (140°).

Restaurant / Full Service, BC-2-94-1125

System Performance:

(36 pod system treating the grey & blackwater flow)
(This system has been in operation for 9 months)

	NIB GPD	NIBBLER INFLUENT (SURGE TANK TO NIBBLER) BOD	TSS	O&G	pH	TEMP
Averages	1411.4	1066.7	186.1	248.1	6.1	20.9
Num. of Samples	14	0	7	7	8	8
High	2147*	1382	214	597		

* - High Average

	NIBBLER EFFLUENT BOD	TSS	O&G	pH	TEMP
Averages	121.1	45.6	33.0	7.8	18.4
Num. of Samples	8	8	8	8	9

BOD, TSS and O&G reported as mg/L

Percent Reductions	89	75	87

Special Notes:

This system utilizes a cast in place tank which houses the surge tank, Nibbler, clarifier and pump tank to the drainfield.

Recommended Design:

Greywater flow Based on this data this system should be designed to handle 1800 GPD with a maximum BOD5 of 1200.

Blackwater flow Data is not available on the blackwater flow for this system. The BOD5 for blackwater is generally around 250 mg/L.

Restaurant / Full Service, WA-12-93-1121

Basis for design:

This system design was based on two system effluent samples and water meter readings. The design flows for this system were 700 GPD with a maximum BOD_5 of 1114 mg/L.

System Characteristics:

Hours

Open seven days per week from 11 am to 9:00 pm, Sun. 8 am to 9 pm

Seating (capacity) Total Seating 135, Dining 75, Lounge (bar) 25 Banquet 35

Average Number of Meals Served Per Day

Weekdays 50 Friday 110 Saturday 110 Sunday 110

This facility is a full service restaurant. The menu is primarily American.

This facility serves lunch & dinner with breakfast served on Sunday.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Full Service, WA-12-93-1121

Basis for design:

This system design was based on two system effluent samples and water meter readings. The design flows for this system were 700 GPD with a maximum BOD_5 of 1114 mg/L.

System Characteristics:

Hours

Open seven days per week from 11 am to 9:00 pm, Sun. 8 am to 9 pm

Seating (capacity)

Total Seating 190, Dining 150, Banquet 40

Average Number of Meals Served Per Day

Weekdays 40 - 50 Friday 100 Saturday 100 Sunday 100

This facility is a full service restaurant. The menu is primarily American.

This facility serves lunch & dinner with breakfast served on Sunday.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Full Service, WA-10-92-1078

Basis for design:

This system design was based on two system effluent samples and a comparison to other similar systems. The design flow for this system was 1500 GPD with a maximum BOD_5 of 1050 mg/L.

System Characteristics:

Hours

Open seven days per week from noon to 9:00 pm

Seating (capacity) Total Seating 54 - 64, Dining 42 - 48, Banquet 12

Average Number of Meals Served Per Day

Weekdays 20 - 150 Friday 50 - 150 Saturday 75 - 250 Sunday 50 - 200

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	NO
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

This facility has seasonal fluctuations .

The dishwasher is a chemical rinse (140°).

On occasion running water is used to thaw frozen food.

Restaurant / Full Service, WA-12-93-1121

System Performance:

(8 pod system treating the grey & blackwater flows)
(This system has been in operation for 1 year)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	683.4	733.1	87.0	57.0	5.8	13.3
Num. of samples	12	7	7	7	7	7
High	999*	1162	131	67.2		

* - High Average

CLARIFIER EFFLUENT
(PUMP TANK TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP
Averages	133.5	90.7	19.7	7.7	13.5
Num. of samples	8	8	8	8	8

BOD, TSS and O&G reported as mg/L

Percent Reductions	82	-4	65

Special Notes:

None

Recommended Design:

Grey & Black water flows

Based on this data this system should be designed to handle 900 GPD with a maximum BOD5 of 900 mg/L.

Restaurant / Full Service, WA-10-92-1078

System Performance:

(16 pod system treating the Grey & Blackwater flows)
(This system has been in operation for 2 years)

NIBBLER INFLUENT
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP°C
Averages	1111	536.6	151.4	149.5	6.7	10.0
Num. of samples	16	8	8	8	0	8
High	1707*	692	198	205		

* - High Average

CLARIFIER EFFLUENT
(EFFLUENT TO SANDFILTER)

	BOD	TSS	O&G	pH	TEMP°C
Averages	79.0	18.4	20.7	7.9	12.2
Num. of Samples	5	5	5	5	5

BOD, TSS and O&G reported as mg/L

Percent Reductions	85	88	86

Special Notes:

This system is situated in an extreemly sensitive environmental setting with a salmon spawning stream and oyster beds adjacent to this site. The Nibbler pretreatment system is followed by a sand filter. No evidence of the effluent has beeen found in the samon stream or in the bay were the oysters are raised.

Recommended Design:

Grey & Black water flows

Based on this data this system should be sized to handle 1500 GPD with a maximum BOD5 of 700 mg/L.

Fast Food

Restaurant / Fast Food, WA-7-94-1155

Basis for design:

This system design was based on estimates for simular facilities. At the time of this design the type of fast food restaurant which would occupy this site was not known. The design flow for this system was 3500 GPD with a maximum BOD5 of 1115 mg/L.

System Characteristics:

Hours
Weekdays & Weekends from 6:00 am to 11:00 pm

Seating (capacity) Total Seating 56

Average Number of Meals Served Per Day
Weekdays 646 Friday N/A Saturday N/A Sunday N/A

The primary cuisine is american fast food; burgers, fries, sodas etc.

This facility serves breakfast, lunch and dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow bathroom fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system.	NO

Tableware is disposable.

Dishes are washed by hand in a sink.

Restaurant / Fast Food, WA-7-94-1155

System Performance:

(40 pod Nibbler system treating the blackwater and greywater flows from the fast food and some of the blackwater from the supermarket)
(This system has been in operation for 2 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1749	676	96.9	36.5	5.9	21
Num. of Samples	5	2	2	2	2	2
High	2393*	1028.0	97.0	27.0		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	47.2	25	11.5	7.5	20.7
Num. of Samples	3	3	3	3	3

BOD, TSS and O&G reported as mg/L

Percent Reduction	93	74	68		

Special Notes:

This system was sized to handle the greywater and blackwater flow from a popular fast food restaurant.

Recommended design:

This system is just getting started and may not represent the true flows for this type of facility. Therefore we do not recommend designing a system based on this data. Recommend using other comparative data.

Restaurant / Fast Food, WA-4-92-1054

Basis for design:

The flows were an estimate based on similar facilities and the waste strength was measured on two separate occasions prior to design. This system is designed to handle 500 GPD (greywater only) with a maximum BOD_5 of 975 mg/L.

System Characteristics:

Hours
Seven days per week from 10 am to 10 pm

Seating (capacity) Total Seating 68

Average Number of Meals Served Per Day
Weekdays 550 Friday 750 Saturday 700 Sunday 750

This facility is a fast food restaurant. The menu is primarily burgers fries & ice cream.

This facility serves, lunch & dinner.

This facility has a drive-up window which accounts for approximately 35% of the business.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using the bathroom.	YES
Does this facility have low flow fixtures? (Toilets)	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is disposable.

Dishes are washed by hand in a sink.

Restaurant / Fast Food, WA-4-92-1054

System Performance:

(8 pod Nibbler treating the greywater flow only)
(This system has been in operation for 2 1/2 years)

	NIBBLER	DISPOSAL FIELD	NIBBLER INFLUENT (SURGE TANK EFFLUENT)				
	GPD	GPD	BOD	TSS	O&G	pH	TEMP
Averages	395.8	1289.6	954.9	126.9	66.2	5.7	20.1
Num. of Samples	23	19	9	9	9	9	9
High	546*	2315	1294	329	102		

* - High average

	NIBBLER EFFLUENT (CLARIFIER EFFLUENT)				
	BOD	TSS	O&G	pH	TEMP
Averages	121.9	43.0	7.5	7.4	18.9
Num. of Samples	12	12	12	12	12

BOD, TSS and O&G reported as mg/L

Percent Reduction	87	66	89

Special Notes:

The flows recorded may not truely reflect the actual flows at this facility since the tanks are known to leak. The waste strength data may also be affected by the leak.

The owner of this facility diverts some of the blackwater flow into the Nibbler side of the system. Therefore, the flows shown for this system do not represent a true blackwater- greywater split.

Recommended design:

Greywater Design	Based on this data this system should be designed to handle 500 GPD with a maximum inffluent BOD5 of 1200.
Grey &Black water flows	Based on this data this system should be designed to handle 1950 GPD.

Restaurant / Fast Food, OR-11-93-1114

Basis for design:

The design flows were based on meter readings. The waste strength was measured once prior to design. This information was then compared to similar systems. The design flow for this system was 1200 GPD with a maximum BOD_5 of 1300 mg/L.

System Characteristics:

Hours
Open seven days per week from 10am to 10pm

Seating (capacity) Total Seating 80

Average Number of Meals Served Per Day
Weekdays 340 Friday N/A Saturday N/A Sunday N/A

This facility is a fast food restaurant. The menu is primarily burgers, sandwiches and ice cream.

This facility serves lunch & dinner.

This facility has a drive-up window.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine? (Both ice cream & yogurt)	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using the bathroom.	YES
Does this facility have low flow fixtures?	N/A
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is disposable.

Dishwasher is hot water rinse (140°).

Restaurant / Fast Food, OR-11-93-1114

System Performance:

(32 pod system designed to treat the grey & blackwater flow with a double pass)
(This system has been in operation for 1 year)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1111	985.3	142.7	137.8	4.9	14.7
Num. of Samples	11	7	7	7	7	7
High	1270*	1216	195	87.3		

* - High average

NIBBLER EFFLUENT
(DRAINFIELD PUMP TANK)

	BOD	TSS	O&G	pH	TEMP
Averages	81.5	98.2	7.7	7.7	14.1
Num. of Samples	8	8	8	8	8

BOD, TSS and O&G reported as mg/L

Percent Reduction	92	31	94

Special Notes:

This system is set-up to run the wastewater through a double pass to produce a polished effluent. The effluent discharge standard for this system is 30 mg/L BOD5 and 30 mg/L TSS. Early sample results exceeded these levels due to factors affecting the treatment process. However, the last two samples collected at this site met the 30/30 standard.

Recommended design:

Grey & Black water flow Based on this information, we recommend design parameters of 1200 GPD with a BOD5 of 1300 mg/L, for a similar facility.

Restaurant / Fast Food, FL-4-94-1131

Basis for design:

The flows were an estimate based on simular facilities. However, this was a new customer for us and we were not familiar with their chain of restaurants. This system was designed to handle 1500 GPD with a maximum BOD_5 of 1295 mg/L.

System Characteristics:

Hours
Weekdays & Weekends from 6 am to 11 pm

This facility servesBreakfast, Lunch & Dinner

Seating
(capacity) Total Seating 72

Drive-up window

Type of Menu
American Ice Cream & Burgers

Average Number of Meals Served Per Day
Weekdays 1022 Friday 1192 Saturday 1300 Sunday 903

This facility is a Fast Food restaurant. The menu is primarily American (Burgers, Fries, Ice Cream, etc.)

This facility serves breakfast, lunch & dinner.

This facility has a drive-up window.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using the bathroom.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

The tableware is disposable.

This facility bakes biscuits in the restuarant.

Restaurant / Fast Food, FI-4-94-1131

System Performance:

(20 pod system treating the greywater only)
(This system has been in operation for 6 months)

	NIB GPD	NIBBLER INFLUENT (SURGE TANK EFFLUENT) BOD	TSS	O&G	pH	TEMP
Averages	1653	859.3	80.5	78.7	5.4	32.7
Num. of Samples	3	3	3	3	3	3
High	2242*	1140	97.6	128		

* - High Average

	NIBBLER EFFLUENT (CLARIFIER) BOD	TSS	O&G	pH	TEMP
Averages	92.8	73.8	17	7.2	30.7
Num. of Samples	3	3	3	3	3
Percent Reductions	89	8	78		

	DOSE TANK EFFLUENT (EFFLUENT TO DRAINFIELD) BOD	TSS	O&G	pH	TEMP
Averages	56.8	22.5	7.0	7.0	
Num. of Samples	2	2	2	2	

BOD, TSS and O&G reported as mg/L

Special Notes:

This system is plumbed so that both the blackwater and the greywater can be treated by the Nibbler system.

Recommended Design:

Greywater Based on this data this system should be designed to handle 2000 GPD with a maximum BOD5 of 1000 mg/L.

Blackwater No data was available on the blackwater side of the system. The wastestrength of blackwater is generally around 250 mg/L.

Restaurant / Fast Food, WA-3-94-1127

Basis for design:

The design flow was based on meter readings. The waste strength was measured once prior to design. The design flow for this system was 389 GPD with a maximum BOD_5 of 3116 mg/L.

System Characteristics:

Hours
Open seven days per week from 7:30 am to 11 pm - M-F, 8:30 am to 12:00 am

Seating (capacity)
Total Seating 20

Type of Menu
American - Ice Cream & Burgers

Average Number of Meals Served Per Day
Weekdays 200-400 Friday 200-400 Saturday 200-500 Sunday 200-500

This facility serves breakfast, lunch & dinner

This is a fast food restaurant, serving a deli style menu.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is disposable.

Dishes are washed by hand in a sink.

Restaurant / Fast Food, WA-3-94-1127

System Performance:

(8 pod system treating the grey & blackwater flows)
(This system has been in operation for 8 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	309	471	96	57.6	6.3	17.2
Num. of Samples	8	5	5	5	5	5
High	357*	690	156	89.7		

* - High Average

NIBBLER EFFLUENT
(PUMP TANK TO DF)

	BOD	TSS	O&G	pH	TEMP
Averages	40	30	4.5	7.8	17.7
Num. of Samples	7	7	7	7	7

BOD, TSS and O&G reported as mg/L

Percent Reductions	92	69	92

Special Notes:

This site had an extremly small area available for the drainfield. The drainfield is constructed so that if it floods, the overflow will pass to an overflow tank. This tank will require pumping if the drainfield is unable to accept the total flow. The collection system in this drainfield also doubles as a vent for the drainfield.

Recommended Design:

Grey & Black water flows — Based on this data this system should be designed to handle 400 GPD with a maximum BOD5 of 650.

Restaurant / Fast Food, WA-10-92-1083

Basis for design:

This system design was based on one system effluent sample and water meter readings. The design flow for this system was 1043 GPD with a maximum BOD_5 of 1500 mg/L.

System Characteristics:

Hours

Open seven days per week from 6 am to 10 pm M-F and 7 am to 10 pm Sat & Sun.

Seating (capacity) Total Seating 75

Average Number of Meals Served Per Day

Weekdays 95 Friday 95 Saturday 200 Sunday 200 Highest 302

This is a fast food restaurant.

This facility serves breakfast, lunch and dinner.

This facility has a drive up window

Type of service

Deli, Burgers, Fries,

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine? (They do serve hard ice cream)	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system? An ice machine and ice cream scoop cleaner is plumbed to send waste water to the septic system.	YES

This facility is on a restricted water use program from their company.

Dishes are washed in the sink.

Tableware is disposable.

Restaurant / Fast Food, WA-10-92-1083

System Performance:

(16 pod system treating the greywater only)
(This system has been in operation for 2 years)

NIBBLER INFLUENT
(SURGE TANK)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	770.5	906.7	209.1	219.2	4.8	19.8
Num. of Samples	17	9	9	9	9	9
High	1065*	1440	555	712		

* - High Average

NIBBLER EFFLUENT
(PUMP TANK TO D.F.)

	BOD	TSS	O&G	pH	TEMP
Averages	75.4	71.6	15.9	7.2	18.2
Num. of Samples	11	11	11	11	11

BOD, TSS and O&G reported as mg/L

Percent Reductions	92	66	93

Special Notes:

None

Recommended Design:

Greywater Based on this data this system should be designed to handle 1000 GPD with a maximum BOD5 of 1100 mg/L.

Blackwater No data was available on the blackwater side of this system. Blackwater BOD5 is generally around 250 mg/L.

Restaurant / Fast Food, WA-5-94-1118

Basis for design:

The system waste strength design was based on two system effluent samples. The information used for estimating the flow quantity was not available. The design flow for this system was 500 GPD with a maximum BOD_5 of 1559 mg/L.

System Characteristics:

Hours

Open seven days per week from 11 am to 8 pm (open to 10 pm in the summer)

Seating (capacity)

Total Seating 30

Average Number of Meals Served Per Day

Weekdays 150 Friday 300 Saturday 300 Sunday 200

This is a fast food restaurant serving burgers, fries, etc.

This facility serves lunch and dinner.

This facility has a drive up window

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Dishes are washed in the sink.

Tableware is disposable.

Restaurant / Fast Food, WA-5-94-1118

System Performance:

(8 pod system treating the grey & blackwater flow)
(This system has been in operation for 6 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	364.3	277.0	65.5	16.3	6.5	17.5
Num. of Samples	6	2	2	2	2	2
High	555*	302	75	25		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	33.5	12.1	2.4	8.1	20.6
Num. of Samples	5	5	5	5	5

BOD, TSS and O&G reported as mg/L

Percent Reductions	88	82	85

Special Notes:

none

Recommended Design:

Grey & Black water flows

Based on this data this system should be designed to handle 500 GPD with a maximum BOD5 of 350 mg/L.

Golf Courses / Banquet Facilities

Restaurant / Golf Course, OR-9-91-1025

Basis for design:

This system design was based on two system effluent samples and water meter readings. The design flow for this system was 1600 GPD with a maximum BOD_5 of 640 mg/L.

System Characteristics:

Hours

Open six days per week from 10:00 am to 11:30 pm, closed Monday
Open at 8:00 am on the weekend

Seating (capacity) Total Seating 300, Dining 150, Banquet 150

Average Number of Meals Served Per Day

Weekdays 100 Friday 100+ Saturday 100+ Sunday 100+

This is a full service restaurant. The data presented here is from when this facility operated as a Chinese restaurant. It is now serving an American menu.

This facility serves lunch and dinner. Also serve breakfast on the weekend.

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	YES - (not using)
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a chemical rinse (140°).

They try and make an effort to minimize their water use.

Restaurant / Golf Course, OR-9-91-1025

System Performance:

(16 pod system treating the Grey and Blackwater flows)
(This system has been in operation for 3 years)

INFLUENT TO NIBBLER

	GPD	BOD	TSS	O&G	pH	TEMP°C
Averages	1714	407.1	82.8	30.9	6.10	17
Num. of Samples	25	8	8	8	8	7
High	2719*	683	237	63.2		

* - High Average

EFFLUENT FROM CLARIFIER

	BOD	TSS	O&G	pH	TEMP°C
Averages	68.6	69.9	5.9	7.4	20.0
Num. of Samples	8	8	7	7	5

BOD, TSS and O&G reported as mg/L

Percent Reduction	83.1	15.6	80.9

Special Notes:

A carbon filter which had been installed on the Nibbler vent stack impeaded the treatment at this facility by reducing the flow through the Nibbler unit.
The spices and cooking practices associated with a Chinese restaurant present a special challange to any biological treatment process. Therefore we recommend over-sizing this system.

Recommended Design:

Grey & Black water flows

Based on this information this system should be sized to handle 2200 GPD with a maximum BOD5 of 700 mg/L.

Restaurant / Golf Course & Grill, WA-3-92-1043

Basis for Design:

The total flow design was based on 85 seat occupancy for the restaurant, at 40 gallon per seat for 3400 GPD. The exercise room and pool add another 150 occupants which are factored in at 10.6 gallons for an additional 1590 GPD. The greywater design for this system was negotiated down to 1200 GPD with a maximum BOD_5 of 1200 mg/L.

System Characteristics:

Public Golf Course with Public Rest rooms & Banquet Room

Hours

Seven days a week from 10 am to 6 pm

Seating (capacity) Total Seating 85 Banquet 200

Average Number of Meals Served Per Day

Weekdays 60 Friday 100 Saturday 100 Sunday 100

Number of banquets per year N/A Ave. attendance 150 Max. att. 200

This facility is a full service restaurant. The menu is American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from just using the rest room.	YES
Does this facility have low flow fixtures?	N/A
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

Dishwasher is chemical rinse (140°).

There is an ice machine plumbed to send waste water to the septic system.

Restaurant / Golf Course & Grill, WA-3-92-1043

System Performance:

(16 pod system treating the greywater flow only)
(This system has been in operation for 2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	451.6	419.3	120.1	72.6	6.1	17.7
Num. of Samples	5	3	3	3	3	3
High	788*	630	147	100		

* - High average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	22.8	20.3	8.9	8.0	16.7
Num. of Samples	5	5	5	5	5

BOD, TSS and O&G reported as mg/L

Percent Reduction	95	83	88

Special Notes:

This facility is not meeting the expectations of the owners and therefore the flows and waste strength are much lower than would be expected for this type of facility.

Recommended Design:

Greywater Based on this data this system should be designed to handle 700 GPD with a maximum BOD5 of 650 mg/L.

Blackwater Data not available. Blackwater generally has a BOD5 of approximately 200 to 250 mg/L.

Restaurant / Golf Course, WA-4-91-1018

Basis for Design:

The total flow design was originally based on a tournament event with 200 people attending at 5 GPD and 80 people eating at 10 GPD. Another 160 GPD was added for a mop sink and four employees. A safety factor was added to this for a total flow of 3000 GPD. The greywater flow was negotiated down to 680 GPD with a maximum BOD_5 of 1200 mg/ L. based on similar facilities.

System Characteristics:

Public Golf Course with Public Restrooms

Hours

Seven days a week from 7 am to 9 pm

Seating (capacity) Total Seating 68 Dining 36. Patio 32

Number of banquets per year ? NO Ave. attendance 0 Max. att. 0

Average Number of Meals Served Per Day

Weekdays 40 - 50 day Friday N/A Saturday N/A Sunday N/A

This is more of a snack bar facility, with burgers hotdogs and fries

This facility serves Breakfast & lunch.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a chemical rinse (140°).

They try and make an effort to minimize their water use.

Restaurant / Golf Course, WA-4-91-1018

System Performance:

(8 pods treating the grey & blackwater flow)
(This system has been in operation for 3 years)

NIBBLER INFLUENT
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP°C
Averages	428.6	176.4	33.2	19.2	7.3	18.0
Num. of Samples	23	5	5	5	5	5
High	586*	279	67.5	29.4		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP°C
Averages	19.7	25.3	6.0	7.5	17.4
Num. of Samples	14	14	14	14	14

BOD, TSS and O&G reported as mg/L

Percent Reductions	89	24	69		

Special Notes:

This system has treated the entire flow for most of the life of the system. However, during one summer period (Highest use time) only the greywater was treated by the Nibbler system. At this time the greywater flow was 155 GPD. Therefore for this Golf Course/ Restaurant the flow split would calculate out to 65% Black / 35% Grey.

This is a nine hole golf course and the restaurant does not get heavy use.

No banquets at this site.

Recommended Design:

Grey & Black water flow — Based on this data this system should be designed to handle 600 GPD with a maximum BOD5 of 300 mg/L.

Restaurant / Golf Course w/ Banquet, WA-8-93-1109

Basis for Design:

The total flow design was based on water meter readings and two samples taken from two locations (pro Shop tank & Club House tank). This system was designed for expansion and a new Pro Shop. The expansion design was based on a comparison to similar facilities. The design flows were 2250 GPD with a maximum BOD_5 of 1040 mg/L.

System Characteristics:

Public golf course with public restrooms & banquet room.

Hours

Six days a week from N/A, Closed Tuesday

Seating (capacity) Total Seating N/A Restaurant N/A Pro Shop N/A

Average Number of Meals Served Per Day

Weekdays 65 Friday N/A Saturday N/A Sunday N/A

Number of banquets per year 36 Ave. attendance N/A Max. att. N/A

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

Dishwasher is hot water rinse (180°).

Restaurant / Golf Course w/ Banquet, WA-8-93-1109

System Performance:

(24 pod system treating the Grey & Blackwater flow)
(This system has been in operation for 1 year)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	NIB GPD	BOD	TSS	O&G	pH	TEMP
Averages	1015	247.1	91.7	37.1	6.9	15.3
Num. of Samples	11	7	6	7	7	7
High	2213*	352	180	95.2		

* - High Average

NIBBLER EFFLUENT
(PUMP TANK EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	31.2	39.9	6.0	7.6	16.9
Num. of Samples	9	8	9	9	9

BOD, TSS and O&G reported as mg/L

Percent Reductions	87	56	84

Special Notes

Surge tank should be oversized if tournaments are expected. This will help curb the peak flows associated with such an event.

Recommended Design:

Grey & Black water flow

Based on this data this system should be designed to handle 1500 GPD with a maximum BOD5 of 350.

Restaurant / Golf Course, OR-12-93-1122

Basis for Design:

The total flow design was based on flows and waste strength from similar facilities. The design flow for this system was 1750 GPD with a maximum BOD_5 of 890 mg/L.

System Characteristics:

Public Golf Course with Public Rest rooms & Banquet Room

Hours

Seven days a week from Dawn to Dusk

Seating (capacity) Total Seating 300 Restaurant/Bar 130 Banquet 170

Average Number of Meals Served Per Day

Weekdays 25-35 Friday N/A Saturday 50-60 Sunday N/A

Number of banquets per year N/A Ave. attendance N/A Max. att. N/A

This is a full service restaurant, serving an American menu (fine dining).

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard

Dishwasher is Chemical Rinse (140°).

The water use at this facility is conservative.

Restaurant / Golf Course, OR-12-93-1122

System Performance:
(16 pod system treating the greywater flow only)
(This system has been in operation for 5 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	780.8	490.0	138.7	66.4	6.8	28.0
Num.of Samples	5	3	3	3	3	1
High	1219*	585	197	85.5		

* - High average

NIBBLER EFFLUENT
(PUMP TANK TO SAND FILTER)

	BOD	TSS	O&G	pH	TEMP
Averages	17.0	18.5	7.6	7.4	25.3
Num. of Samples	6	6	6	6	3

BOD, TSS and O&G reported as mg/L

Percent Reductions	97	87	89

GRAVEL RECIRC FILTER INFLUENT
(CO-MINGLE EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	137.0	130.0	6.9	6.8	-
Num. of Samples	1	1	1	1	1

GRAVEL RECIRC FILTER EFFLUENT
(DRAINFIELD INFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	23.4	12.0	3.9	6.7	-
Num. of Samples	2	2	2	2	

Special Notes:

This restaurant and golf course are not as successful as anticipated. Therefore the flows may be lower than a simular designed facility.

Club house has a banquet facility. Design for peak flows in primary and surge portion of the system.

Recomended Design:

Greywater flow Based on this data this system should be sized to handle 1000 GPD with a maximum BOD5 of 600 mg/L.

Blackwater flow Data is not available for the blackwater side of the system. However, the BOD5 for blackwater flow is generally around 250 mg/L.

Restaurant / Golf Course, OR-4-92-1048

System Performance:

(16 pod system treating the greywater flow)
(This system has been in operation for 2 1/2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1766	735.0	230.4	196.9	6.0	24.3
Num. of Samples	35	6	6	6	6	6
High	3178*	1222	510	534		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	109.8	76.5	14.6	7.4	21.6
Num. of Samples	11	11	11	11	11

BOD, TSS and O&G reported as mg/L

Percent Reductions	85	67	93

Special Notes:

This system hosts a large golf tournament every year. Therefore, the surge capacity of this system is being modified to handle the peak flow associated with this event. The flows at this site has increased over the life of the system, therefore the Nibbler system is also being expanded.

Recommended Design:

Greywater Based on this data this system should be designed to handle 2500 GPD with a maximum BOD5 of 1100 mg/L.

Blackwater Data is not available for the blackwater side of the system. The BOD5 for Blackwater is generally around 250 mg/L.

Restaurant / Golf Course, OR-4-92-1048

Basis for Design:

The total flow design was based on comparisons to similar facilities. The design flow for this system was 1400 GPD with a maximum BOD_5 of 640 mg/L.

System Characteristics:

Private Golf Course with Private Rest rooms & Banquet Room

Hours

Seven days a week from 8 am to Midnight

Seating (capacity) Total Seating 400 Restaurant/Bar 125 Banquet 250
Bar & dining room + Grill & Bar in Locker room

Average Number of Meals Served Per Day

Weekdays 60 Friday 150 Saturday N/A Sunday N/A

Number of banquets per year N/A Ave. attendance N/A Max. att. N/A

This facility is a full service restaurant. The menu is primarily American.

This facility serves breakfast, lunch & dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder? (3 - in kitchen)	YES
Does this facility have a public rest room?	NO
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is standard.

Dishwasher is chemical rinse (140°).

Bed & Breakfast

Restaurant / Bed & Breakfast, WA-1-92-1029

Basis for Design:

The system was designed to handle 50 seats at 5 gallons per seat, 2 employees at 15 GPCD and a 4 bedroom residence at 480 GPD, for a total of 760 gallons per day. The design flow for this system was 760 GPD with a maximum BOD_5 of 500 mg/L.

Restaurant:

Hours
Wednesday thru Sunday (5 days a week) from 5:30 pm to 9:30 pm

Seating (capacity) Total Seating 42

Average Number of Meals Served Per Day
Weekdays 20 Friday 25 Saturday 30 Sunday 20

This is a full service restaurant, serving an American menu (fine dining).

This facility serves dinner only.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is standard

Dishwasher is Chemical Rinse (140°).

When the kitchen is busy, the dishwasher has a tendency to not scrape sauces and excess food off the plates.

Bed & Breakfast:

Number of Rooms
Capacity - 10, Average Occupancy (in season) - 5 /day

Number of Staff
In Season - 3, Off Season - 3

Average Number of Meals Served Per Day
Weekdays 4 Friday 4 Saturday 6 Sunday 8

Type of Facilities
Showers - 4, Laundry (# of machines) - 1

Breakfast for the B&B guests is prepared and served at this facility. All of the kitchen details are handled above.

Restaurant / Bed & Breakfast, WA-1-92-1029

System Performance:

(8 pod Nibbler system treating the Grey & Blackwater flow)
(This system has been in operation for 3 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	375	523.8	148.3	135.3	6.5	24.3
Num. of Samples	8	4	4	4	4	4
High	733*	612	173	173		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	58	21.9	27.6	7.4	19
Num. of samples	8	8	8	8	8

BOD, TSS, and O&G reported as mg/L

Percent Reduction	89	85	80

Special Notes:

none

Recommended Design:

Grey & Black water flows

Based on this information this system should be designed to handle 600 GPD with a maximum BOD5 of 600 mg/L.

Tavern

Restaurant / Tavern, WA-3-94-1128

Basis for design:

This system design was based on two effluent samples and a comparison to other similar systems. The design flow for this system was 1300 GPD with a maximum BOD_5 of 1196 mg/L.

System Characteristics:

Hours
Open seven days per week from 11 am to 2 am

Seating
(capacity) Total Seating 192

Average Number of Meals Served Per Day
Weekdays 30 Friday 20 Saturday 20 Sunday 20

This is a full service bar / restaurant with take-out. The menu is American however, Tuesday is Mexican food night.

This facility serves lunch and dinner.

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

The tableware is standard and disposable

The dishwasher is a hot water rinse (180°).

Grease is scraped into a 55 gallon drum and hauled away.

Restaurant / Tavern, WA-3-94-1128

System Performance:

(16 pod Nibbler system treating the grey & blackwater flow)
(This system has been in operation for 8 months)

		NIBBLER INFLUENT (SURGE TANK EFFLUENT)				
	NIB GPD	BOD	TSS	O&G	pH	TEMP
Averages	359.1	678.6	143.0	74.4	7.3	15.6
Num. of Samples	7	5	5	5	5	5
High	698*	1020	200	96.1		

* - High Average

	SANDFILTER INFLUENT (CLARIFIER EFFLUENT)				
	BOD	TSS	O&G	pH	TEMP
Averages	22.5	19.6	5.0	7.6	17.0
Num. of Samples	7	7	7	7	7

BOD, TSS and O&G reported as mg/L

Percent Reductions	97	86	93

Special Notes:

This facility installed low flow fixtures in the bathrooms. This caused a large reduction (72%) in the water usage at this facility. This reduction may also be related to the old fixtures leaking/malfunctioning, thereby sending excess water to the septic system. This facility is really more of a bar that serves some meals than a restaurant which has a bar.

Recommended Design:

Grey & Black water flow Based on this data this system should be sized to handle 600 GPD with a maximum BOD5 of 900 mg/L.

Businesses

Supermarkets

Mini Mall / Supermarket, WA-NON-010

Basis for Design:

The drainfield at this site only has the capacity to handle 2700 GPD. Therefor the greywater side of this system is simply a holding tank sized for 2700 GPD. The blackwater side of this system consits of a septic tank and an in-ground bottomless sandfilter sized to handle 2700 GPD. There is no Nibbler at this site.

System Characteristics:

Hours
Weekdays & Weekends from 6 am to 12 am (midnight)

Businesses
The type of businesses at this facility are;
Video Store, Dry Cleaners, Sandwich Shop, Pizza Delivery, Mens/Womens & Childrens Haircuttting, Dental Clinic, Veterinary, Supermarket, Bank & Coffee Stand

Type of food service
Deli, Pizza delivery

The supermarket is approximatlry 30,625 sqft

The satallite stores occupy approximatley 21,000 sqft.

Does this facility have a salad bar?	N/A
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	N/A
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system? (Three ice machines)	YES

There is a hot water rinse (180°) dishwasher.

Mini Mall / Supermarket, WA-NON-010

System Performance:

(Non-Nibbler System)

GREYWATER HOLDING TANK
(DESIGN RATE: 2700 GPD)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	3,811	1212	271	104	3.8	-
Num. of Samples	74	1	1	1	1	0
High	7285*					

* - High average

BLACKWATER PUMP TANK
(DESIGN RATE: 2700 GPD)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	2,164	185.0	71.1	23.4	6.7	16.6
Num. of samples	87	72	73	71	74	32
High	14143*	406	708.0	141.0		

* - High average flows were recorded at times when the ice machine or air conditioner was discharging excessively into the blackwater side of the system.

BOD, TSS and O&G reported as mg/L

Special Notes:

The greywater side of this system is pumped and trucked to a sewer manhole. The blackwater side of this sytem goes directly to the bottomless sandfilter.

Recommended Design:

Greywater Based on this data this sytem should be designed to handle 5500 GPD with a BOD5 of 900. This BOD value was derived from simular facilities, the one sample collected at this site would act as a verification of the predicted BOD5.

Blackwater Based on this data this system should be designed to handle 3000 GPD with a maximum BOD5 of 300 mg/L.

Supermarket, WA-7-94-1150

Basis For Design:

This system design was based on flow volumes and waste strength data from simular facilities. The design flow for this system was 3500 GPD with a maximum BOD_5 of 1115 mg/L.

Types of Service

The building is 50,000 sqft

Deli, Meat cutting, Produce & Bakery

Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	N/A
Does this facility have an ice cream or yogurt machine?	N/A
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system? Two ice machines.	YES

Supermarket, WA-7-94-1150

System Performance:

(40 pod system treating the greywater flows from supermarket)
(This system has been in operation for 4 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1250	1860	251	86.7	4.87	23
Num. of Samples	5	1	1	1	1	1
High	2540*					

* - High average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	33.2	21.0	2.6	7.9	21.3
Num. of Samples	2	3	3	3	3

BOD, TSS and O&G reported as mg/L

Percent Reduction	98	92	97

Special Notes:

This facility has just opened and this data may not be representative of a large supermarket doing a good business.

Recommended design:

Greywater This system is just getting started and may not represent the true flows for this facility. Therefore we do not recommend designing a system based on this data. Recommend using other comparative data.

Blackwater No data available. The BOD5 for a blackwater flow is generally 200 to 250 mg/L. This can vary with low flush fixtures.

Basis For Design:

This system design was based on an extensive review of this system including numerous samples and long term meter readings. The design flow for this system was 2500 GPD with a maximum BOD_5 of 1200 mg/L.

Types of Service

The building is 38,000 sq ft.

Type of service
Deli, Meat cutting, Produce & Bakery

Does this facility have a salad bar?	N/A
Does this facility have a deep fat fryer?	N/A
Does this facility have an ice cream or yogurt machine?	N/A
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	N/A
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Supermarket, OR-9-92-1071

System Performance:

(48 pod sytem treating the Grey & Blackwater flows)
(This system has been in operation for 2 years)

INFLUENT TO NIBBLER
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	2101	1376.0	248.1	93.8	5.0	19.1
Num. of Samples	35	9	8	8	9	7
High	2965*	2550	573	396		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER INFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	143.2	120.7	10.6	7.4	16.6
Num. of Samples	12	12	12	12	10

BOD, TSS and O&G are reported in mg/L

Percent Reductions	90	51	89		

RGF EFFLUENT
(DRAINFIELD INFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	30.5	46.2	0.0	7.2	10.0
Num. of Samples	2	2	2	2	2

Special Notes:

This system had several failures prior to having the Nibbler system installed. This system now consists of septic tanks followed by the Nibbler process. A Recirculating Gravel Filter (RGF) polishes the effluent prior to discharge to the drainfield.

Recommended Design:

Grey & Black water flow Based on this data this system should be sized to handle 2500 GPD with a maximum BOD5 of 1500 mg/L.

Basis For Design:

This system design was based on a comparison to similar facilities and one wastewater sample. The design flow for this system was 3500 GPD with a maximum BOD_5 of 1337 mg/L.

Types of Service

Deli, Meat cutting, Produce & Bakery

The building is 60,000 sqft

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room (tour buses).	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Supermarket, WA-5-94-1142

System Performance:

(48 pod system treating the grey & blackwater flows)
(This system has been in operation for 6 months)

INFLUENT TO NIBBLER
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	3956	771.7	153.0	89.5	5.5	18.7
Num. of Samples	4	3	3	3	3	3
High	4680*	820	185	110		

* - High Average

NIBBLER EFFLUENT
(CLARFIER EFFLUENT)

	BOD	TSS	O&G	pH	TEMP
Averages	56.0	54.8	7.3	7.6	21.3
Num. of Samples	6	6	6	6	6

BOD, TSS and O&G reported as mg/L

Percent Reductions	93	64	92

Special Notes:

An additional system is being designed to treat the flows from a new chinese deli now being installed in this supermarket. The design flow for the new china deli is 1500 GPD with a maximum BOD5 of 1039 mg/L.

Recommended Design:

Grey & Black water flow

Based on this information this system should be designed to handle 3500 GPD with a maximum BOD5 of 1337 mg/L.

Basis For Design:

This system design was based on a comparison to similar facilities and one wastewater sample. This system is designed to handle 4500 GPD with a maximum BOD_5 of 1200 mg/L.

Types of Service

Hours

Open seven days a week - 24 hours per day

Deli, Meat cutting, Produce, Bakery & China express deli.

Seating (capacity) Total seating (china deli) 12

The building is 50,000 sqft

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room?	NO
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

Tableware is disposable

Supermarket, WA-4-92-1030

System Performance:

(48 pod system treating the grey & blackwater flow)
(This system has been in operation for 3 years)

INFLUENT TO NIBBLER
(SURGE TANK EFFLUENT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	4642.4	873.2	200.0	95.2	5.0	19.9
Num. of Samples	52	13	13	12	12	11
High	6732*	1336	683	200		

* - High Average

NIBBLER EFFLUENT
(INFLUENT TO CLARFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	189.4	129.1	16.6	6.7	19.4
Num. of Samples	29	29	29	29	29

BOD, TSS and O&G reported as mg/L

Percent Reductions	78	35	83		

Special Notes:

This facility had a failed system. The annual cost for pumping and disposal was approximately $ 279,000.00 per year.

Recommended Design:

Grey & Black water flows

Based on this information, we recommend design parameters of 5500 GPD with a maximum BOD5 of 1200 mg/L, for a similar facility .

Supermarket, WA-3-91-1014

Basis For Design:

No information was available on the basis for design. The design flow for this system was 3000 GPD with a maximum BOD_5 of 1800 mg/L.

Types of Service

Deli, Meat cutting, Produce, & Bakery

The building is 47,000 sqft

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or frozen yogurt machine?	YES
Are the bathroom fixtures low flow?	NO
Are ice machines or other cooling devices draining to the septic system?	NO
Is a garbage grinder or garbage disposal used?	NO

The employees are aware of the need to conserve water

Supermarket, WA-3-91-1014

System Performance:

(32 pod system treating the greywater & some blackwater - 4/91 to 10/92, 48 pod system from 10/92 to present)
(This system has been in operation for 3 1/2 years)

GREYWATER INFLUENT
(SURGE TANK EFFLEUNT)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	1577	1128	91	37.6	4.9	18.0
Num. of Samples	79	30	32	32	31	29
High	3836*	2738	238	166		

* - High Average

CLARIFIER EFFLUENT
(INFLUENT TO 1ST PUMP TANK)

	BOD	TSS	O&G	pH	TEMP
Averages	241	81	16.6	7.1	18.5
Num. of Samples	11	13	13	13	11
Percent Reductions	79	11	56		

CO-MINGLE PUMP TANK
(EFFLUENT TO DRAINFIELD)

	BOD	TSS	O&G	pH	TEMP
Averages	146	74	10.0	7.3	18.4
Num. of Samples	44	47	47	46	47

BLACKWATER EFFLUENT
(EFFLUENT TO NIBBLER AND CO-MINGLE TANK)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	2509	519	76.6	35.0	6.1	18.4
Num. of Samples	80	17	17	17	16	14

BOD, TSS and O&G reported as mg/L

Special Notes:

This system operated with 4 Nibbler units from 4/91 to 10/92
As of 7/2/93 50% of blackwater flow is treated by Nibbler.
Blackwater flow is not true blackwater. This flow has input from sources other than just bathrooms. The mop room and meat department drain to the blackwater side of the system.
Use combined flows (greywater & blackwater) for total GPD to the drainfield. The average total flow, for this time frame, is 4086 GPD.

Recommended Design:

Grey & Black water flow — Based on this data this system should be designed to handle 5000 GPD with a maximum BOD5 of 1500 mg/L.

Senior Center - WA-10-92-1080

Basis for design:

The flows for this system were based on water meter readings and comparisons to similar facilities. This facility is a meeting place for seniors. Lunch is served 4 times a week to about 40 - 60 and dinner about once a month. The design flow for this system was 585 GPD with a maximum BOD_5 of 1350 mg/L.

System Characteristics:

Hours - 8:30 am to 4:30 pm M-F, Some Weekends

Number of Guests or Campers
Capacity - 250
Ave. Occupancy (In-Season) - 50

Number of Staff
In-Season - 12 (There is only one full time employee.)
Off-Season - 7

Type of Facilities
Cafeteria, Laundry (1 machine)

Cafeteria Seating 150

Average Number of Meals Served Per Day
Weekdays - 30 Friday - 15 Saturday - 0 Sunday - 0

Misc. Data

This is a meeting place which serves lunch. The menu varies.

Food is prepared at this facility.	YES
Dishes are done at this facility.	YES
Does this facility have a salad bar?	YES
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	N/A
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room during the summer months.	YES
Does this facility have low flow fixtures?	YES
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	NO

The tableware is standard.

The dishwasher is a chemical rinse (140°) unit.

Mini Markets

Gas Station / Mini Mart, WA-4-94-1135

Basis for design:

The design was based on water meter readings and one sample collected and analyzed for BOD_5, TSS and O&G. This information was compared to several similar facilities. The design flow for this system was 700 GPD with a maximum BOD_5 of 1114 mg/L.

System Characteristics:

Hours
Weekdays & Weekends from 5:00 am to 12:00 am

Type of service
Deli, Soups

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	NO
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using their rest room.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Dishes are washed in the sink.

Tableware is disposable.

Gas Station / Mini Mart, WA-4-94-1135

System Performance:

(8 pod system treating both the greywater and blackwater flows)
(This system has been in operation for 7 months)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	357	436.8	105.0	44.4	6.5	17
Num. of Samples	6	4	4	4	4	4
High	498*	520	150	54.1		

* - High Average

NIBBLER EFFLUENT
(CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	30.7	15.5	2.6	7.9	17
Num. of Samples	6	6	6	6	6

BOD, TSS and O&G reported as mg/L

Percent Reductions	93	85	94

Special Notes:

None

Recommended Design:

Grey & Black water flows

Based on this data this system should be designed to handle 600 GPD with a maximum BOD5 of 550 mg/L.

Gas Station / Mini Mart, WA-6-92-1057

Basis for design:

The design was based on data collected during a nine month monitoring program which collected both flow volume and waste strength information. The design flow for this system was 500 GPD with a maximum BOD_5 of 1100 mg/L.

System Characteristics:

Hours
Weekdays & Weekends 24 hours per day

This facility is a mini-mart with minimum food service.
Deli, Burgers, Fries, Soups

Does this facility have a salad bar?	NO
Does this facility have a deep fat fryer?	YES
Does this facility have an ice cream or yogurt machine?	NO
Does this facility have a garbage grinder?	NO
Does this facility have a public rest room? This facility gets extra traffic from people just using the bathroom.	YES
Does this facility have low flow fixtures?	NO
Does this facility have an ice machine or other cooling device plumbed to send waste water to the septic system?	YES

Tableware is disposable.

Dishes are washed in three sinks.

Gas Station / Mini Mart, WA-6-92-1057

System Performance:

(8 pod system treating the grey & black water flow)
(System has been in operation for 2 1/2 years)

NIBBLER INFLUENT
(SURGE TANK TO NIBBLER)

	GPD	BOD	TSS	O&G	pH	TEMP
Averages	445.1	648.2	53.5	47.2	6.1	26.8
Num. of Samples	18	5	5	5	5	5
High	549*	883	61.5	68		

* - High Average

NIBBLER EFFLUENT
(EFFLUENT FROM CLARIFIER)

	BOD	TSS	O&G	pH	TEMP
Averages	50.8	60.5	6.5	7.0	21.2
Num. of Samples	13	13	13	13	13

BOD, TSS and O&G reported as mg/L

Percent Reduction	92	-13	86		

Special Note:

None

Recommended design:

Grey & Black water flow

Based on this information this system should be designed to handle 550 GPD with a maximum BOD5 of 700 mg/L.