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Scott Walker, Governor
Laura Gutiérrez, Secretary

Private Onsite Wastewater Treatment Systems Technical Code Advisory Committee
Room 121C, 1400 East Washington Avenue, Madison
Contact: Bradley Johnson (608) 266-2112
September 26, 2017

9:00 A.M.

The following agenda describes the issues that the committee plans to consider at the meeting. At the time of the meeting, items may be removed from the agenda. Please consult the meeting minutes for a record of the actions of the committee.

AGENDA

OPEN SESSION – CALL TO ORDER – ROLL CALL

A. Adoption of Agenda (1)

B. Approval of the Minutes of May 16, 2017 (2)

C. Administrative Matters – Discussion and Consideration

1. Department and Staff Updates
2. Committee Members
   a) Aaron Ausen
   b) Frederick Hegeman
   c) Daniel Keymer
   d) Robert Roy Schmidt
   e) Daniel Vander Leest
   f) Eric Wellauer

D. Technical Advisory Matters – Discussion and Consideration (3-233)

1. Eljen In-ground and Mound Components Manuals **(3-105)**
2. VIRTUAL PRESENTATION 9:30 A.M.: Presby Environmental, Inc. Representatives on In-Ground and Mound Components
3. Presby In-Ground and Mound Components Manuals **(105-233)**

E. Committee Meeting Process (Time Allocation, Agenda Items) – Discussion and Consideration

F. Public Comments

G. Adjournment

POWTS TECHNICAL ADVISORY COMMITTEE
MEETING MINUTES
May 16, 2017

PRESENT: Aaron Ausen, Frederick Hegeman, Daniel Keymer, Robert Roy Schmidt, Daniel Vander Leest, Eric Wellauer

STAFF: Bradley Johnson, Section Chief; Tim Vander Leest, DIS Staff; Laura Smith, Bureau Assistant; and other Department staff

ADOPTION OF AGENDA

MOTION: Frederick Hegeman moved, seconded by Robert Schmidt, to adopt the agenda as published. Motion carried unanimously.

TECHNICAL ADVISORY MATTERS

GeoMat In-Ground Component

See To Do list for informal record of concerns.

Presby WI In-Ground Component

See To Do list for informal record of concerns.

Presby WI Advanced Enviro-Septic Mound Component

See To Do list for informal record of concerns.

Performance Monitoring Under SPS 383.71(4)

No money allocated in State budget at this point.

ADJOURNMENT

MOTION: Robert Schmidt moved, seconded by Frederick Hegeman, to adjourn the meeting. Motion carried unanimously.

Meeting adjourned at 3:05 p.m.

	Proposed Verbiage	Mound Page	In-Ground Page	Justification
Volume of a single dose to absorption component when pumps or siphons are employed in the design	Maximum volume of a single dose to absorption component when pumps or siphons are employed in the design	3	3	Clarification
Distribution cell area per orifice when pressure distribution is used ≤ 12 ft2	Distribution cell area per orifice when pressure distribution is used ≤ 24 ft2 B43 or ≤ 20 ft2 A42	4	3	This was a carry-over from the original mound manual. The orifice should be set at least one orifice per unit.
Pumping up to a Distribution Box and allowing gravity flow from that box is also acceptable.	Gravity flow from a distribution box is also acceptable.	9		This was the intent of the original insert.

GSF IN-GROUND

COMPONENT MANUAL

May 2017

Table of Contents Page

Published by:
Eljen Corporation
125 McKee St.
East Hartford, CT 06108

This component manual was produced exclusively by Eljen Corporation for use with Eljen GSF products. This manual is based upon the "In-Ground Soil Absorption Component Manual for Private Onsite Wastewater Treatment Systems" Ver. 2.0, October, 2012, by the State of Wisconsin, Department of Safety and Professional Services.

Eljen Corporation reserves the right to revise this component manual according to changes in regulations or Eljen GSF system installation instructions.

I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for an GSF system. However, these items must accompany a properly prepared and reviewed plan acceptable to the governing unit to help provide a system that can be installed and function properly. Violations of this manual constitute a violation of chs. SPS 383 and 384, Wis. Adm. Code. The GSF system must receive influent flows and loads less than or equal to those specified in Table 1. When designed, installed and maintained in accordance with this manual, the GSF system provides treatment and dispersal of domestic wastewater in conformance with ch. SPS 383 of the Wis. Adm. Code. Final effluent characteristics will comply with s. SPS 383.41, Wis. Adm. Code when inputs are within the range specified in Tables 1 to 3.

Note: Detailed plans and specifications must be developed, and submitted for review and approval by the governing unit having authority over the plan for the installation. Also, a Sanitary Permit must be obtained from the department or governmental unit having jurisdiction. See Section XII for more details.

Table 1
Influent Flows and Loads

Design Wastewater flow (DWF)	≤ 5000 gal/day
Monthly average value of Fats, Oil and Grease (FOG)	≤ 30 mg/L
Monthly average value of five day Biochemical Oxygen Demand (BOD_5)	≤ 220 mg/L
Monthly average value of Total Suspended Solids (TSS)	≤ 150 mg/L
Volume of a single dose to absorption component when pumps or siphons are employed in the design	A42 = 3 gallons/dose/unit B43 = 4 gallons/dose/unit
Design wastewater flow (DWF) from one and two-family dwellings	Based on s. SPS 383.43 (3), (4), or (5), Wis. Adm. Code
Design wastewater flow (DWF) from public facilities	≥ 150% of estimated daily wastewater flow in accordance with Table 4 of this manual or s. SPS 383.43 (6), Wis. Adm. Code
Wastewater particle size	≤ 1/8 inch
Distribution cell area per orifice when pressure distribution is used	≤ 24 ft^2 B43 or ≤ 20 ft^2 A42

Table 2 SIZE AND ORIENTATION	
Distribution cell width (A)[a]	≤ 6 feet = Number of product rows x product width. Product width is shown in Table 2b; two rows of A42s can achieve a 6 foot width. Units may also use up 18 inches of sand on each side of the product to achieve a 6 foot width. For instance, B43 units used with 18 inches of specified sand can achieve a 6 foot width; refer to Table 2c for configurations
Required # of Products	≥ Design wastewater flow rate ÷ design loading rate of the fill material ÷ square footage of product (shown in Table 2b), round up to nearest whole number; Min 5 B43 units per bedroom or 6 A42 units per bedroom in residential applications
Distribution cell length (B)[a]	Multiple # of GSF units x 4 ft + 1 ft
Orientation	Longest dimension parallel to surface grade contours on sloping sites.
Deflection of distribution cell on concave slopes	≤ 10%
Basal area	Design wastewater flow ÷ soil application rate for the in situ soil at the infiltrative surface or a lower horizon if the lower horizon adversely affects the dispersal of wastewater in accordance with s. SPS 383.44 (4) (a) and (c) , Wis. Adm. Code
Soil Application Rate	The designer may use Effluent #2 in accordance with s. SPS Table 383.44-1 and 383.44-2, Wis. Adm. Code

Table 2b APPROVED PRODUCT MODEL NUMBERS AND DIMENSIONS				
Product	Square Footage	Product Width	Product Length	Product Height
A42	12 square feet per unit	36"	48"	7"
B43	16 square feet per unit	48"	48"	7"

Table 2c APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE				
Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

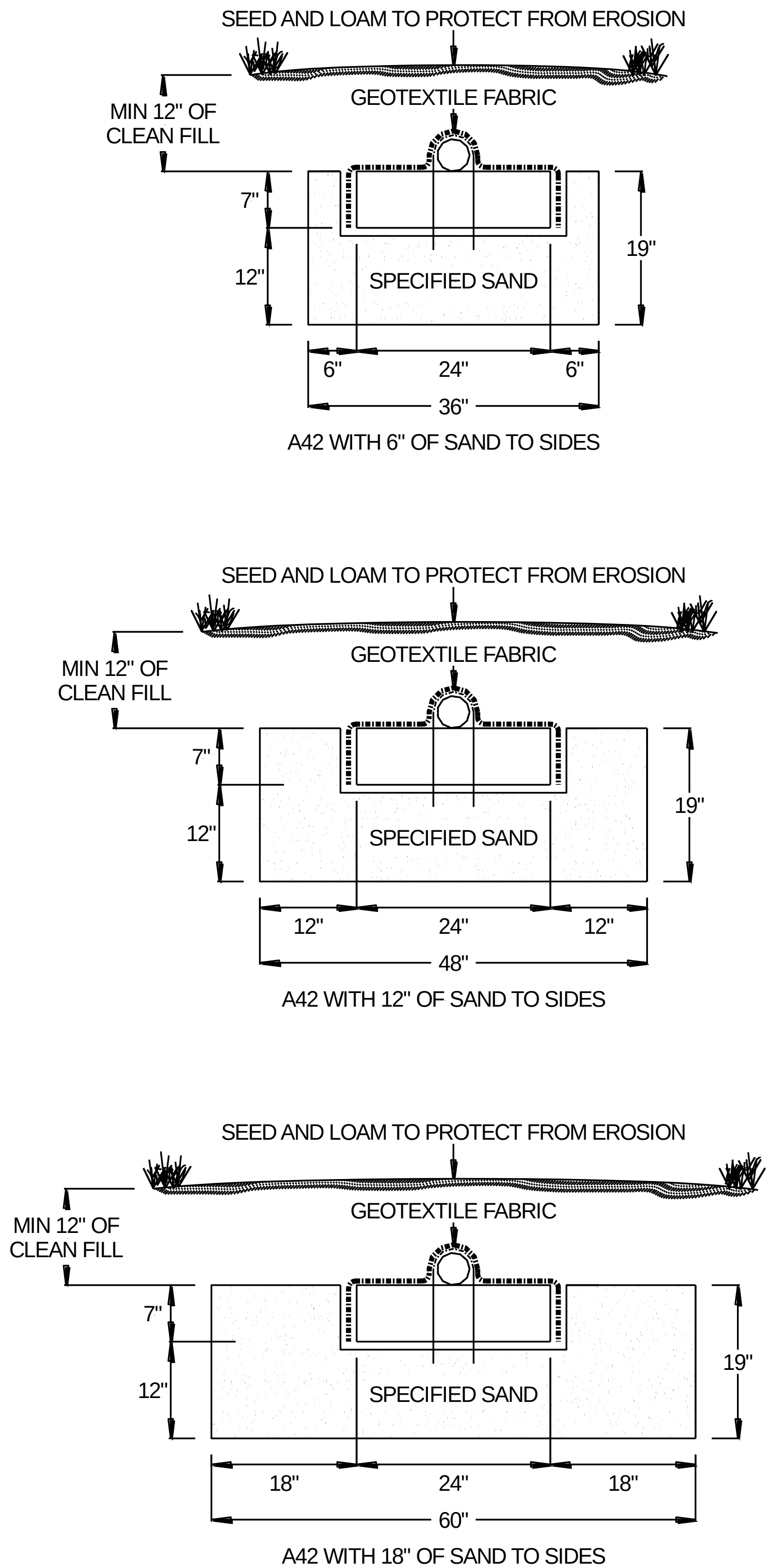


Figure 1. A42 Single Lateral In-Ground Cross Sections

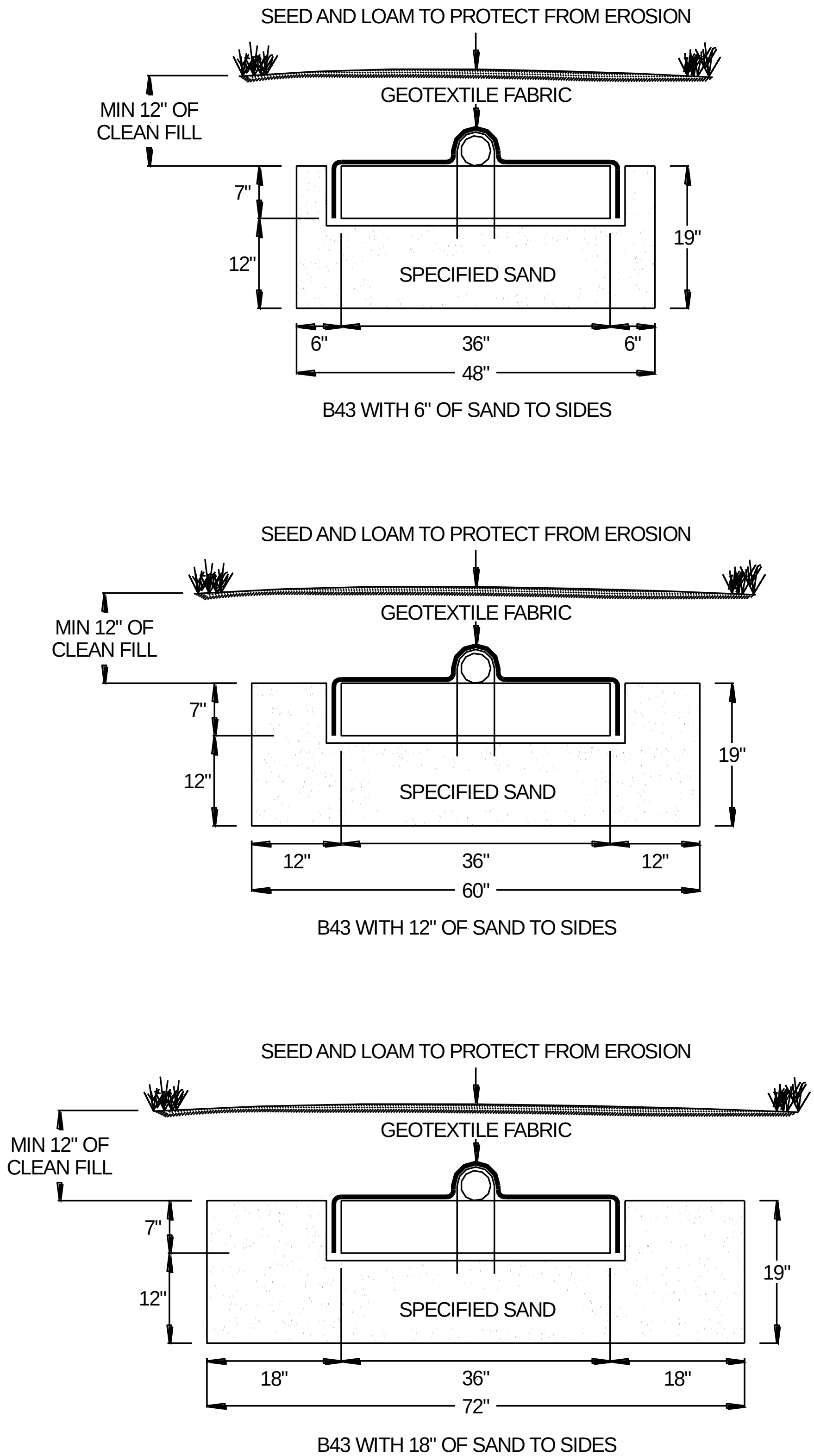


Figure 2. B43 Single Lateral In-Ground Cross Sections

Table 3 OTHER SPECIFICATIONS	
Slope of in situ soil	≤ 25% in area of component
Vertical separation between bottom of GSF unit and seasonal saturation defined by redoximorphic features,	≥ Equal to depth required by s. SPS 383 Table 383.44-3, Wis. Adm. Code
Bottom of distribution cell	Level
Horizontal separation between distribution cells	≥ 3 ft.
Piping material in the distribution system	Meets requirements of s. SPS 384.30 (2), Wis. Adm. Code for its intended use
Piping material for observation, vent, and	Meets requirements of s. 384.30 Table 384.30-1, Wis. Adm. Code
Slope of gravity flow perforated distribution lateral piping	≤ 4 inches per 100 feet away from distribution boxes, drop boxes or header
Location of gravity flow perforated distribution pipe in distribution cell	Centered over the GSF unit
Location of GSF Units	Located as follows: Single A42 Line 12 sf/unit – Units are centered in a 3 foot width trench, 6 inches of sand on either side Single A42 Line 16 sf/unit – Units are centered in a 4 foot width trench, 12 inches of sand on either side Single A42 Line 20 sf/unit – Units are centered in a 5 foot width trench, 18 inches of sand on either side Dual A42 System – Units have 6 inches of sand from sidewall and 1 foot of sand in between units Single B43 Line 16 sf/unit – Units are centered in a 4 foot width trench, 6 inches of sand on either side Single B43 Line 20 sf/unit – Units are centered in a 5 foot width trench, 12 inches of sand on either side Single B43 Line 24 sf/unit – Units are centered in a 6 foot width trench, 18 inches of sand on either side

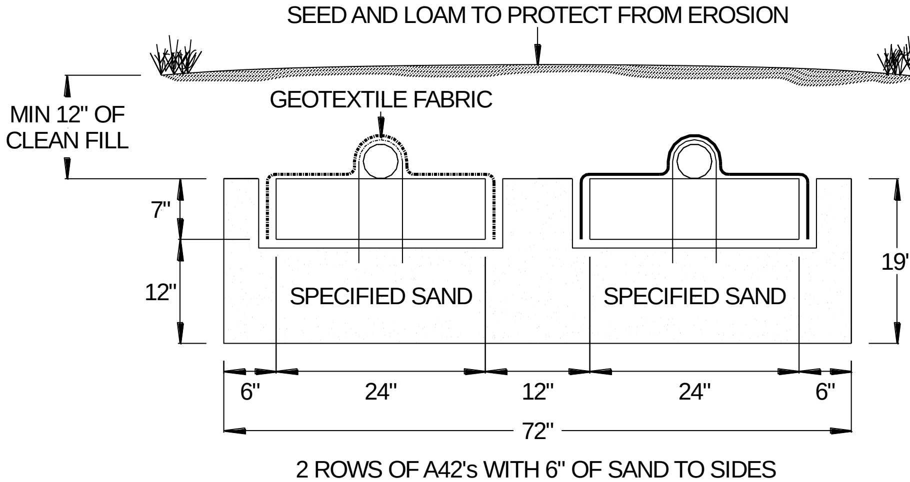


Figure 3. A42 Dual Lateral In-Ground Cross Section

Table 3 OTHER SPECIFICATIONS (continued)	
Length of distribution pipe for components using gravity flow distribution	≥ Equal to length of distribution cell minus 2 feet
Distance between distribution pipe end orifice and end of distribution cell for components using gravity flow distribution	≤ 2 feet
Length of GSF system row	Multiple # of GSF units x 4 ft
Number of observation pipes per distribution cell	≥ 2
Location of observation pipes	For flexibility in pipe location, see VII. C. 5.
Design and installation of observation pipes	1. Have an open bottom 2. Have a nominal pipe size of 4 inches 3. The lower 19 inches slotted 4. Slots are ≥ 1/4" and ≤ 1/2" in width and located on opposite sides 5. Anchored in a manner that will prevent the pipe from being pulled out 6. Extend from the infiltrative surface up to or above finish grade 7. Terminate with a removable watertight cap, or 8. Terminate with a vent cap if ≥ 12 inches above finish grade

Table 3 OTHER SPECIFICATIONS (continued)	
Effluent application to GSF system	1. If DWF < 1500 gpd, effluent may be applied by gravity flow, dosed to distribution cell or distribution box, then applied by gravity flow to the distribution cell, or by use of pressure distribution, unless pressure distribution is required in accordance with s. SPS 383.44 (5) (b) 2. If DWF ≥ 1500 gpd, effluent must be dosed to distribution cell or distribution box, then applied by gravity flow to the distribution cell, or by use of pressure distribution, unless pressure distribution is required in accordance with s. SPS 383.44 (5) (b) , Wis. Adm. Code
Septic tank effluent pump system	Meets requirements of s. SPS 384.10, Wis. Adm. Code and this manual
Dose tank or compartment volume employing one pump	≥ Volume of a single dose + reserve capacity[a] + drain back volume[b] + (6 inches x average gal/inch of tank)[c] Notes: a: Reserve capacity ≥ the estimated daily flow. b: Drain back volume ≥ volume of wastewater that will drain into the dose tank from the distribution cell. c: Four inches of this dimension ≥ vertical distance from pump intake to bottom of tank. Two inches of this dimension ≥ vertical distance between pump on elevation and high water alarm activation elevation.
Max bury depth	There is no max bury depth on this product.

Table 3 OTHER SPECIFICATIONS (continued)	
Dose tank or compartment volume employing duplex pumps	≥ Volume of a single dose + drain back volume[a] + (6 inches x average gal/inch of tank)[b] Notes: a: Drain back volume ≥ volume of wastewater that will drain into the dose tank from the force main. b: Four inches of this dimension ≥ vertical distance from pump intake to bottom of tank. Two inches of this dimension ≥ vertical distance between pump on elevation and high water alarm activation elevation.
Siphon tank or compartment volume	≥ What is required to accommodate volumes necessary to provide dosing as specified in this manual
Distribution network for pressurized distribution systems.	By use of pressure distribution network conforming with the sizing methods of either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" or Dept. of Safety and Professional Services publications SBD-10573-P or SBD-10706-P, entitled Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems".
Vent pipes installed in the GSF system	1. Connect to a gravity flow distribution lateral by the use of a fitting 2. Have a nominal pipe size of 4 inches 3. Extend from the distribution lateral ≥ 12 inches above finish grade 4. Terminate in a manner that will allow a free flow of air between the distribution lateral and the atmosphere 5. The vent opening port is downward 6. Required for systems with ≥ 18 inches of cover.
Combination observation/vent pipes installed in a GSF system	Meets all of the requirements of observation pipes with the following exceptions: 1. Have a minimum 4 inch pipe connection to a distribution lateral 2. Extend from the infiltrative surface ≥ 12 inches above finish grade 3. Terminate in a manner that will allow a free flow of air between the distribution lateral and the atmosphere 4. The vent opening port is downward
Cover material over the geotextile fabric	Soil that will provide frost protection, prevent erosion and excess precipitation or runoff infiltration and allow air to enter the distribution cell
Installation inspection	In accordance with ch. SPS 383, Wis. Adm. Code
Management	In accordance with ch. SPS 383, Wis. Adm. Code and this manual

II. DEFINITIONS

Definitions not found in this section, are located in ch. SPS 381 of the Wisconsin Administrative Code or the terms use the standard dictionary definition.

A. A42 is a 24”wide by 48” long and 7” high unit made of cuspated core and geotextile fabric.

B. B43 is a 36” wide by 48” long and 7” high unit made of cuspated core and geotextile fabric.

C. “Product” means one GSF unit (A42 or B43), manufactured by Eljen Corporation.

D. “Septic tank effluent pump system” means a septic tank which has a pump installed in the tank that will pump effluent from the clear zone.

E. “Site plan” means a scaled or completely dimensioned drawing, drafted by hand or computer aided technology, presented in a permanent form that shows the relative locations of setback encumbrances to a regulated object. The site plan also includes a reference to north and the permanent vertical and horizontal reference point or benchmark.

III. DESCRIPTION AND PRINCIPLE OF OPERATION

POWTS in-ground component operation is a two-stage process involving both wastewater treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the product and in situ soil. The physical characteristics of the influent wastewater, influent loading rate, temperature, and the nature of the receiving fill material and in situ soil affect these processes.

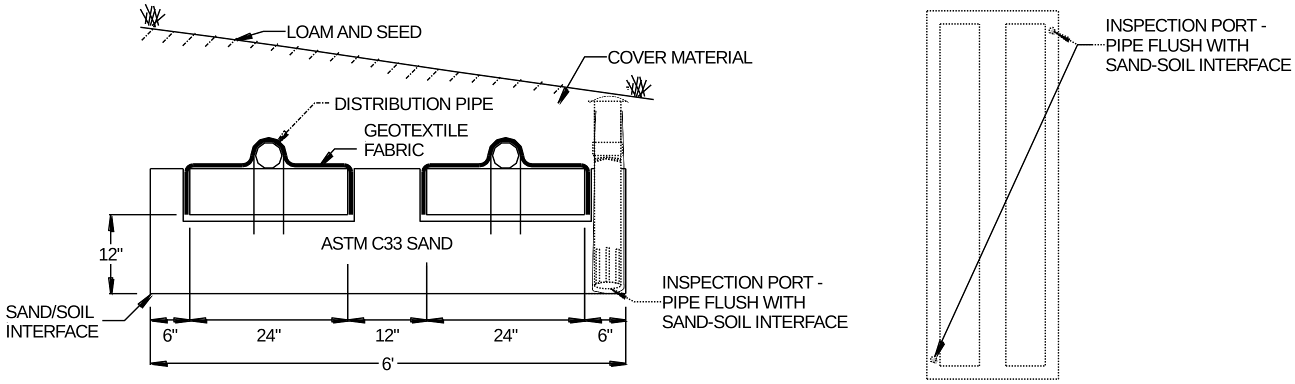
Physical entrapment, increased retention time, and conversion of pollutants in the wastewater are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the wastewater are eventually deactivated through filtering, retention, and absorption by in situ soil.

Dispersal is primarily affected by the depth of the unsaturated receiving soil, the soil’s hydraulic conductivity, influent application rate, land slope and the area available for dispersal.

The in-ground GSF System consists of a distribution cell and cover material. Influent is dispersed into the GSF unit where it flows through the system and undergoes biological, chemical and physical treatment and then passes into the underlying soil for further treatment and dispersal to the environment.

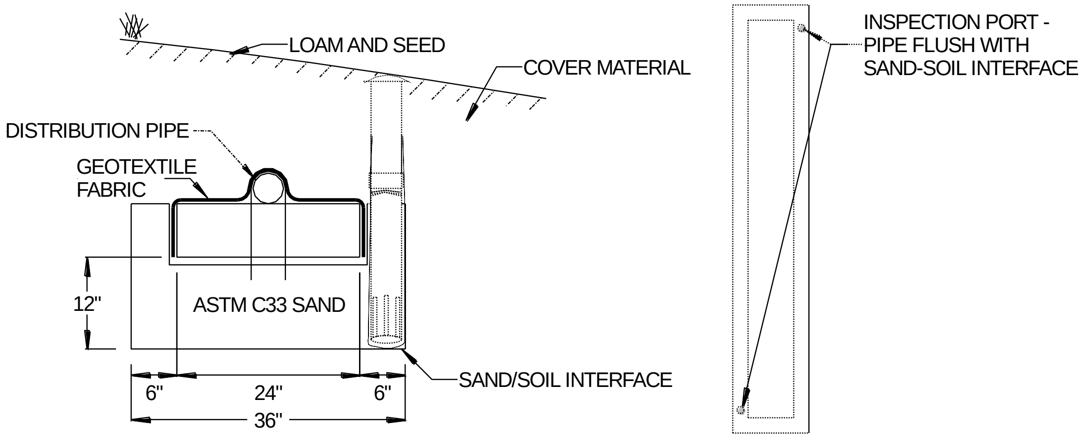
Cover material consisting of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange. See Figures 1 & 2.

The in situ soil serves within the dispersal zone and provides for final dispersal of the effluent.



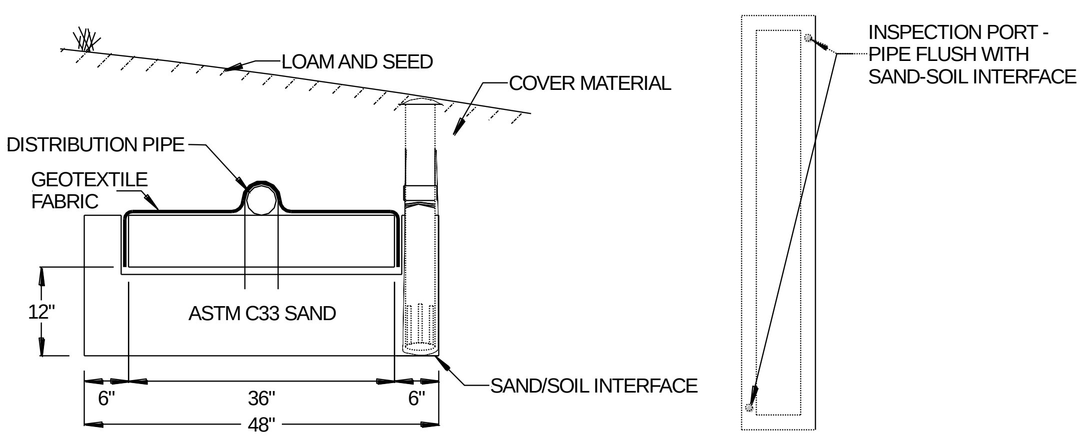
*All inspection ports require anchoring, see the Observation Port section for more info.

Figure 4. A cross section of a 2 rows of A42 modules



*All inspection ports require anchoring, see the Observation Port section for more info.

Figure 5. A cross-section of an in-ground A42 GSF System with a single lateral



*All inspection ports require anchoring, see the Observation Port section for more info.

Figure 6. A cross-section of an in-ground B43 GSF System with a single lateral

IV. SOIL AND SITE REQUIREMENTS

Every GSF in-ground design is ultimately matched to the given soil and site.

The design approach presented in this manual is based on criteria that all applied wastewater is successfully transported away from the system, that it will not affect subsequent wastewater additions, and that the effluent is ultimately treated.

A. Minimum Soil Depth Requirements - The minimum soil factors required for successful in-ground GSF system performance are listed in the introduction and specification section of this manual.

Soil evaluations must be in accordance with ch. SPS 385 of the Wis. Adm. Code. In addition, soil application rates and depths must be in accordance with ch. SPS 383 of the Wis. Adm. Code.

B. Other Site Considerations -

1. In-ground GSF location - In open areas, exposure to sun and wind increases the assistance of evaporation and transpiration in the dispersal of the wastewater.
2. Sites with trees and large boulders - Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing a in-ground system because of difficulty in preparing the distribution cell. Areas that are occupied with rock fragments, tree roots, stumps and boulders reduce the amount of soil available for proper treatment. If no other site is available, trees in the distribution cell must be removed.
3. Setback distances - The setbacks specified in ch. SPS 383, Wis. Adm. Code for soil subsurface treatment/dispersal component apply to in-ground systems. The distances are measured from the edge of the distribution cell area.

V. COVER MATERIAL

The cover material is a soil that will allow air exchange while promoting plant growth. The gas exchange will increase the treatment performance of the system by providing oxygen to the wastewater to help ensure aerobic conditions in the system. The plant growth will provide frost protection in the winter season. Clays may not be used for cover material, as they will restrict oxygen transfer. Often, excavated soil from the site can be used.

VI. DESIGN

A. Location, Size and Shape

Placement, sizing and geometry of the distribution cell must be in accordance with this component manual.

B. Component Design

Design of the GSF system is based upon the design wastewater flow and the soil characteristics. It must be sized such that it can accept the daily wastewater flow without causing surface seepage or groundwater pollution. Consequently, the surface area of dispersal zone, which is the in situ soil area beneath the component, must be sufficiently large enough to absorb the applied effluent into the underlying soil. The GSF must also be designed to avoid encroachment of the water table into the required minimum unsaturated zone.

Design of the GSF includes the following three steps: (A) calculating design wastewater flow, (B) calculating soil infiltration area, and (C) design of the distribution cell. Each step is discussed below.

Step A. Design Wastewater Flow Calculations

One and two-family dwellings. Distribution cell size for one and two-family dwelling application is determined by calculating the design wastewater flow (DWF). To calculate DWF use Group 1, 2 or 3. Group 1 is for combined wastewater flows, which consist of blackwater, clearwater and graywater. Group 2 is for only clearwater and graywater. Group 3 is for blackwater only.

Group 1	Group 2	Group 3
Combined wastewater	Clearwater & Graywater	Blackwater
DWF = 150 gal/day/bedroom	DWF = 90 gal/day/bedroom	DWF = 60 gal/day/bedroom

Public Facilities. Distribution cell size for public facilities application is determined by calculating the DWF using Formula 2. Only facilities identified in Table 4 are included in this manual. Estimated daily wastewater flows are determined in accordance with Table 4 or s. 383.43(6), Wis. Adm. Code. Many commercial facilities have high BOD5, TSS and FOG (fats, oils and grease), which must be pretreated in order to bring their values down to an acceptable range before entering into the GSF system described in this manual.

Formula 1

DWF = Sum of each estimated wastewater flow per source per day x 1.5

Where 1.5 = Conversion factor to convert estimated wastewater flow to design wastewater flow

Table 4 Public Facility Wastewater Flows		
Source	Unit	Estimated Wastewater Flow (gpd)
Apartment or Condominium	Bedroom	100
Assembly hall (no kitchen)	Person (10 sq. ft./person)	1.3
Bar or cocktail lounge (no meals served)	Patron (10 sq. ft./patron)	4
Bar or cocktail lounge* (w/meals – all paper service)	Patron (10 sq. ft./patron)	8
Beauty salon	Station	90
Bowling alley	Bowling lane	80
Bowling alley (with bar)	Bowling lane	150
Camp, day and night	Person	25
Camp, day use only (no meals served)	Person	10
Campground or Camping Resort	Space, with sewer connection and/or service building	30
Campground sanitary dump station	Camping unit or RV served	25
Catch basin	Basin	65
Church (no kitchen)	Person	2
Church* (with kitchen)	Person	5
Dance hall	Person (10 sq. ft./person)	2
Day care facility (no meals prepared)	Child	12
Day care facility* (with meal preparation)	Child	16
Dining hall* (kitchen waste only without dishwasher and/or food waste grinder)	Meal served	2
Dining hall* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Meal served	5
Dining hall* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Meal served	7
Drive-in restaurant* (all paper service with inside seating)	Patron seating space	10
Drive-in restaurant* (all paper service without inside seating)	Vehicle space	10
Drive-in theater	Vehicle space	3
Employees (total all shifts)	Employee	13
Floor drain (not discharging to catch basin)	Drain	25
Gas station / convenience store	Patron (minimum 500 patrons)	3
Gas station (with service bay) Patron Service bay	 Patron Service bay	 3 50
Hospital*	Bed space	135
Hotel, motel or tourist rooming house	Room	65
Medical office building Doctors, nurses, medical staff Office personnel Patients	 Person Person Person	 50 13 6.5
Migrant labor camp (central bathhouse)	Employee	20
Mobile Home (Manufactured home) (served by its own POWTS)	Bedroom	100
Mobile home park	Mobile home site	200

* = May be high strength waste

Table 4 Public Facility Wastewater Flows (continued)		
Source	Unit	Estimated Wastewater Flow (gpd)
Nursing, Rest Home, Community Based Residential Facility	Bed space	65
Outdoor sport facilities (toilet waste only)	Patron	3.5
Parks (toilets waste only)	Patron (75 patrons/acre)	3.5
Parks (toilets and showers)	Patron (75 patrons/acre)	6.5
Public shower facility	Shower taken	10
Restaurant*, 24-hr. (dishwasher and/or food waste grinder only)	Patron seating space	4
Restaurant*, 24-hr. (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	12
Restaurant, 24-hr. (toilet waste)	Patron seating space	28
Restaurant*, 24-hr. (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	40
Restaurant*, 24-hr. (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	44
Restaurant* (dishwasher and/or food waste grinder only)	Patron seating space	2
Restaurant* (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	6
Restaurant (toilet waste)	Patron seating space	14
Restaurant* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	20
Restaurant* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	22
Retail store	Patron (70% of total retail area ÷ 30 sq. ft. per patron)	1
School* (with meals and showers)	Classroom (25 students/classroom)	500
School* (with meals or showers)	Classroom (25 students/classroom)	400
School (without meals or showers)	Classroom (25 students/classroom)	300
Self-service laundry (toilet waste only)	Clothes washer	33
Self-service laundry (with only residential clothes washers)	Clothes washer	200
Swimming pool bathhouse	Patron	6.5

* = May be high strength waste

Step B. <u>Sizing of the Distribution Cell Area</u>

The required distribution cell area is based on the design wastewater flow and the slowest soil application rate of the in situ soil at the infiltrative surface or a lower horizon adversely affects the dispersal of wastewater in accordance with s. SPS 383.44 (4) (a) and (c). Wastewater application rates to the soil are found in ch. SPS 383, Table 383.44-2, Wisconsin Admin Code.

Using the above information, the required distribution cell area can be determined using the following formula:

Area = design wastewater flow ÷ application rate of the in situ soil in accordance with s. SPS 383.44 (4) (a) and (c), Wisconsin Administrative Code. Note: This area may include the area of more than on distribution cell.

Step C. <u>Component Configuration</u>

The maximum distribution cell width is six feet. The maximum length and width of the distribution cell is dependent on setback requirements of s. SPS Table 383.43-1, Wisconsin Administrative Code, and the soil evaluations results.

Where possible, on sloping sites the distribution cell is aligned with its longest dimension parallel to the land surface contours so as not to concentrate the effluent into a small area as it moves vertically and horizontally down slope.

Distribution Cell Height

The distribution cell height provides effluent treatment and support of the piping within the distribution cell. The height of the product is seven inches high. With the ASTM C33 sand it is a minimum 19 inches high which provides a minimum space of 12 inches beneath the unit. See Figure 7.

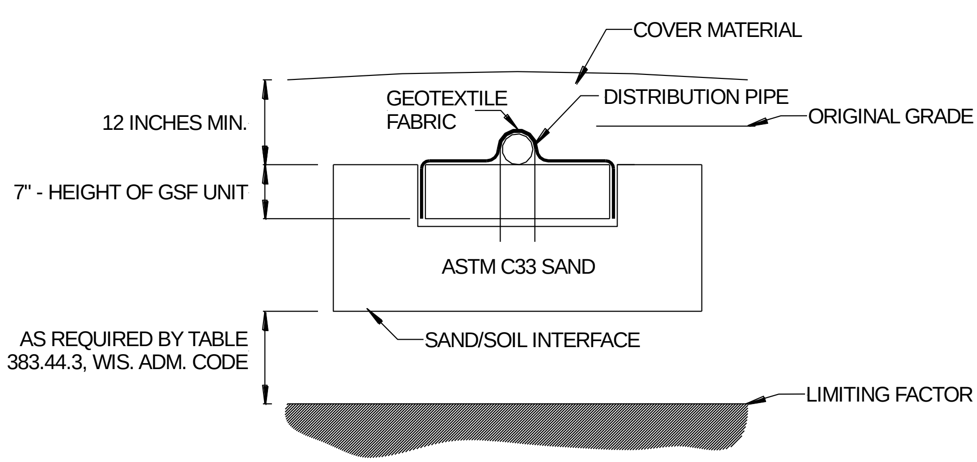


Figure 7. Height of system using GSF Units

Cover Material

A minimum of 12 inches of cover material must be placed over the top of the unit. Finished grade of the cover material must be at or above the surrounding land surface elevation. Depressional areas over the distribution cell that collect and retain surface water runoff must be avoided.

Distribution Network and Dosing Component

The effluent application to the distribution cell may be by gravity or pressure. Distribution boxes or drop boxes may be used to distribute effluent to gravity feed distribution cells. Distribution piping for a gravity component has a nominal inside diameter of 4 inches. The distribution header is non-perforated pipe. The slope of gravity flow perforated distribution piping is less than or equal to 4 inches per 100 feet away from distribution boxes, drop boxes or header. When a drop box design wastewater flow per day by is used, the invert of the drop box overflow pipe must be at least 4 inches lower than the invert of the treatment tank outlet or force main connection.

The design and installation of distribution boxes must be watertight and capable of providing a means of providing equal distribution of effluent to each distribution cell. Drop boxes must be watertight and capable of distributing effluent to another distribution cell.

Components that are designed to receive a DWF greater than 1500 gal/day, dose the effluent to the distribution cell by means of a pump or siphon. The dose chamber shall contain sufficient volume to dose the distribution cell as required by its system design, retain drain back volume, contain a one day reserve zone, provide a minimum 2 inch separation between alarm activation and pump-on activation, and allow for protection of the pump from solids.

Drain back volumes can be calculated based on values listed in Table 5.

Table 5
VOID VOLUME FOR VARIOUS DIAMETER PIPES BASED ON NOMINAL I.D.[a]

Nominal Pipe Size	Gallons per Foot
1-1/4	0.064
1-1/2	0.092
2	0.163
3	0.367
4	0.65
6	1.469

Note a: Table is based on - $\pi(d/2)^2$ x 12”/ft ÷ 231 cu.in./cu.ft.
Where: d = nominal pipe size in inches

A reserve capacity is required on a system with only one pump. The reserve volume must be equal to or greater than the estimated daily wastewater flow. Reserve capacity may be calculated using 100 gallons per bedroom per day for one and two family residences or the values computed by using Table 4.

The dose volume shall be included in the sizing of the dose chamber. (Volume of a septic tank effluent pump system is determined by department plumbing product approval.)

The pump alarm activation point must be at least 2 inches above the pump activation point.

Allow “dead” space below the pump intake to permit settling of solids in the dose chamber. This can be accomplished by placing the pump on concrete blocks or other material that can form a pedestal.

The pump manufacturer’s requirements shall be followed. This may include the “pump off” switch being located high enough to allow for complete immersion of the pump in the dose chamber.

GSF distribution pipe tops are at or below the original grade. GSF units are placed directly on top of the ASTM C33 sand. See Figures 1, 2 and 3 for proper positioning of the units in the trench.

Observation Pipes

Observation pipes are installed in each distribution cell and are provided with a means of anchoring to prevent them from being lifted up. Acceptable methods include placing a bar through the observation pipe as depicted below and using a flange fitting at the base of the observation port. Observation pipes extend from the sand/soil interface to a point at or above finish grade. The portion of the observation pipe below the distribution pipe is slotted while the portion above the unit is solid wall. All observation piping has a nominal pipe size of 4 inches. See Figure 8.

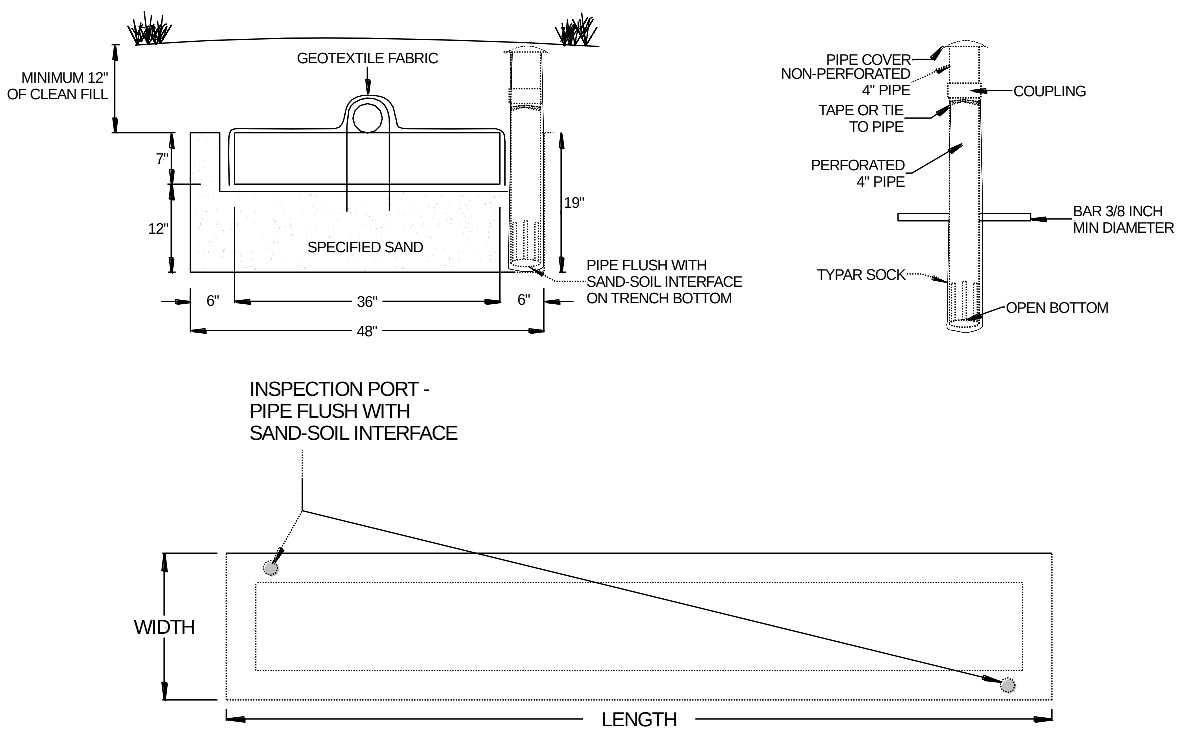


Figure 8. Observation pipes

Vent Pipes

Vent pipes, if installed, connect to the upper half of the gravity flow distribution laterals and extend up to at least 12 inches above finish grade. Vent pipes terminate with the vent opening facing downward by the means of a vent cap or fittings. Vent caps must allow a free flow of air between the distribution lateral and the atmosphere. All vent pipes has a nominal pipe size of 4 inches.

When a vent pipe is connected to an observation pipe, the point of connection shall be made at a point above the module and terminate as required for vent pipes.

An observation pipe may serve as a combination observation/vent pipe providing it terminates in the same manner as required for vent pipes. See Figure 9.

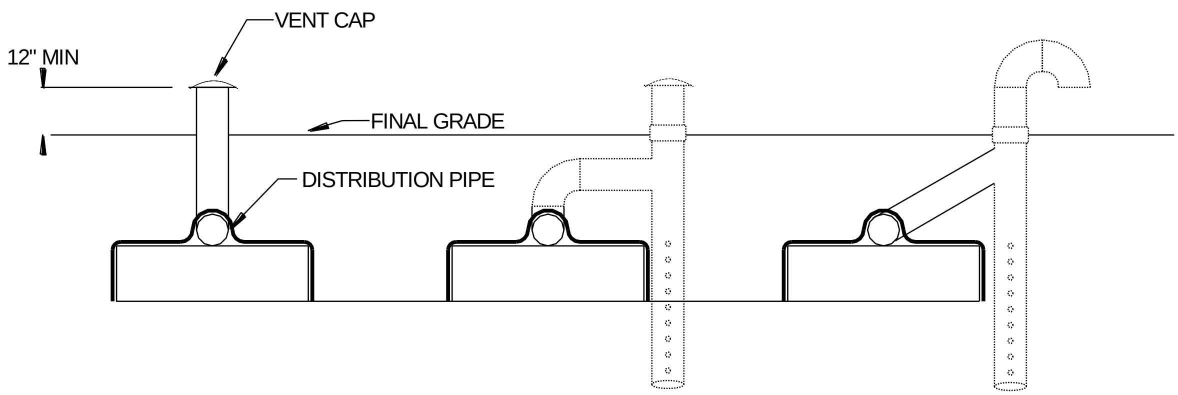


Figure 9. Vent and combination observation/vent pipes

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of a in-ground GSF system are just as critical as the design of the component. A good design with poor construction results in system failure. It is emphasized that the soil only be worked when it is not frozen and the moisture content is low to avoid compaction and smearing. Consequently, installations are to be made only when the soil is dry enough to prevent compaction and smearing of the infiltrative surface. The construction plan to be followed includes:

A. Equipment - Proper equipment is essential. Track type equipment that will not compact the infiltrative surface. Minimize foot traffic and avoid equipment traffic over the infiltrative surface.

B. Sanitary Permit - Prior to the construction of the system, a sanitary permit, obtained for the installation must be posted in a clearly visible location on the site. Arrangements for inspection(s) must also be made with the department or governmental unit issuing the sanitary permit.

C. Construction Procedures

1. Check the moisture content and condition of the soil. If the soil at the infiltrative surface can be rolled into a 1/4-inch wire, the site is too wet, smearing and compaction will result, thus reducing the infiltrative capacity of the soil. If the site is too wet, do not proceed until it dries out. If the soil at or below the infiltrative surface is frozen, do not proceed.

2. Set up a construction level or similar device and determine all relative elevations in relationship to the bench mark. It is necessary to determine the bottom elevation of the distribution cell, land surface contour lines, and approximate component elevations critical to the installation.

3. Lay out the absorption area within the designated area. Where possible lay out the absorption areas(s) on the site so that the distribution cell runs parallel with the land surface contours.

Reference stakes offset from the corner stakes are recommended in case corner stakes are disturbed during construction.

4. Excavate the distribution cell(s) to the correct bottom elevation(s) taking care not to smear the infiltrative surface. If the infiltrative surface or sidewalls are smeared, loosen it with the use of a rake or similar device.

5. Install observation pipes with the bottom 19 inches of the pipe slotted. Installation of the observation pipe includes a suitable means of anchoring so the pipes are not dislodged during inspections. Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance. Flexibility in location allows that observation pipes: be located such that there are a minimum of two installed in each dispersal cell at opposite ends from one another; be located near the dispersal cell ends; placed alongside the GSF unit; and be installed at an elevation to view the sand soil interface.

6. Install the GSF units in accordance with the manufacturer's installation instructions.
   a. Place ASTM C33 sand in two 6 inch lifts into the distribution cell and stabilize the sand.
   b. Place the GSF Modules end to end on top of the specified sand along their 4-foot length, PAINTED STRIPE FACING UP.
   c. Set up the distribution system.
      a. Gravity Installations - A standard 4-inch perforated pipe, meeting Wisconsin Admin Code, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock positions. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
      b. Pressure Installations - A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock positions. Insert a low pressure pipe (LPP) into the standard 4-inch perforated pipe. The LPP orifices are set at the 12 o'clock position. All 4-inch pipes are secured to the modules with manufacturers supplied wire clamps, one per module. Orifice shields are also permitted on the pressure distribution pipe, one per module.
   d. Install vent pipe, if one is to be installed as prescribed in Table 3.
   e. Spread Eljen cover fabric lengthwise over the pipe and drape over the sides of the GSF module rows. Secure in place with Specified Sand between and along the sides of the modules. Avoid blocking holes in perforated pipe by placing the cover fabric over the pipe prior to placing fill over the modules.
   f. Place 6 inches minimum of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each row.
   g. Complete backfill with topsoil, 12 inches minimum of cover over the GSF modules. Backfill exceeding 18 inches requires venting at the distal end of the system. Fill must be clean, porous and devoid of rocks. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff. Finish grade to prevent surface ponding. Use backfill material that is soil suitable for the growth of vegetation, and be seeded to control erosion.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The GSF system owner is responsible for the operation and maintenance of the component. The county, department or POWTS service contractor may make periodic inspections of the components, checking for surface discharge, effluent levels, etc.

The owner or owner's agent is required to submit necessary maintenance reports to the appropriate jurisdiction and/or the department.

B. Design approval and site inspections before, during, and after the construction are accomplished by the county or other appropriate jurisdictions in accordance to ch. SPS 383 of the Wis. Adm. Code.

C. Routine and preventative maintenance aspects:

   1. Septic and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.

   2. The effluent filter on shall be cleaned as required.

   3. Inspections of the in-ground GSF system performance are required at least once every three years. These inspections include checking the liquid levels in the observation pipes and examination for any seepage around the GSF system.

   4. Winter traffic on the soil absorption system is not advised to avoid frost penetration and to minimize compaction.

   5. A good water conservation plan within the house or establishment will help assure that the GSF system will not be overloaded.

D. User's Manual: A user's manual is to accompany the GSF system. The manual is to contain the following as a minimum:

   1. Diagrams of all components and their location. This should include the location of the reserve area, if one is provided.

   2. Names and phone numbers of local health authority, component manufacturer or POWTS service contractor to be contacted in the event of component failure or malfunction.

   3. Information on the periodic maintenance of the component, including electrical/mechanical components.

   4. Information on limited activities on reserve area if provided.

E. Performance monitoring must be performed on GSF systems installed under this manual.

   1. The frequency of monitoring must be:

      a. At least once every three years following installation and,
      b. At time of problem, complaint, or failure.

   2. The minimum criteria addressed in performance monitoring of GSF systems are:

      a. Type of use.
      b. Age of system.
      c. Nuisance factors, such as odors or user complaints.

d. Mechanical malfunction within the system including problems with valves or other mechanical or plumbing components.
e. Material fatigue or failure, including durability or corrosion as related to construction or structural design.
f. Neglect or improper use, such as exceeding the design rate, poor maintenance of vegetative cover, inappropriate cover over the system, or inappropriate activity over the system.
g. Installation problems such as compaction or displacement of soil, improper orientation or location.
h. Pretreatment component maintenance, including dosing frequency, structural integrity, groundwater intrusion or improper sizing.
i. Dose chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.
j. Distribution piping network, including improper maintenance or improper sizing.
k. Ponding in distribution cell, prior to the pump cycle, is evidence of development of a clogging mat or reduced infiltration rates.
l. Siphon or pump malfunction including dosing volume problems, pressurization problems, breakdown, burnout, or cycling problems.
m. Overflow/seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.

3. Reports are to be submitted in accordance with ch. SPS 383, Wis. Adm. Code.

IX. REFERENCES

R.J. Otis, G.D. Plews and D.H. Patterson. "Design of Conventional Soil Absorption Trenches and Beds." In: Home Sewage Treatment, Proceeding of the Second National Home Sewage Treatment Symposium, ASAE Publication 5-77.

United States EPA, EPA 625/1-80-012, October 1980. "Design Manual – Onsite Wastewater Treatment and Disposal Systems."

X. GSF IN-GROUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.

Slope - _____%

Occupancy – One or Two-Family Dwelling - _______ (# of bedrooms)

Public Facility - _________ gal/day (Estimated wastewater flow)

Depth to limiting factor - ________inches

Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code - __________ inches

In situ soil application rate used - _________ gal/ft^2/day

FOG value of effluent applied to component - ___________ mg/L

Treated Effluent from Component

BOD_5 value of effluent leaving the component - $\leq$ 30 TSS mg/L TSS

value of effluent leaving the component - $\leq$ 30 mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100ml _X_ No

Product(s) to be installed in one laying length of distribution cell -

Table 2c
APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE

Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

B. DESIGN WASTEWATER FLOW (DWF)

<u>One or Two-family Dwelling.</u>

Combined wastewater flow:

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x _____# of bedrooms

= _______ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Public Facilities.

DWF = Estimated wastewater flow x 1.5

= ___________ gal/day x 1.5

= ___________ gal/day

C. DESIGN OF THE GSF SECTION DISTRIBUTION CELL

1. Determine the design loading rate (DLR) for the site.

   From Table 383.44-1 or-2, Wis. Adm. Code, select the soil application rate for the most restrictive soil horizon at the infiltrative surface or a lower horizon if the lower horizon adversely affects the dispersal of wastewater in accordance with s. SPS 383.44 (4) (a) and (c). The design loading rate (DLR) is the soil application rate selected from Table 383.44-1 or-2, Wis. Adm. Code, unless the component consists of products that have been recognized through s. SPS 384.50, Wis. Adm. Code, as having a different soil application rate.

   DLR = _________ gpd/ft^2

2. Total size of the Distribution cell(s) area

   Calculate the distribution cell area by dividing the daily design wastewater flow (DWF) by the design loading rate (DLR).

   Distribution cell area = DWF ÷ DLR
   Distribution cell area = ______ gpd ÷ _______ gpd/ft^2
   Distribution cell area = ______ ft^2

3. The product selected determines the minimum trench width.

Table 2c APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE				
Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60"	48"	19"
B43	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60"	48"	19"
	24 square feet per unit	72"	48"	19"

A = ______ ÷ 12 in/ft = ________ ft

4. Determine the total distribution cell length.

Calculate the total distribution cell length (B) by dividing the required distribution area by the distribution cell width (A).

B = Distribution cell area ÷ A
B = _______ ft^2 ÷ ______ ft
B = _______ ft

Final Dimensions = A, B
_______ft, _____ft

XI. EXAMPLE GSF IN-GROUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.

Slope - _____%

Occupancy – One or Two-Family Dwelling - __4____ (# of bedrooms)

Public Facility - _________ gal/day (Estimated wastewater flow)

Depth to limiting factor - __60____inches

Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code - _____36___ inches

In situ soil application rate used - ___0.8____ gal/ft^2/day

FOG value of effluent applied to component - ___20______ mg/L

Treated Effluent from Component

BOD$_5$ value of effluent leaving the component - $\leq$ 30 TSS mg/L TSS

value of effluent leaving the component - $\leq$ 30 mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100ml _X_ No

Product(s) to be installed in one laying length of distribution cell -

Table 2c
APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE

Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

B. DESIGN WASTEWATER FLOW (DWF)

<u>One or Two-family Dwelling.</u>

Combined wastewater flow:

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x __4___# of bedrooms

= __600___ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Public Facilities.

DWF = Estimated wastewater flow x 1.5

= ___________ gal/day x 1.5

= ___________ gal/day

C. DESIGN OF THE GSF SECTION DISTRIBUTION CELL

4. Determine the design loading rate (DLR) for the site.

   From Table 383.44-1 or-2, Wis. Adm. Code, select the soil application rate for the most restrictive soil horizon at the infiltrative surface or a lower horizon if the lower horizon adversely affects the dispersal of wastewater in accordance with s. SPS 383.44 (4) (a) and (c). The design loading rate (DLR) is the soil application rate selected from Table 383.44-1 or-2, Wis. Adm. Code, unless the component consists of products that have been recognized through s. SPS 384.50, Wis. Adm. Code, as having a different soil application rate.

   DLR = ___0.8______ gpd/ft^2

5. Total size of the Distribution cell(s) area

   Calculate the distribution cell area by dividing the daily design wastewater flow (DWF) by the design loading rate (DLR).

   Distribution cell area = DWF ÷ DLR
   Distribution cell area = ___600___ gpd ÷ __0.8_____ gpd/ft^2
   Distribution cell area = ___750___ ft^2

3. The product selected determines the minimum trench width.

Table 2c APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE				
Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

A = ___36___ ÷ 12 in/ft = ___3_____ ft

4. Determine the total distribution cell length.

Calculate the total distribution cell length (B) by dividing the required distribution area by the distribution cell width (A).

B = Distribution cell area ÷ A
B = ___750____ ft^2 ÷ ___3___ ft
B = ___250____ ft

Final Dimensions = A, B
______3__ft, _250____ft

XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal

In order to install a system correctly, it is important to develop plans that will be used to install the system correctly the first time. The following checklist may be used when preparing plans for review. The checklist is intended to be a **general guide**. Not all needed information may be included in this list. Some of the information may not be required to be submitted due to the design of the system. Conformance to the list is not a guarantee of plan approval. Additional information may be needed or requested to address unusual or unique characteristics of a particular project. Contact the reviewing agent for specific plan submittal requirements, which the agency may require that are different than the list included in this manual.

General Submittal Information

- Photocopies of soil report forms, plans, and other documents are acceptable. However, an original signature is required on certain documents.
- Submittal of additional information requested during plan review or questions concerning a specific plan must be referenced to the Plan Identification indicator assigned to that plan by the reviewing agency.
- Plans or documents must be permanent copies or originals.

Forms and Fees

- Application form for submittal, provided by reviewing agency along with proper fees set by reviewing agent.

Soils Information

- Complete Soils and Site Evaluation Report (form # SBD-8330) for each soil boring described; signed and dated by a certified soil tester, with license number.
- Separate sheet showing the location of all borings. The location of all borings and backhoe pits must be able to be identified on the plot plan.

Documentation

- Architects, engineers or designers must sign, seal and date each page of the submittal or provide an index page, which is signed, sealed and dated.
- Master Plumbers must sign, date and include their license number on each page of the submittal or provide an index page, which is signed, sealed and dated.
- Three completed sets of plans and specifications (clear, permanent and legible); submittals must be on paper measuring at least 8-1/2 by 11 inches.
- Designs that are based on department approved component manual(s) must include reference to the manual by name, publication number and published date.

Plot Plan

- Dimensioned plans or plans drawn to scale (scale indicated on plans) with parcel size or all property boundaries clearly marked.
- Slope directions and percent in system area.
- Bench mark and north arrow.
- Setbacks indicated as per appropriate code.
- Two-foot contours or other appropriate contour interval within the system area.
- Location information; legal description of parcel must be noted.

- Location of any nearby existing system or well.

Plan View

- Dimensions for distribution cell(s).
- Location of observation pipes and vent pipes if required.
- Pipe lateral layout, which must include the number of laterals, pipe material, diameter and length; and number, location and size of orifices.
- Distribution boxes, drop boxes, manifold and force main locations, with materials, length and diameter of all pipes.

Cross Section of System

- Lateral elevation, position of observation pipes, dimensions of distribution cell, and type of cover material such as geotextile fabric, if applicable.
- Distribution cell details
- Minimum and maximum depths of top of the GSF unit below original and final grades.

System Sizing

- For one and two-family dwellings, the number of bedrooms must be included.
- For public buildings, the sizing calculations must be included.

Tank And Pump or Siphon Information

- Cross-section and all construction details for site-constructed tanks.
- Size, model and manufacturer information for prefabricated tanks.
- Notation of pump or siphon model, pump performance curve, friction loss for force main and calculation for total dynamic head.
- Notation of alarm manufacturer and model number.
- Cross section of dose tank / chamber to include storage volumes; connections for piping, vents, and power; pump "off" setting; dosing cycle and volume, high water alarm setting, and storage volume above the highwater alarm; and location of vent and manhole.

B. Inspections

Inspection shall be made in accordance with ch. 145.20, Wis. Stats. and s. SPS 383.26, Wis. Adm. Code. The inspection form on the following two pages may be used. The inspection of the system installation and/or plans is to verify that the system at least conforms to specifications listed in Tables 1 - 3 of this manual.

XIII. POWTS INSPECTION REPORT

(ATTACH TO PERMIT)

GENERAL INFORMATION

Permit Holder's Name	☐ City ☐ Village ☐ Town of	County	Sanitary Permit No.
State Plan ID No.	Tax Parcel No.	Property Address if Available	

TREATMENT COMPONENT INFORMATION			**SETBACKS (FT)**				
TYPE	MANUFACTURER AND MODEL NUMBER	CAPACITY	P/L	WELL	WATER LINE	BLDG.	VENT
SEPTIC							
DOSING							
AERATION							
HOLDING							
FILTER							

PUMP / SIPHON INFORMATION

Manufacturer:	Model No.	Demand in GPM	TDH - Design

FORCE MAIN INFORMATION			**FRICTION LOSS (FT)**			
Length	Diameter	Dist. To Well	Component Head	Force Main Losses	Vert. Lift	TDH - As Built

SOIL ABSORPTION COMPONENT

TYPE OF COMPONENT:				COVER MATERIAL:		
Cell Width	Cell Length	Cell Depth	Cell Spacing	No. of Cells		
UNIT		Manufacturer: Eljen Corporation			Model No.	
SETBACK INFO. (FT)	Property Line	Bldg.	Well		Water Line	

DISTRIBUTION COMPONENT

Elevation data on back of form

Header / Manifold		Distribution Lateral(s)			Orifice size	Orifice Spacing	Obs. Pipes Inst. & No.
Length	Dia.	Length	Dia.	Spacing			

SOIL COVER

Depth over center of cell:	Depth over edge of cell:	Depth of Cover material	Texture	Seeded / Sodded	Mulched

DEVIATIONS FROM APPROVED PLAN

DATE OF INST. DIRECTIVE:	DATE OF ENFORCEMENT ORDER:
DATE OF REFERRAL TO LEGAL COUNSEL:	

COMMENTS (Persons present, discrepancies, etc.)

COMPONENTS NOT INSPECTED

Plan Revision Required ☐ Yes ☐ No	Date:	Signature of Inspector:	Cert. Number

Sketch on other side

ELEVATION DATA

Point	Back sight	Height of instrument	Foresight	Elevation	Comments
Bench mark					
Bldg. Sewer					
Tank inlet					
Tank outlet					
Tank inlet					
Tank outlet					
Dose tank					
Bottom of dose					
Dist. lateral 1					
System elev. 1					
Dist. lateral 2					
System elev. 2					
Dist. lateral 3					
System elev. 3					
Grade elev. 1					
Grade elev. 2					
Grade elev. 3					

SKETCH OF COMPONENT & ADDITIONAL COMMENT

GSF MOUND

COMPONENT MANUAL

May 2017

Table of Contents Page

Published by:
Eljen Corporation
125 McKee St.
East Hartford, CT 06108

This component manual was produced exclusively by Eljen Corporation for use with Eljen GSF products. This manual is based upon the "Mound Component Manual for Onsite Wastewater Treatment Systems" Ver. 2.0, Jan. 30, 2001, by the State of Wisconsin, Department of Safety and Professional Services.

Eljen Corporation reserves the right to revise this component manual according to changes in regulations or Eljen GSF system installation instructions.

I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for an GSF mound component. However, these items must accompany a properly prepared and reviewed plan acceptable to the governing unit to help provide a system that can be installed and function properly. Violations of this manual constitute a violation of chs. SPS 383 and 384, Wis. Adm. Code. The mound component must receive influent flows and loads less than or equal to those specified in Table 1. When designed, installed and maintained in accordance with this manual, the mound component provides treatment and dispersal of domestic wastewater in conformance with ch. SPS 383 of the Wis. Adm. Code. Final effluent characteristics will comply with s. SPS 383.41, Wis. Adm. Code when inputs are within the range specified in Tables 1 to 3.

Note: Detailed plans and specifications must be developed, and submitted to be reviewed and approved by the governing unit having authority over the plan for the installation. Also, a Sanitary Permit must be obtained from the department or governmental unit having jurisdiction. See Section XII for more details.

Table 1
Influent Flows and Loads

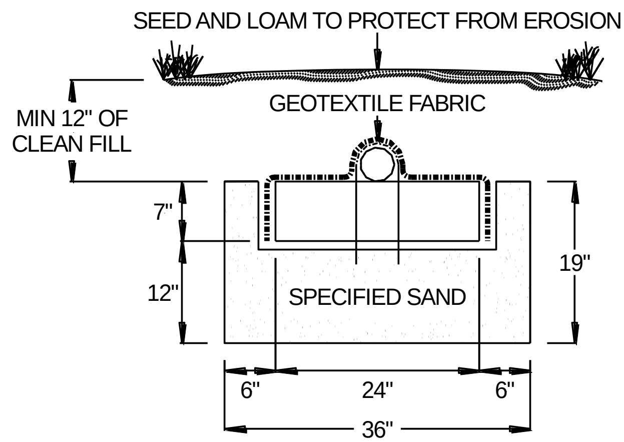
Design Wastewater flow (DWF)	≤ 5000 gal/day
Monthly average value of Fats, Oil and Grease (FOG)	≤ 30 mg/L
Monthly average value of five day Biochemical Oxygen Demand (BOD_5)	≤ 220 mg/L
Monthly average value of Total Suspended Solids (TSS)	≤ 150 mg/L
Design loading rate of fill	≤ 2.0 gal/ft^2/day if BOD_5 and TSS ≤ 30 mg/L
Design loading rate of the basal area	= soil application rate of effluent with maximum monthly average values of BOD_5 and TSS of ≤ 30 mg/L when distribution component receives effluent with a BOD_5 and TSS of ≤ 30 mg/L or when fill material depth is ≥ 12 inches as measured at the D dimension.
Volume of a single dose to absorption component when pumps or siphons are employed in the design	A42 = 3 gallons/dose/unit B43 = 4 gallons/dose/unit
Design wastewater flow (DWF) from one and two-family dwellings	Based on s. SPS 383.43 (3), (4), or (5), Wis. Adm. Code

Table 1 INFLUENT FLOWS AND LOADS (continued)	
Design wastewater flow (DWF) from public facilities	≥ 150% of estimated daily wastewater flow in accordance with Table 4 of this manual or s. SPS 383.43 (6), Wis. Adm. Code
Linear loading rate for systems with in situ soils having a soil application rate of ≤ 0.3 gal/ft^2/day within 12 inches of fill material	≤ 4.5gal/ft/day
Wastewater particle size	≤ 1/8 inch
Distribution cell area per orifice	≤24 ft^2 B43 or ≤ 20 ft^2 A42

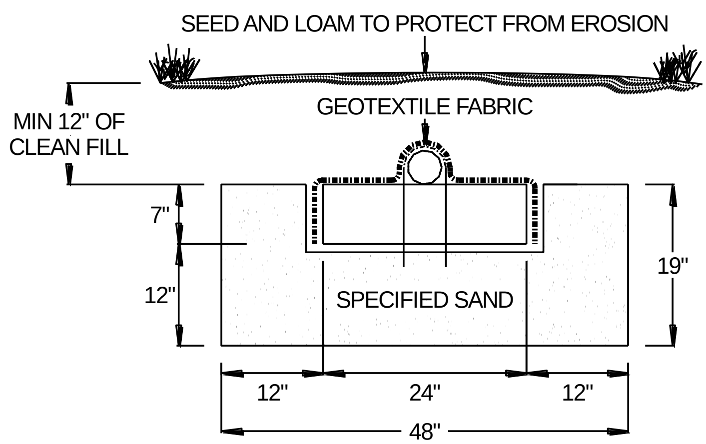
Table 2a SIZE AND ORIENTATION	
Distribution cell width (A)[a]	≤ 10 feet = Number of product rows x product width. Product width is shown in Table 2c; multiple product rows are acceptable
Required # of Products	≥ Design wastewater flow rate ÷ design loading rate of the fill material ÷ square footage of product (shown in Table 2b), round up to nearest whole number; Min 5 B43 units per bedroom or 6 A42 units per bedroom in residential applications
Distribution cell length (B)[a]	Multiple # of Products x 4 ÷ # of Rows + 1
Total distribution cell area (A x B)[a]	A x B
Orientation	Longest dimension parallel to surface grade contours on sloping sites.
Deflection of distribution cell on concave slopes	≤ 10%
Fill material depth at up slope edge of distribution cell (D)[a]	Min. 1 ft of fill material at up slope edge
Distribution cell depth (F)[a]	Product height shown in Table 2b
Depth of cover material at top center of distribution cell area (H)[a]	≥ 12 inches
Depth of cover material at top outer edge of distribution cell area (G)[a]	≥ 6 inches
Basal area	≥ Design wastewater flow rate ÷ Design loading rate of basal area as specified in Table 1
Soil Application Rate	The designer may use Effluent #2 in accordance with s. SPS Table 383.44-1 and 383.44-2, Wis. Adm. Code
Note a: Letter corresponds to letters referenced in figures, formulas and on worksheets.	

Table 2b APPROVED PRODUCT MODEL NUMBERS AND SQUARE FOOTAGE PER PRODUCT				
Product	Square Footage	Product Width with Sand	Product Length	Product Height
A42	12 square feet per unit	36"	48"	7"
B43	16 square feet per unit	48"	48"	7"

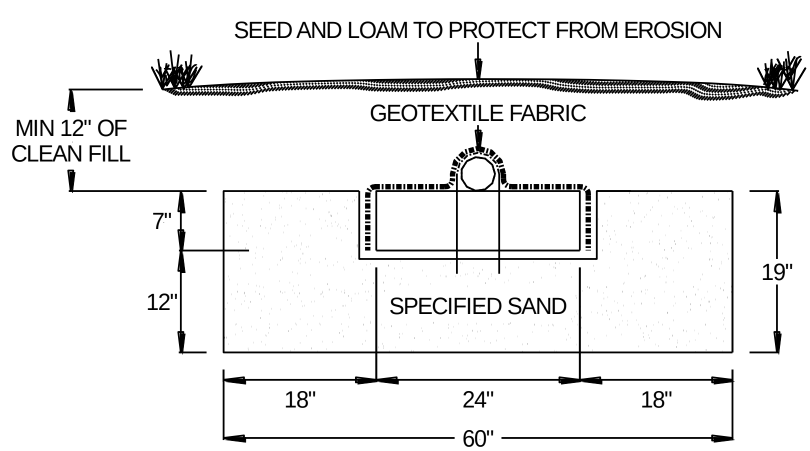
Table 2c APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE				
Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”



A42 WITH 6" OF SAND TO SIDES

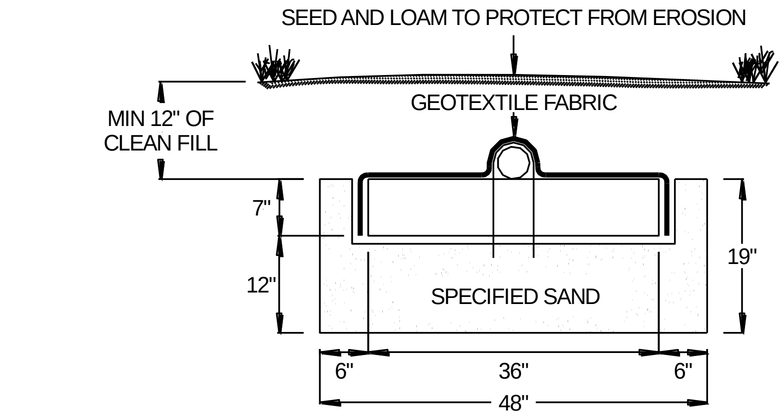


A42 WITH 12" OF SAND TO SIDES

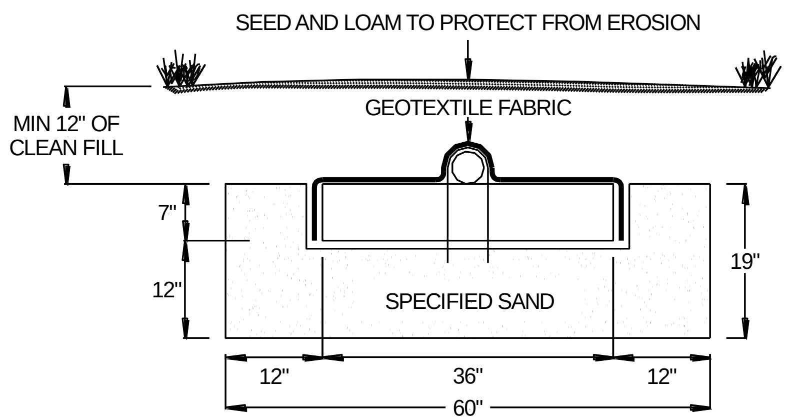


A42 WITH 18" OF SAND TO SIDES

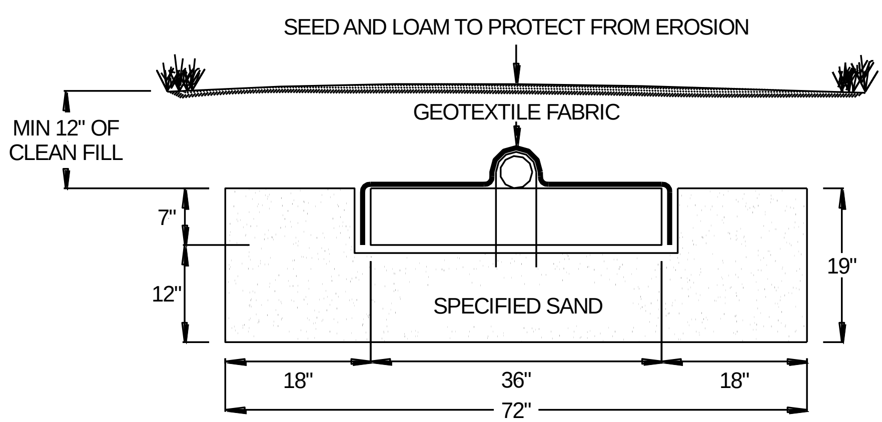
Figure 1. A42 Single Lateral In-Ground Cross Sections



B43 WITH 6" OF SAND TO SIDES



B43 WITH 12" OF SAND TO SIDES



B43 WITH 18" OF SAND TO SIDES

Figure 2. B43 Single Lateral In-Ground Cross Sections

Table 3 OTHER SPECIFICATIONS	
Bottom of distribution cell	Level
Slope of original grade	≤ 25% in area of basal area of the mound
Depth of in situ soil to high groundwater elevation and bedrock under basal area	≥ 6 inches
Vertical separation between distribution cell infiltrative surface and seasonal saturation defined by redoximorphic features, groundwater, or bedrock	≥ 3 ft. measured to the bottom of the GSF unit. ≥ 2ft. measured to the bottom of the GSF system sand.
Fill material	Meets ASTM Specification C-33 for fine aggregate
Size for basal area (for level sites) (B x W)[a]	Cell length x [Total mound width]
Size for basal area (for sloping sites) (B x {A +I})[a]	Cell length x [(# of cells x cell width) + ({# of cells – 1} x cell spacing) + down slope width]
Observation Pipe Material	Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance. • be located such that there are a minimum of two installed in each dispersal cell at opposite ends from one another • be located near the dispersal cell ends • be at least 6 inches from the end wall and sidewall • be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell.

Table 3 OTHER SPECIFICATIONS (continued)	
Effluent application	By use of pressure distribution network conforming to sizing methods of either Small Scale Waste Management Project publication 9.6, entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems” or Dept. of Safety and Professional Services publications SBD-10573-P or SBD-10706-P, entitled “Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems” Pumping up to a Distribution Box and allowing gravity flow from that box is also acceptable.
Piping Material	Meets requirements of s. SPS 384.30 (2), Wis. Adm. Code for its intended use
Distribution cell aggregate material	GSF products as listed in Table 2b
Number of observation pipes per distribution cell	≥ 2
Location of observation pipes	Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers’ installation instructions.
Maximum final slope of mound surface	≤ 3:1
Cover material	Soil that will provide frost protection, prevent erosion and excess precipitation or runoff infiltration and allow air to enter the distribution cell
Grading of surrounding area	Graded to divert surface water around mound system
Limited activities	Unless otherwise specifically allowed in this manual, vehicular traffic, excavation, and soil compaction are prohibited in the basal area and 15 feet down slope of basal area, if there is a restrictive horizon that negatively affects treatment or dispersal
Installation inspection	In accordance with ch. SPS 383, Wis. Adm. Code
Management	In accordance with ch. SPS 383, Wis. Adm. Code and this manual

II. DEFINITIONS

Definitions not found in this section, are located in ch. SPS 381 of the Wisconsin Administrative Code or the terms use the standard dictionary definition.

A. “Basal Area” means the effective in situ soil surface area available for infiltration of partially treated effluent from the fill material.

B. “Deflection of distribution cell” means the ratio between the maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects the furthest points of the contour line along the down slope edge of the distribution cell.

C. “Distribution cell area” means the area within the mound where the effluent is distributed into the fill material.

D. “Fill Material” means sand that meets specifications of ASTM Standard C33 for fine aggregate and is used along the sides of and under the distribution cell to provide treatment of effluent.

E. “Limiting Factor” means high groundwater elevation or bedrock.

F. “Mound” means an on-site wastewater treatment and dispersal component. The structure contains a distribution cell area surrounded by, and elevated above, the original land surface by suitable fill material. The fill material provides a measurable degree of wastewater treatment and allows effluent dispersal into the natural environment under various soil permeability.

G. “Original Grade” means that land elevation immediately prior to the construction of the mound system.

H. “Parallel to surface grade contours on sloping sites” means the mound is on the contour except that a 1% cross slope is allowed along the length of the mound. See Ch. SPS 383 Appendix A-383.44 ORIENTATION (6).

I. “Permeable Soil” means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resource Conservation Service, classification system of silt loam to gravelly medium sand.

J. “Slowly Permeable Soil” means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resource Conservation Service, classification system of clay loams and silty clay loams that exhibit a moderate grade of structure; and loams, silt loams, and silts with weak grades of structure; or soils with weak to moderate grades of platy structure.

K. “Product” means one GSF product, manufactured by Eljen Corporation.

L. “Unsaturated flow” means liquid flow through a soil media under a negative pressure potential. Liquids containing pathogens and pollutants come in direct contact with soil/fill material microsites, which enhances wastewater treatment by physical, biological, and chemical means.

M. “Vertical Flow” means the effluent flow path downward through soil or fill material, which involves travel along soil surfaces, or through soil pores.

N. “Vertical Separation” means the total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell and limiting factor (as by redoximorphic features, groundwater or bedrock.

III. DESCRIPTION AND PRINCIPLE OF OPERATION

POWTS mound component operation is a two-stage process involving both wastewater treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the product and in situ soil. The physical characteristics of the influent wastewater, influent loading rate, temperature, and the nature of the receiving fill material and in situ soil affect these processes.

Physical entrapment, increased retention time, and conversion of pollutants in the wastewater are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the wastewater are eventually deactivated through filtering, retention, and absorption by the fill material. In addition, many pollutants are converted to other chemical forms by oxidation processes.

Dispersal is primarily affected by the depth of the unsaturated receiving soils, their hydraulic conductivity, land slope, and the area available for dispersal.

The mound consists of fill material, a distribution cell, and cover material. Effluent is dispersed into the distribution cell where it flows through the fill material and undergoes biological, chemical and physical treatment and then passes into the underlying soil for further treatment and dispersal to the environment.

Cover material consisting of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange. See Figure 3, for a typical mound system.

The in situ soil serves in combination with the fill, as dispersal media for the treated effluent.

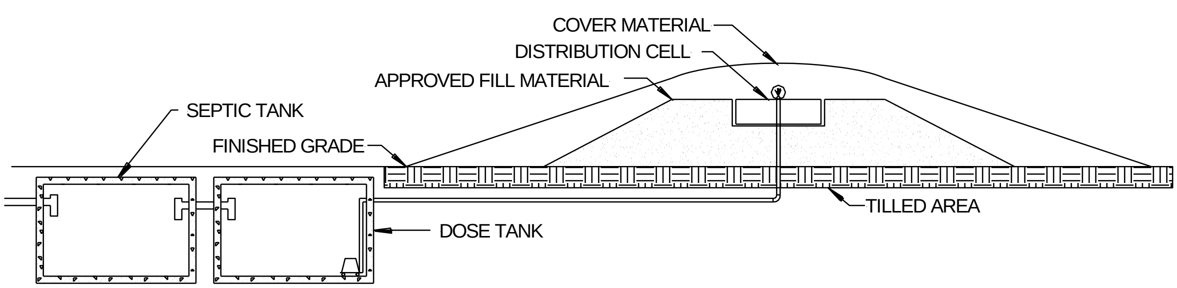


Figure 3. A cross-section of a mound system for POWTS

IV. SOIL AND SITE REQUIREMENTS

Every GSF mound design is ultimately matched to the given soil and site.

The design approach presented in this manual is based on criteria that all applied wastewater is successfully transported away from the system, that it will not affect subsequent wastewater additions, and that the effluent is ultimately treated.

A. <u>Minimum Soil Depth Requirements</u> - The minimum soil factors required for successful mound system performance are listed in the introduction and specification section of this package.

   Soil evaluations must be in accordance with ch. SPS 385 of the Wis. Adm. Code. In addition, soil application rates must be in accordance with ch. SPS 383 of the Wis. Adm. Code.

B. <u>Other Site Considerations</u> -

1. Slopes - The slope on which a mound is to be installed may not indicate the direction of groundwater movement. If there is documentation that the direction of groundwater movement is different than the slope of the land, the direction of groundwater movement must be considered during mound design.

   On a crested site the fill can be situated such that the effluent can move laterally down both slopes. A level site allows lateral flow in all directions, but may present problems as the water table could rise higher beneath the fill in slowly permeable soils. The sloping site allows the liquid to move in one direction away from the fill. Figure 5 shows a cross-section of a mound and the effluent movement in a slowly permeable soil on a sloping site. Systems that are installed on a concave slope may have a deflection that does not exceed that allowed in Table 2.

   Mound components rely on lateral effluent movement through the upper soil horizons. Lateral movement becomes more important as soil permeability decreases.

2. Mound location - In open areas, exposure to sun and wind increases the assistance of evaporation and transpiration in the dispersal of the wastewater.

3. Sites with trees and large boulders - Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing a mound system because of difficulty in preparing the surface and the reduced infiltration area beneath the mound. Areas that are occupied with rock fragments, tree roots, stumps and boulders reduce the amount of soil available for proper treatment. If no other site is available, trees in the basal area of the mound must be cut off at ground level. A larger fill area is necessary when any of the above conditions are encountered, to provide sufficient infiltrative area.

4. Setback distances - The setbacks specified in ch. SPS 383, Wis. Adm. Code for soil subsurface treatment/dispersal component apply to mound systems. The distances are measured from the up slope and end slope edge of the distribution cell and from the down slope toe of the mound.

V. FILL AND COVER MATERIAL

A. Fill Material - The fill material and its placement are one of the most important components of the mound system. Quality control of the fill material is critical to system performance, each truckload of material must meet specifications for the fill.

   Determining whether a proposed fill material is suitable or not requires that a textural analysis be performed. The standard method to be used for performing this analysis conforms to ASTM C-136, Method for Sieve Analysis of Fine and Coarse Aggregates, and ASTM E-11, Specifications for Wire-Cloth Sieves for Testing Purposes, Annual Book of ASTM Standards, Volume 04.02. Information concerning these methods can also be obtained from Methods of Soils Analysis Part 1, C. A. Black, ed., ASA, Monograph #9, American Society of Agronomy,Inc., 1975.

B. Cover material - The cover material is a soil that will allow air exchange while promoting plant growth. The gas exchange will increase the treatment performance of the system by providing oxygen to the wastewater to help ensure aerobic conditions in the mound system. The plant growth will provide frost protection in the winter season. Clays may not be used for cover material, as they will restrict oxygen transfer. Often, excavated soil from the site can be used. Seeding or other means must be done to prevent erosion of the mound.

VI. DESIGN

A. Location, Size and Shape - Placement, sizing and shaping of the mound and the distribution cell within the mound must be in accordance with this manual. The means of dosing the distribution network must provide equal distribution of the wastewater. A pressurized distribution network using a method of sizing as described in either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption System" or Dept. of Safety and Professional Services publications SBD-10573-P or SBD-10706-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" is acceptable. Additionally, gravity distribution is also permitted.

B. Component Design - Design of the mound system is based upon the design wastewater flow and the soil characteristics. It must be sized such that it can accept the design wastewater flow without causing surface seepage or groundwater pollution. Consequently, the basal area, which is the in situ soil area beneath the fill, must be sufficiently large enough to absorb the effluent into the underlying soil. The system must also be designed to avoid encroachment of the water table into the required minimum unsaturated zone.

Design of the mound includes the following three steps: (A) calculating design wastewater flow, (B) design of the distribution cell within the fill, (C) design of the entire mound. This includes calculating total width, total length, system height, distribution lateral location and observation pipes. Each step is discussed. A design example is provided in section XI of the manual. The letters for the various dimensions correlate with those in Figures 4 and 5.

Step A. Design Wastewater Flow Calculations

One and two-family dwellings. Distribution cell size for one and two-family dwelling application is determined by calculating the design wastewater flow (DWF). To calculate DWF use, Formulas 1, 2 or 3. Formula 1 is for combined wastewater flows, which consist of blackwater, clearwater and graywater. Formula 2 is for only clearwater and graywater. Formula 3 is blackwater only.

Formula 1	Formula 2	Formula 3
Combined wastewater	Clearwater & Graywater	Blackwater
DWF = 150 gal/day/bedroom	DWF = 90 gal/day/bedroom	DWF = 60 gal/day/bedroom

Public Facilities. Distribution cell size for public facilities application is determined by calculating the DWF using Formula 4. Only facilities identified in Table 4 are included in this manual. Estimated daily wastewater flows are determined in accordance with Table 4 or s. SPS 383.43(6), Wis. Adm. Code. Many commercial facilities have high BOD5, TSS and FOG (fats, oils and grease), which must be pretreated in order to bring their values down to an acceptable range before entering into the mound component described in this manual.

Formula 4

DWF = Sum of each estimated wastewater flow per source per day x 1.5

Where 1.5 = Conversion factor to convert estimated wastewater flow to design wastewater flow

Table 4 Public Facility Wastewater Flows		
Source	Unit	Estimated Wastewater Flow (gpd)
Apartment or Condominium	Bedroom	100
Assembly hall (no kitchen)	Person (10 sq. ft./person)	1.3
Bar or cocktail lounge (no meals served)	Patron (10 sq. ft./patron)	4
Bar or cocktail lounge* (w/meals – all paper service)	Patron (10 sq. ft./patron)	8
Beauty salon	Station	90
Bowling alley	Bowling lane	80
Bowling alley (with bar)	Bowling lane	150
Camp, day and night	Person	25
Camp, day use only (no meals served)	Person	10
Campground or Camping Resort	Space, with sewer connection and/or service building	30
Campground sanitary dump station	Camping unit or RV served	25
Catch basin	Basin	65
Church (no kitchen)	Person	2
Church* (with kitchen)	Person	5
Dance hall	Person (10 sq. ft./person)	2
Day care facility (no meals prepared)	Child	12
Day care facility* (with meal preparation)	Child	16
Dining hall* (kitchen waste only without dishwasher and/or food waste grinder)	Meal served	2
Dining hall* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Meal served	5
Dining hall* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Meal served	7
Drive-in restaurant* (all paper service with inside seating)	Patron seating space	10
Drive-in restaurant* (all paper service without inside seating)	Vehicle space	10
Drive-in theater	Vehicle space	3
Employees (total all shifts)	Employee	13
Floor drain (not discharging to catch basin)	Drain	25
Gas station / convenience store	Patron (minimum 500 patrons)	3
Gas station (with service bay) Patron Service bay	 Patron Service bay	 3 50
Hospital*	Bed space	135
Hotel, motel or tourist rooming house	Room	65
Medical office building Doctors, nurses, medical staff Office personnel Patients	 Person Person Person	 50 13 6.5
Migrant labor camp (central bathhouse)	Employee	20
Mobile Home (Manufactured home) (served by its own POWTS)	Bedroom	100
Mobile home park	Mobile home site	200

* = May be high strength waste

Table 4 Public Facility Wastewater Flows (continued)		
Source	Unit	Estimated Wastewater Flow (gpd)
Nursing, Rest Home, Community Based Residential Facility	Bed space	65
Outdoor sport facilities (toilet waste only)	Patron	3.5
Parks (toilets waste only)	Patron (75 patrons/acre)	3.5
Parks (toilets and showers)	Patron (75 patrons/acre)	6.5
Public shower facility	Shower taken	10
Restaurant*, 24-hr. (dishwasher and/or food waste grinder only)	Patron seating space	4
Restaurant*, 24-hr. (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	12
Restaurant, 24-hr. (toilet waste)	Patron seating space	28
Restaurant*, 24-hr. (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	40
Restaurant*, 24-hr. (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	44
Restaurant* (dishwasher and/or food waste grinder only)	Patron seating space	2
Restaurant* (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	6
Restaurant (toilet waste)	Patron seating space	14
Restaurant* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	20
Restaurant* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	22
Retail store	Patron (70% of total retail area ÷ 30 sq. ft. per patron)	1
School* (with meals and showers)	Classroom (25 students/classroom)	500
School* (with meals or showers)	Classroom (25 students/classroom)	400
School (without meals or showers)	Classroom (25 students/classroom)	300
Self-service laundry (toilet waste only)	Clothes washer	33
Self-service laundry (with only residential clothes washers)	Clothes washer	200
Swimming pool bathhouse	Patron	6.5

* = May be high strength waste

Step B. Design of the Distribution Cell - This section determines the required infiltrative surface area of the distribution cell/fill interface, as well as the dimensions of the distribution network within the fill.

1. Sizing the Distribution Cell - The minimum bottom area of the distribution cell is determined by dividing the design wastewater flow per day by the design loading rate of the fill material. As specified in Table 1, the design loading rate of the infiltration surface of the distribution cell is:

   ≤ 2.0 gal/ft2/day if BOD5 or TSS ≤ 30 mg/L

   Using the above information, the infiltrative surface area of the distribution cell area is determined by using formulas 5 and 6.

   Formula 5

   Required # of units = (DWF ÷ design loading rate of the fill material) ÷ square footage of product (shown in Table 2c), round up to nearest whole number.

   Notes: The width of the distribution cell must be selected first based on intended product(s) to be installed.

   The length of the system = 4 x required # of units ÷ # of Rows + 1

   Formula 6

   Area = The length of the system x the distribution cell width (shown in Table 2c).

   For concave systems the actual distribution cell length must be checked to determine if the cell area is sufficient. See Step B 3 for further information.

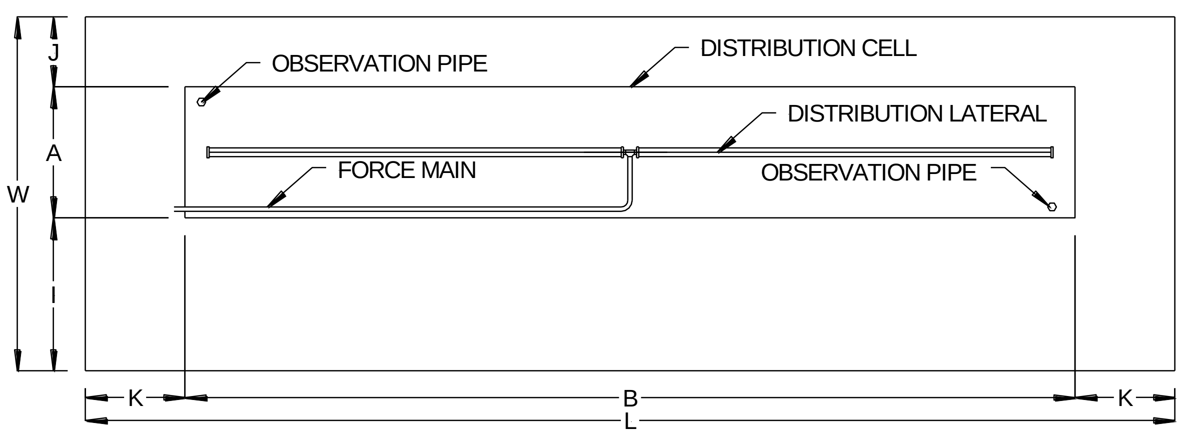


Figure 4. Detailed plan view of a mound

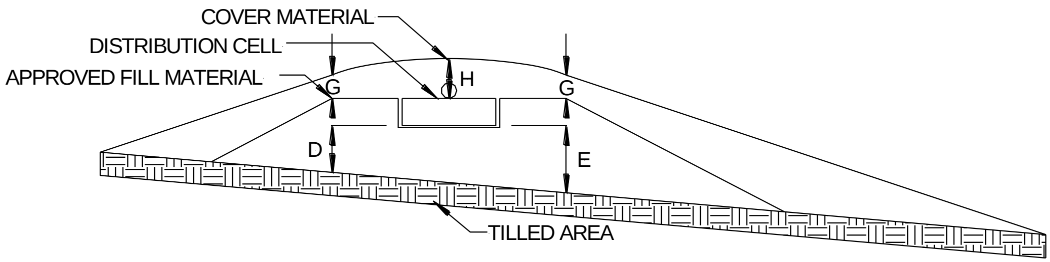


Figure 5. Detailed cross-section of a mound

2. System Configuration - The GSF product distribution cell must be longer than it is wide. Maximum width of the distribution cell is 10 feet. The maximum length of the distribution cell is dependent on setback requirements and soil evaluation.

   The distribution cell is aligned with its longest dimension parallel to surface grade contours on sloping sites as required by the specifications of this package so as not to concentrate the effluent into a small area as it moves laterally down slope.

   The bottom of the distribution cell is level so one area of the distribution cell is not overloaded.

   The dimensions for the distribution cell are calculated using Formulas 7 or 8. Formula 7 is used when the in situ soil has a soil application rate of greater than 0.3 gal/ft2/day. Formula 8 must be used to check for linear loading rate for the system when the in situ soil within 12 inches of the fill material has a soil application rate of ≤ 0.3 gal/ft2/day. When the in situ soil within 12 inches of the fill material has a soil application rate of ≤ 0.3 gal/ft2/day the linear loading rate may not exceed 4.5 gal/ft/day.

   Formula 7

   Area of distribution cell = A x B.

   Where: A = Total width products that constitute one laying length of the distribution cell (Distribution Cell width - Max. allowed is 10 ft.)

   B = (# of units) x 4 ÷ # of Rows + 1

   Formula 8

   Linear Loading Rate = DWF ÷ B

   Where: DWF = Design wastewater flow
   B = Distribution cell length

3. Concave Mound Configuration – The maximum deflection of a concave distribution cell of a mound system is 10%. The percent of deflection of a distribution cell is determined by dividing the amount of deflection by the effective distribution cell length of the concave distribution cell. The deflection is the maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects furthest points of the contour line along the down slope edge of the distribution cell. The effective distribution cell length of the concave distribution cell is the distance between the furthest points along the contour line of the down slope edge of the concave distribution cell. See Figures 6 and 7.

The deflection of a distribution cell on concave slopes is calculated using Formula 9.

Formula 9

Percent of Deflection = (Deflection ÷ Effective distribution cell length) x 100

Where: Deflection = Maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects furthest points of the contour line along the down slope edge of the distribution cell

Effective distribution cell length = Distance between the furthest points along the contour line of the down slope edge of the concave distribution cell

100 = Conversion factor

The actual distribution cell length must be checked to determine if the cell area is sufficient. The actual distribution cell length is calculated using Formula 10.

Formula 10

Actual distribution cell length = [(% of deflection x 0.00265) + 1] x effective distribution cell length

Where: % of deflection = Determined by Formula 9

0.00265 = Conversion factor from percent to feet

1 = Constant

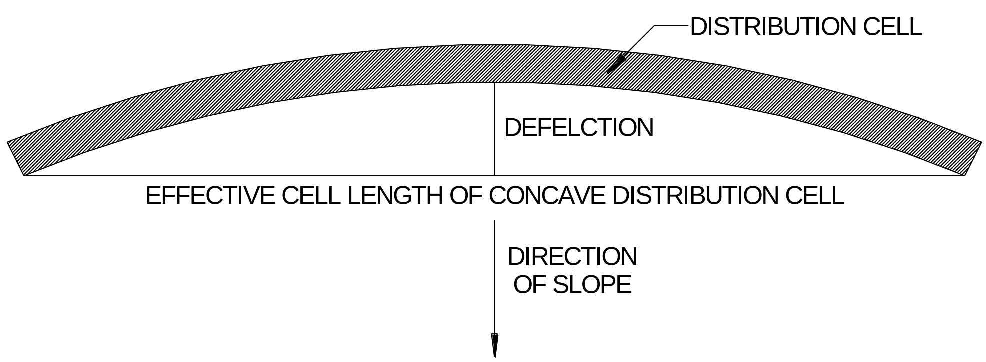


Figure 6. Simple concave distribution cell

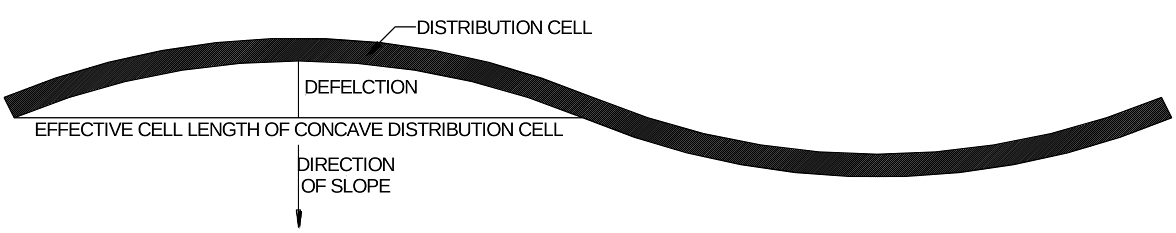


Figure 7. Complex concave distribution cell

Step C. Sizing the Mound

1. Mound Height - The mound height on sloping sites is calculated using Formula 11.

Formula 11

Mound Height = (D + E) ÷2 + F + H

Where: D = Sand fill depth

E = Down slope fill depth

F = GSF product distribution cell depth

H = Cover material depth

2. Fill Depth - The depth of fill under the distribution cell is based on the minimum depth of unsaturated soil required for treatment listed in Table 383.44-3, Wis. Adm. Code. The minimum fill depth is 12 inches, but not greater than 36 inches when the soil listed in Table 383.44-3, Wis. Adm. Code, is 36 inches or less. The minimum fill depth is 12 inches, but not greater than 36 inches when the soil listed in Table 383.44-3, Wis. Adm. Code, is greater than 36 inches. A minimum unsaturated flow depth required for proper treatment of the wastewater is as required by Table 383.44-3, Wis. Adm. Code.

   For sloping sites the fill depth below down slope edge of distribution cell (E) ≥ D + [% slope of original grade as a decimal x width of distribution cell (A)]

3. Distribution Cell Depth - The distribution cell depth (F) provides wastewater storage within the distribution cell. For an GSF mound system, the distribution cell depth (F) shall be defined as the height of the product.

   Formula 12

   Distribution cell depth (F) = 7 inches

4. Cover Material - The cover material (G & H) provides frost protection and a suitable growth medium for vegetation. For design purposes, use a depth of 12 inches above the center of the distribution cell (H) and 6 inches above the outer edge of the distribution cell (G).

   Cover material depth at product distribution cell center (H) ≥ 12 inches

   Cover material depth at product distribution cell edges (G) ≥ 6 inches

5. Fill Length and Width - The length and width of the fill are dependent upon the length and width of the product, fill depth and side slopes of the fill. Side slopes may not be steeper than 3:1 over the basal area, (i.e. 3 feet of run to every 1 foot of rise). Soil having textures other than those specified for the fill media may be used to make the slopes gentler than the required 3:1 slopes, once the 3:1 slope exists with the fill material. The distribution cell length is generally perpendicular to the direction of slope so the effluent is spread out along the contour.

   The fill length consists of the end slopes (K) and the distribution cell length (B). The fill width consists of the up slope width (J), the distribution cell width (A), and the down slope width (I). On sloping sites the up slope width (J) is less while the down slope width (I) is greater than on a level site to maintain the 3:1 side slope (see Fig. 4). To calculate the up slope and down slope widths when a 3:1 side slope is maintained, multiply the calculated width by the correction factor found by using the following equations or the correction factor listed in Table 5.

Up slope correction factor = 100 ÷ [100 + (3 x % of slope)]
Down slope correction factor = 100 ÷ [100 - (3 x % of slope)]

Table 5 Down slope and up slope width correction factors		
Slope %	Down slope correction factor	Up Slope correction factor
0	1.00	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.915
4	1.14	0.89
5	1.18	0.875
6	1.22	0.85
7	1.27	0.83
8	1.32	0.81
9	1.37	0.79
10	1.43	0.77
11	1.49	0.75
12	1.56	0.735
13	1.64	0.72
14	1.72	0.705
15	1.82	0.69
16	1.92	0.675
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.625
21	2.70	0.61
22	2.94	0.60
23	3.23	0.59
24	3.57	0.58
25	4.00	0.57

The most critical dimensions of the fill are: fill depths (D) & (E), distribution cell length (B), distribution cell width (A), and the down slope width (I).

<u>End slope width (K)</u> = Total fill at center of distribution cell {[(D + E) ÷2]+ F + H} x horizontal gradient of selected side slope (3 if 3:1 side-slope)

<u>Fill Length (L)</u> = Distribution cell length (B) + 2 x end slope width (K)

<u>Up slope width (J)</u> = Fill depth at up slope edge of distribution cell (D + F + G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 + (3 x % of slope)] if 3:1}

<u>Down slope width (I)</u> = Fill depth at down slope edge of distribution cell (E + F + G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 - (3 x % of slope)] if 3:1}

Fill Width (W) = Up slope width (J) + down slope width (I) + width of distribution cell (A)

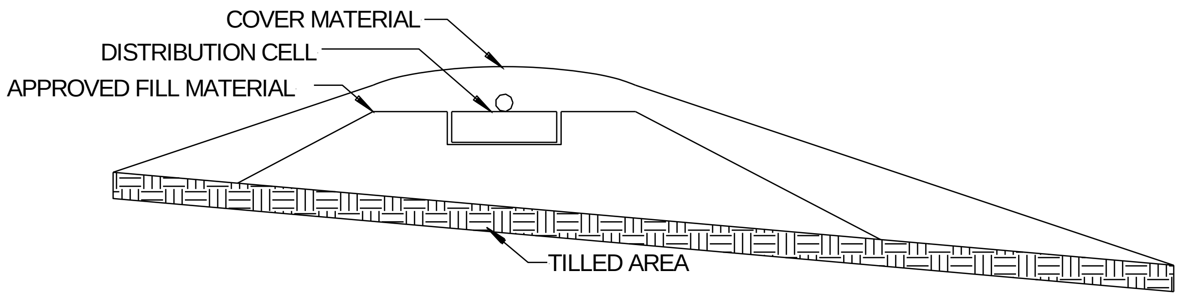


Figure 8. Cross-section of a mound system

6. Basal Area - The basal area is the in situ soil/fill interface between the soil and the fill material. Its function is to accept the effluent from the fill, assist the fill in treating the effluent, and transfer the effluent to the subsoil beneath the fill or laterally to the subsoil outside of the fill.

   The soil infiltration rate of the in situ soil determines how much basal area is required. The wastewater applied to the mound has values for BOD5 and TSS of ≤ 30 mg/L the soil application rates for the basal area may be those specified in Table 383.44-1 or -2 for maximum monthly average BOD5 and TSS of ≤ 30 mg/L.

   For level sites, the total basal area, excluding end slope area [length of distribution cell (B) x width of fill and cover (W)] beneath the fill and soil cover is available for effluent absorption into the soil (see Figure 9). For sloping sites, the available basal area is the area down slope of the up slope edge of the distribution cell to the down slope edge of the fill and soil cover or (A + I) times the length of the distribution cell (B) (see Figure 10). The up slope width and end slopes are not included as part of the total basal area.

   It is important to compare the required basal area to the available basal area. The available basal area must equal or exceed the required basal area.

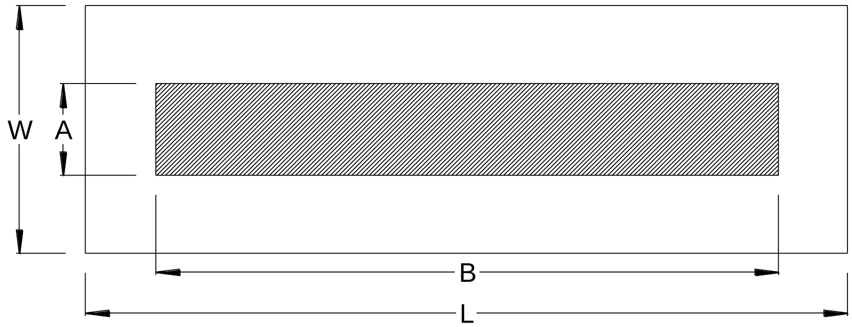


Figure 9. Level site

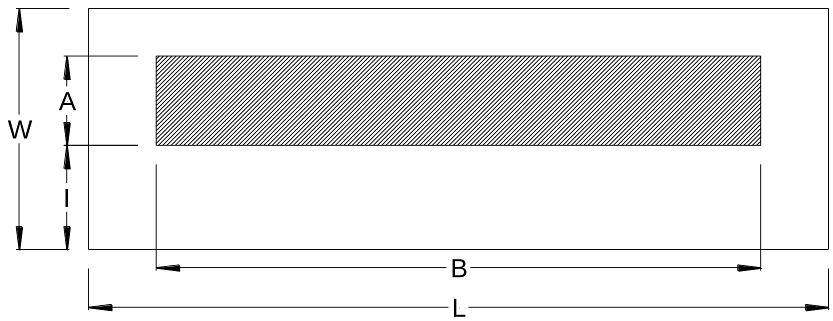


Figure 10. One direction slope

Basal area required = DWF ÷ Infiltration rate of in situ soil

Basal area available = B x W on a level site or = B x (A+I) on a sloping site.

If sufficient area is not available for the given design and site conditions, corrective action is required to increase (J) and (I) on level sites or (I) on sloping sites.

7. Location of the observation pipes.

   Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance.

   - be located such that there are a minimum of two installed in each dispersal cell at opposite ends from one another
   - be located near the dispersal cell ends
   - be at least 6 inches from the end wall and sidewall
   - be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell

   Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers' installation instructions

Step D. Distribution Network and Dosing System A pressurized distribution network based on a **method of sizing** as described in either Small Scale Waste Management Project publication 9.6, entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems” or Dept. of Safety and Professional Services publications SBD-10573-P or SBD-10706-P, entitled “Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems” is acceptable. The designer is allowed to pump up to an appropriately sized distribution box and use gravity flow from that box. Additionally, gravity distribution is also permitted in gravity dose or pump up to a distribution box and then gravity flow out.

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of a mound system are just as critical as the design of the system. A good design with poor construction results in system failure. It is emphasized that the soil only be tilled when it is not frozen and the moisture content is low to avoid compaction and puddling. The construction plan to be followed includes:

A. Equipment - Proper equipment is essential. Track type equipment that will not compact the mound area or the down slope area is required.

B. Sanitary Permit - Prior to the construction of the system, a sanitary permit, obtained for the installation must be posted in a clearly visible location on the site. Arrangements for inspection(s) must also be made with the department or governmental unit issuing the sanitary permit.

C. Construction Procedures

1. Check the moisture content of the soil to a depth of 8 inches. Smearing and compacting of wet soil will result in reducing the infiltration capacity of the soil. Proper soil moisture content can be determined by rolling a soil sample between the hands. If it rolls into a 1/4- inch wire, the site is too wet to prepare. If it crumbles, site preparation can proceed. If the site is too wet to prepare, do not proceed until it dries.

2. Lay out the fill area on the site so that the distribution cell runs perpendicular to the direction of the slope.

3. Establish the original grade elevation (surface contour) along the up slope edge of the distribution cell. This elevation is used throughout the mound construction as a reference to determine the bottom of the distribution cell, lateral elevations, etc., and is referenced to the permanent bench mark for the project. A maximum of 4 inches of sand fill may be tilled into the surface.

4. Determine where the force main from the dosing chamber will connect to the distribution system in the distribution cell. Place the pipe either before tilling or after placement of the fill. If the force main is to be installed in the down slope area, the trench for the force main may not be wider than 12 inches.

5. Cut trees flush to the ground and leave stumps, remove surface boulders that can be easily rolled off, remove vegetation over 6 inches long by mowing and removing cut vegetation. Prepare the site by breaking up, perpendicular to the slope, the top 7-8 inches so as to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. When using a moldboard plow, it should have as many bottoms as possible to reduce the number of passes over the area to be tilled and minimize compaction of the subsoil. Tilling with a moldboard plow is done along contours. Chisel

type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that a rough, unsmeared surface be left. The sand fill will intermingle between the clods of soil, which improves the infiltration rate into the natural soil.

Immediate application of at least 6 inches of fill material is required after tilling. All vehicular traffic is prohibited on the tilled area. For sites where the effluent may move laterally, vehicle traffic is also prohibited for 15 ft. down slope and 10 ft. on both sides of level sites. If it rains after the tilling is completed, wait until the soil dries out before continuing construction, and contact the local inspector for a determination on the damage done by rainfall.

6. Place the approved sand fill material, around the edge of the tilled area being careful to leave adequate perimeter area, not covered by the sand fill, on which to place the soil cover. There should be approximately two feet of basal area adjacent to the mound perimeter that is not covered by the sand fill. This area serves to tie the soil cover into the natural surface material that has been tilled and helps seal the toe from leakage. Work from the end and up slope sides. This will avoid compacting the soils on the down slope side, which, if compacted, affects lateral movement away from the fill and could cause surface seepage at the toe of the fill on slowly permeable soils.

7. Move the fill material into place using a small track type tractor with a blade or a large backhoe that has sufficient reach to prevent compaction of the tilled area. Do not use a tractor/backhoe having tires. Always keep a minimum of 6 inches of fill material beneath tracks to prevent compaction of the in situ soil.

8. Place the fill material to the required depth.

9. Form the distribution cell. Hand level the bottom of the distribution cell.

10. Shape the sides with additional fill to the desired slopes.

11. Install the GSF products and distribution piping per instructions. If using pressure distribution, distribution pipe should be sleeved through the 4-inch corrugated pipe located in the GSF product. One out of every five orifices in each distribution pipe shall be installed at the 6 o'clock position so as to allow for thorough drainage of the distribution pipe following each dose. The remaining four orifices shall be installed in the 12 o' clock position. All pipes must drain after dosing. The designer is allowed to pump up to an appropriately sized distribution box and use gravity flow from that box.

12. If using pressure, at the end of the lateral, place a 90° long sweep with a capped piece of pipe pointing up through the soil surface. Cover the capped pipe with a valve box and lid of an adequate size. The cover of the valve box shall be located above the final grade of the mound (Figure 11). Not required if a pump to gravity application is in use.

13. Install an observation pipe in each row of GSF products with the bottom 19 inches of the observation pipe slotted. Installations of all observation pipes include a suitable means of anchoring (Figure 11).

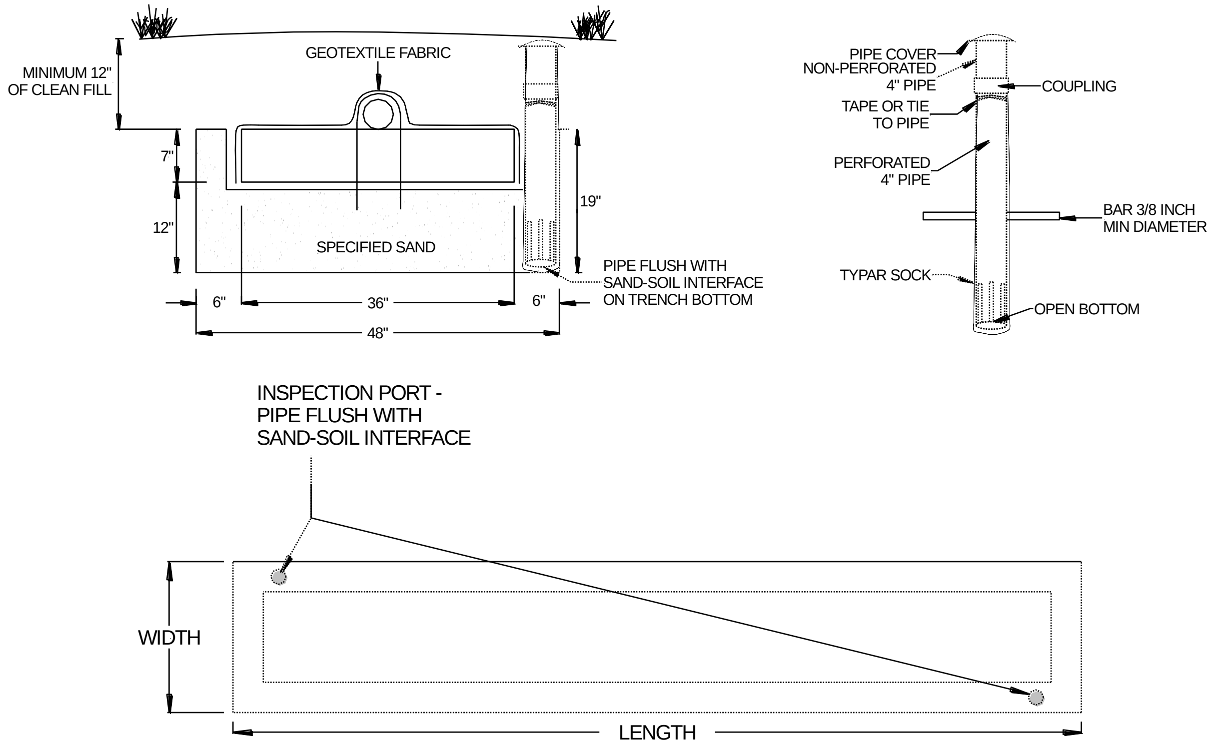


Figure 11

14. Place approved barrier cover, conforming to requirements of ch. SPS 384, Wis. Adm. Code or otherwise approved by the Dept. of Safety and Professional Services, over the product rows, cover barrier cover with cover material, and extend the soil cover to the boundaries of the overall component. Be sure to keep the required 6-inch minimum compacted cover over the system.

15. Complete final grading to divert surface water drainage away from mound. Sod or seed and mulch the entire mound component.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The component owner is responsible for the operation and maintenance of the component. The county, department or POWTS service contractor may make periodic inspections of the components, checking for surface discharge, treated effluent levels, etc.

The owner or owner's agent is required to submit necessary maintenance reports to the appropriate jurisdiction and/or the department.

B. Design approval and site inspections before, during, and after the construction are accomplished by the county or other appropriate jurisdictions in accordance to ch. SPS 383 of the Wis. Adm. Code.

C. Routine and preventative maintenance aspects:

1. Septic and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.

2. Inspections of the mound component performance are required at least once every three years. These inspections include checking the liquid levels in the observation pipes and examination for any seepage around the mound component.

3. Winter traffic on the mound is not advised to avoid frost penetration and to minimize compaction.

4. A good water conservation plan within the house or establishment will help assure that the mound component will not be overloaded.

D. User's Manual: A user's manual is to accompany the component. The manual is to contain the following as a minimum:

1. Diagrams of all components and their location. This should include the location of the reserve area, if one is provided.

2. Names and phone numbers of local health authority, component manufacturer or POWTS service contractor to be contacted in the event of component failure or malfunction.

3. Information on periodic maintenance of the component, including electrical/mechanical components.

4. Information on limited activities on reserve area if provided.

E. Performance monitoring must be performed on mound systems installed under this manual.

1. The frequency of monitoring must be:

   a. At least once every three years following installation and,
   b. At time of problem, complaint, or failure.

2. The minimum criteria addressed in performance monitoring of mound systems are:

   a. Type of use.
   b. Age of system.
   c. Nuisance factors, such as odors or user complaints.
   d. Mechanical malfunction within the system including problems with valves or other mechanical or plumbing components.
   e. Material fatigue or failure, including durability or corrosion as related to construction or structural design.
   f. Neglect or improper use, such as exceeding the design rate, poor maintenance of vegetative cover, inappropriate cover over the mound, or inappropriate activity over the mound.
   g. Installation problems such as compaction or displacement of soil, improper orientation or location.
   h. Pretreatment component maintenance, including dosing frequency, structural integrity, groundwater intrusion or improper sizing.
   i. Dose chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.
   j. Distribution piping network, including improper maintenance or improper sizing.
   k. Ponding in distribution cell, prior to the pump cycle, is evidence of development of a clogging mat or reduced infiltration rates.

l. Siphon or pump malfunction including dosing volume problems, pressurization problems, breakdown, burnout, or cycling problems.
m. Overflow/seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.

3. Reports are to be submitted in accordance with ch. SPS 383, Wis. Adm. Code.

IX. REFERENCES

"Wisconsin Mound Soil Absorption System: Siting, Design and Construction." Converse, J.C., and E. J. Tyler. Publication 15.22, Small Scale Waste Management Project., 1 Agriculture Hall, University of Wisconsin, Madison, WI.

"Mound Component Manual for Private Onsite Wastewater Treatment Systems." State of Wisconsin Department of Safety and Professional Services Division of Safety and Buildings. Version 2.0, January 30, 2001.

XI. EXAMPLE GSF MOUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.

Slope - _____%

Occupancy – One or Two-Family Dwelling - __________ (# of

bedrooms) Public Facility - _______________________ gal/day

(Estimated wastewater flow)

Depth to limiting factor - ________inches

Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code - __________ inches

In situ soil application rate used - _________ gal/ft^2/day

FOG value of effluent applied to component - ___________

mg/L

Treated Effluent from Component

BOD$_5$ value of effluent leaving the component - $\leq$ 30 TSS

mg/L TSS value of effluent leaving the component - $\leq$ 30

mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100ml X No

Product(s) to be installed in the distribution cell - ___ A42 __ B43

Table 2c
APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE

Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
	16 square feet per unit	48"	48"	19"
	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling.

Combined wastewater flow:

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x ______# of bedrooms

= ________ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Public Facilities.

DWF = Estimated wastewater flow x 1.5

= ___________ gal/day x 1.5

= ___________ gal/day

C. DESIGN OF THE GSF SECTION DISTRIBUTION CELL

1. Total size of the Distribution cell(s) area
   a. Loading rate of fill material (LLR) = _______≤ 2.0 gal/ft^2/day if BOD_5 or TSS ≤ 30 mg/L

   b. Required # of units = DWF ÷ 2.0 gal/ft^2/day ÷ Product square footage

      (note: If the answer is not a whole number, round up to the next whole number.)

   Required # of 4 ft. product increments = ______ gal/day ÷ 2.0 gal/ ft^2/day ÷ _____ ft^2 = ________,
   Round up to ____ for two equal rows of _____.

   Note: The minimum number of A42 units is 6 per bedroom or 5 B43s per bedroom.

   c. Area = _____(Minimum number of 4 ft. product increments determined in b. above) x 4 x Product width

      Area = ________ x 4 x _____ ft = ________ ft^2

2. Distribution cell Configuration

   a. Distribution cell width(s) (A) = _________ ft (≤ 10 ft = width of product(s) to be installed. Product width is shown in Table 2b)

   b. Distribution cell length (B) = area of distribution cell ÷ distribution cell width

      B = _______ ft^2 ÷ ______= _______ ft.

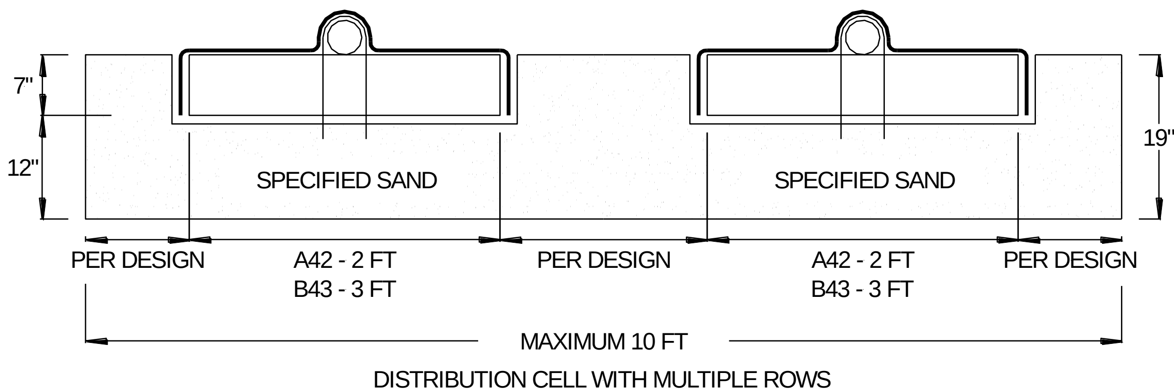


Figure 12. Distribution Cell with Multiple Rows

c. Check distribution cell length (B)

For linear loading rate:

Linear Loading Rate ≤ DWF ÷ Cell length (B) or effective cell length for a concave mound)

Linear Loading Rate ≤ _____ gal/day ÷ _____ ft

Linear Loading Rate ≤ _____ gal/ft

Linear loading rate for systems with in situ soils having a soil application rate of ≤ 0.3 ga/ft2/day within 12 inches of fill must be less ≤ 4.5 gal/ft/day.

Is the linear loading rate ≤ what is allowed? ______ yes _____ no If no, then the length and/or width of the distribution cell must be changed so it does.

d. Check percent of deflection and actual length of concave distribution cell length

Percent of deflection = Deflection ÷ Effective distribution cell length x 100

Percent of deflection = _____ ft ÷ _____ ft x 100

Percent of deflection = _____ % (≤ 10%)

Actual distribution cell length = [(% of deflection x 0.00265) + 1] x effective distribution cell length

Actual distribution cell length = [(_____% x 0.00265) +1] x ______ ft

Actual distribution cell length = _______ ft

D. DESIGN OF ENTIRE GSF PRODUCT MOUND AREA

Fill Depth

a. Minimum fill depth below distribution cell at least 12 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 383.44-3, Wis. Adm. Code, that requires a minimum depth of 36 inches or less. At least 12 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 383.44-3, Wis. Adm. Code, that requires a depth greater than 36 inches.

1) Depth at up slope edge of distribution cell (D) = distance required by Table 383.44-3, Wis. Adm. Code, minus distance in inches to limiting factor

D = ________ inches - _________ inches

D = ________ inches (at least 12 inches, but not greater than 36 inches in accordance with Table 2)

2) Depth at down slope edge of distribution cell (E)

E = Depth at up slope edge of distribution cell (D) + (% natural slope expressed as a decimal x distribution cell width (A))

E = _________ inches + (_________ x __________ feet x 12 inches/ft)

E = _________ or ________ inches

b. Distribution cell depth for GSF product distribution cell.

Distribution cell depth (F) for unit distribution cell = Height of tallest product as shown in Table 2b

________________ unit height = ___________ inches

F = _______________ inches

c. Cover material
1) Depth at distribution cell center (H) ≥ 12 inches

2) Depth at distribution cell edges (G) ≥ 6 inches

2. Mound length
a. End slope width (K)= Total fill at center of distribution cell x horizontal gradient of side slope

K = {([(D + E) ÷ 2] + F + H) x horizontal gradient of side slope} ÷ 12 inches/foot

K = {([(_____ inches + _____ inches) ÷ 2] + _____ inches + ____ inches) x ____ } ÷ 12 inches/ft

K = _________ or ___________ ft

b. Mound length (L) = Distribution cell length + (2 x end slope width)
L = B + 2K
L = ______ ft + (2 x ________ ft)
L = ________ feet

3. Mound width

a. Up slope width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x Horizontal gradient of side slope x Slope correction factor {100 ÷ [100 + (gradient of side slope x % of slope or value from Table 5)]}

J = (D + F + G) x horizontal gradient of side slope x Slope correction factor 100 ÷ [100 + (gradient of side slope x % of slope or value from Table 5)]}
J = (____ in + ____ in + _-___ in) ÷ 12 in/ft x _____ x 100 ÷ [100 + (____ x ___) or
(_____)]
J = _____ or _____ feet

b. Down slope width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope or value from Table 5)]}

I = (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope or value from Table 5)]}

I = (____ in + _____ in + ______ in) ÷ 12 in/ft x 3 x 100 ÷ [100 - (______ x _____) or
(_____)]

I = ______ in ÷ 12 in/ft x 3 x 100 ÷ ____
I = ______ or ______ feet

c. Mound width (W) = Up slope width (J) + Distribution cell width (A) + Down slope width (I)

W = J + A + I
W = ______ ft + _____ ft + ____ ft
W = ______ feet

4. Check the basal area
   a. Basal area required = Daily wastewater flow ÷ soil application rate of in situ soil (The soil application rate may be that which is listed for BOD5 and TSS > or ≤ 30 mg/L depending on wastewater characteristics or fill depth below distribution cell. See Table 1.)
      Basal area required = ______ gal/day ÷ ______ gal/ft^2/day
      = ________ ft^2

   b. Basal area available

      1) Sloping site = Cell length (B) x [(# of cells x cell width) + ({# of cells – 1} x cell spacing) + down slope width] (I)

      Basal area available = ____ ft x [(___ x _____ ft) + ({____ -1} x 0 ft) + _____ ft]
      = ____ ft x (_____ ft + _____ ft + _____ ft)
      = ____ ft x ____ ft
      = ______ ft^2

      2) Level site = Cell length (B) x total mound width (W)
      Basal area available = _____ ft x _____ ft
      = _____ ft^2

   c. Is available basal area sufficient? _____ yes ____ no
      Basal area required < Basal area available
      ____ ft^2 ≤ ____ ft^2

   The available basal area must be increased by ___ ft^2. This can be accomplished by increasing the down slope width (I) by _____ ft. making it _____ ft.

   See d. for recalculation of basal area.

   d. Basal area available (recalculation of basal area)
      1) Sloping site = Cell length (B) x [(# of cells x cell width) + ({# of cells – 1} x cell spacing) + down slope width] (A+I)

      = ____ ft x [(___ x _____ ft) + ({_____ -1} x 0 ft) + _____ ft]
      = ____ ft x (_____ ft + _____ ft + ____ ft)
      = ____ ft x ____ ft
      = ______ ft^2

      2) Level site = Cell length (B) x total mound width (W)
      = ______ ft x ______ ft

= ______ ft^2

5. Determine the location of observation pipes along the length of distribution cell.

   Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance.

   - be located such that there are a minimum of two installed in the GSF dispersal cell
   - be located near the dispersal cell ends
   - be at least 6 inches from the end wall and sidewall
   - be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell
   - Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers' installation instructions.

XI. EXAMPLE GSF MOUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.

Slope - 6 %

Occupancy – One or Two-Family Dwelling - 3 (# of

bedrooms) Public Facility - 0 gal/day

(Estimated wastewater flow)

Depth to limiting factor - 25 inches

Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code - 36 inches

In situ soil application rate used - 0.5 gal/ft^2/day

FOG value of effluent applied to component - < 30

mg/L

Treated Effluent from Component

BOD$_5$ value of effluent leaving the component - ≤ 30 TSS

mg/L TSS value of effluent leaving the component - ≤ 30

mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100ml X No

Product(s) to be installed in the distribution cell - X A42 __ B43

Table 2c
APPROVED PRODUCT INSTALLATIONS AND SQUARE FOOTAGE

Product	Square Footage	Installation Width	Installation Length	Install Height
A42	12 square feet per unit	36"	48"	19"
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	20 square feet per unit	60”	48”	19”
B43	16 square feet per unit	48”	48"	19”
	20 square feet per unit	60”	48"	19”
	24 square feet per unit	72”	48”	19”

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling.

Combined wastewater flow:

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x __3__# of bedrooms

= __450__ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ________# of bedrooms

= ______________ gal/day

Public Facilities.

DWF = Estimated wastewater flow x 1.5

= ___________ gal/day x 1.5

= ___________ gal/day

C. DESIGN OF THE GSF SECTION DISTRIBUTION CELL

2. Total size of the Distribution cell(s) area

a. Loading rate of fill material (LLR) = __X__ ≤ 2.0 gal/ft^2/day if BOD_5 or TSS ≤ 30 mg/L

b. Required # of units = DWF ÷ 2.0 gal/ft^2/day ÷ Product square footage

(note: If the answer is not a whole number, round up to the next whole number.)

Required # of 4 ft. product increments = __450__ gal/day ÷ 2.0 gal/ ft^2/day ÷ __12__ ft^2 = __18.75__,
Round up to __20__ for two equal rows of __10__.

Note: The minimum number of A42 units is 6 per bedroom or 5 B43s per bedroom.

c. Area = __20__(Minimum number of 4 ft. product increments determined in b. above) x 4 x Product width

Area = __20__ x 4 x __3__ ft = __240__ ft^2

2. Distribution cell Configuration

   e. Distribution cell width(s) (A) = 6________ ft (≤ 10 ft = width of product(s) to be installed. Product width is shown in Table 2b)

   d. Distribution cell length (B) = area of distribution cell ÷ distribution cell width

      B = 240___ ft^2 ÷ 6____= 40___ ft.

e. Check distribution cell length (B)

For linear loading rate:

Linear Loading Rate ≤ DWF ÷ Cell length (B) or effective cell length for a concave mound)

Linear Loading Rate ≤ __450__ gal/day ÷ __40____ ft

Linear Loading Rate ≤ __11.25__ gal/ft

Linear loading rate for systems with in situ soils having a soil application rate of ≤ 0.3 ga/ft2/day within 12 inches of fill must be less ≤ 4.5 gal/ft/day.

Is the linear loading rate ≤ what is allowed? __X___ yes _____ no If no, then the length and/or width of the distribution cell must be changed so it does.

d. Check percent of deflection and actual length of concave distribution cell length

Percent of deflection = Deflection ÷ Effective distribution cell length x 100

Percent of deflection = _____ ft ÷ _____ ft x 100

Percent of deflection = _____ % (≤ 10%)

Actual distribution cell length = [(% of deflection x 0.00265) + 1] x effective distribution cell length

Actual distribution cell length = [(_____% x 0.00265) +1] x ______ ft

Actual distribution cell length = _______ ft

D. DESIGN OF ENTIRE GSF PRODUCT MOUND AREA

Fill Depth

a. Minimum fill depth below distribution cell at least 12 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 383.44-3, Wis. Adm. Code, that requires a minimum depth of 36 inches or less. At least 12 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 383.44-3, Wis. Adm. Code, that requires a depth greater than 36 inches.

   1) Depth at up slope edge of distribution cell (D) = distance required by Table 383.44-3, Wis. Adm. Code, minus distance in inches to limiting factor

   D = ___36____ inches - ___25_____ inches

   D = ___11____ inches (at least ≥ 6 or 12 inches, but not greater than 36 inches in accordance with Table 2)

   2) Depth at down slope edge of distribution cell (E)

   E = Depth at up slope edge of distribution cell (D) + (% natural slope expressed as a decimal x distribution cell width (A))

   E = ___11_____ inches + (___0.06_____ x ____6_____ feet x 12 inches/ft)

E = ___15.3_____ or ___16_____ inches

b. Distribution cell depth for GSF product distribution cell.

Distribution cell depth (F) for unit distribution cell = Height of tallest product as shown in Table 2b

____A42____________ unit height = ___7_________ inches

F = _____7___________ inches

c. Cover material
1) Depth at distribution cell center (H) ≥ 12 inches

2) Depth at distribution cell edges (G) ≥ 6 inches

2. Mound length
   a. End slope width (K)= Total fill at center of distribution cell x horizontal gradient of side slope

K = {([(D + E) ÷ 2] + F + H) x horizontal gradient of side slope} ÷ 12 inches/foot

K = {([(__11___ inches + __16___ inches) ÷ 2] + __7___ inches + _12___ inches) x _3___ } ÷ 12 inches/ft

K = ___8.125______ or ____9_______ ft

f. Mound length (L) = Distribution cell length + (2 x end slope width)
L = B + 2K
L = __40_____ ft + (2 x ___9_____ ft)
L = ___58_____ feet

3. Mound width

   a. Up slope width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x Horizontal gradient of side slope x Slope correction factor {100 ÷ [100 + (gradient of side slope x % of slope or value from Table 5)]}

J = (D + F + G) x horizontal gradient of side slope x Slope correction factor 100 ÷ [100 + (gradient of side slope x % of slope or value from Table 5)]}
J = (_11___ in + _7___ in + _6____ in) ÷ 12 in/ft x ___3___ x 100 ÷ [100 + (_3___ x _6__) or (_1.22___)]
J = _5.08_____ or __6___ feet

   b. Down slope width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope or value from Table 5)]}

I = (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope or value from Table 5)]}

I = (_16___ in + _7____ in + ____6___ in) ÷ 12 in/ft x 3 x 100 ÷ [100 - (____3___ x ___6___) or (__0.85____)]

I = __29___ in ÷ 12 in/ft x 3 x 100 ÷ _82__
I = __8.84___ or __9___ feet

g. Mound width (W) = Up slope width (J) + Distribution cell width (A) + Down slope width (I)

W = J + A + I
W = __6___ ft + __5__ ft + __9__ ft
W = __20___ feet

4. Check the basal area
   a. Basal area required = Daily wastewater flow ÷ soil application rate of in situ soil (The soil application rate may be that which is listed for BOD5 and TSS > or ≤ 30 mg/L depending on wastewater characteristics or fill depth below distribution cell. See Table 1.)
   Basal area required = ___450__ gal/day ÷ __0.5___ gal/ft²/day
   = ___900___ ft²

   b. Basal area available

   1) Sloping site = Cell length (B) x [(# of cells x cell width) + ({# of cells – 1} x cell spacing) + down slope width] (I)

   Basal area available = _40__ ft x [(_2_ x __3__ ft) + ({__2__ -1} x 0 ft) + __9__ ft]
   = __40_ ft x (__6__ ft + __0__ ft + __9__ ft)
   = __40_ ft x __15_ ft
   = __600___ ft²

   2) Level site = Cell length (B) x total mound width (W)
   Basal area available = _____ ft x _____ ft
   = _____ ft²

   c. Is available basal area sufficient? _____ yes _X__ no
   Basal area required < Basal area available
   __900_ ft² ≤ __600_ ft²

The available basal area must be increased by _300_ ft². This can be accomplished by increasing the down slope width (I) by __8.5__ ft. making it __17.5__ ft.

See d. for recalculation of basal area.

   h. Basal area available (recalculation of basal area)
   1) Sloping site = Cell length (B) x [(# of cells x cell width) + ({# of cells – 1} x cell spacing) + down slope width] (A+I)

   = _40__ ft x [(_1_ x __5__ ft) + ({__1__ -1} x 0 ft) + __17.5__ ft]
   = __40_ ft x (__5__ ft + __0__ ft + __17.5__ ft)
   = __40_ ft x __22.5_ ft
   = __900___ ft²

   2) Level site = Cell length (B) x total mound width (W)
   = ______ ft x ______ ft

= ______ ft^2

5. Determine the location of observation pipes along the length of distribution cell.

   Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance.

   - be located such that there are a minimum of two installed in the GSF dispersal cell
   - be located near the dispersal cell ends
   - be at least 6 inches from the end wall and sidewall
   - be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell
   - Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers' installation instructions.

XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal

In order to install a system correctly, it is important to develop plans that will be used to install the system correctly the first time. The following checklist may be used when preparing plans for review. The checklist is intended to be a **general guide**. Not all needed information may be included in this list. Some of the information may not be required to be submitted due to the design of the system. Conformance to the list is not a guarantee of plan approval. Additional information may be needed or requested to address unusual or unique characteristics of a particular project. Contact the reviewing agent for specific plan submittal requirements, which the agency may require that are different than the list included in this manual.

<u>General Submittal Information</u>

- Photocopies of soil report forms, plans, and other documents are acceptable. However, an original signature is required on certain documents.
- Submittal of additional information requested during plan review or questions concerning a specific plan must be referenced to the Plan Identification indicator assigned to that plan by the reviewing agency.
- Plans or documents must be permanent copies or originals.

<u>Forms and Fees</u>

- Application form for submittal, provided by reviewing agency along with proper fees set by reviewing agent.

<u>Soils Information</u>

- Complete Soils and Site Evaluation Report (form # SBD-8330) for each soil boring described; signed and dated by a certified soil tester, with license number.
- Separate sheet showing the location of all borings. The location of all borings and backhoe pits must be able to be identified on the plot plan.

<u>Documentation</u>

- Architects, engineers or designers must sign, seal and date each page of the submittal or provide an index page, which is signed, sealed and dated.

- Master Plumbers must sign, date and include their license number on each page of the submittal or provide an index page, which is signed, sealed and dated.
- Three completed sets of plans and specifications (clear, permanent and legible); submittals must be on paper measuring at least 8-1/2 by 11 inches.
- Designs that are based on department approved component manual(s) must include reference to the manual by name, publication number and published date.

<u>Plot Plan</u>

- Dimensioned plans or plans drawn to scale (scale indicated on plans) with parcel size or all property boundaries clearly marked.
- Slope directions and percent in system area.
- Bench mark and north arrow.
- Setbacks indicated as per appropriate code.
- Two-foot contours or other appropriate contour interval within the system area.
- Location information; legal description of parcel must be noted.
- Location of any nearby existing system or well.

<u>Plan View (see Appendix for sample worksheets)</u>

- Dimensions for distribution cell(s).
- Location of observation pipes.
- Dimensions of mound.
- Pipe lateral layout, which must include the number of laterals, pipe material, diameter and length; and number, location and size of orifices.
- Manifold and force main locations, with materials, length and diameter of each.

<u>Cross Section of System (see Appendix for sample worksheets)</u>

- Include tilling requirement, distribution cell details, percent slope, side slope, and cover material.
- Lateral elevation, position of observation pipes, dimensions of distribution cell, and type of cover material such as geotextile fabric, if applicable.

<u>System Sizing</u>

- For one and two-family dwellings, the number of bedrooms must be included.
- For public buildings, the sizing calculations must be included.

<u>Tank And Pump or Siphon Information</u>

- All construction details for site-constructed tanks.
- Size and manufacturer information for prefabricated tanks.
- Notation of pump or siphon model, pump performance curve, friction loss for force main and calculation for total dynamic head.
- Notation of high water alarm manufacturer and model number.
- Cross section of dose tank / chamber to include storage volumes; connections for piping, vents, and power; pump “off” setting; dosing cycle and volume, high water alarm setting, and storage volume above the high water alarm; and location of vent and manhole.
- Cross section of two compartments tanks or tanks installed in a series must include information listed above.

B. Inspections

Inspection shall be made in accordance with ch. 145.20, Wis. Stats. and s. SPS 383.26, Wis. Adm. Code. The inspection form on the following two pages may be used. The inspection of the system installation and/or plans is to verify that the system at least conforms to specifications listed in Tables 1 - 3 of this manual.

XIII. POWTS INSPECTION REPORT

(ATTACH TO PERMIT)

GENERAL INFORMATION

Permit Holder's Name	☐ City ☐ Village ☐ Town of	County	Sanitary Permit No.
State Plan ID No.	Tax Parcel No.	Property Address if Available	

TREATMENT COMPONENT INFORMATION			**SETBACKS (FT)**				
TYPE	MANUFACTURER AND MODEL NUMBER	CAPACITY	P/L	WELL	WATER LINE	BLDG.	VENT
SEPTIC							
DOSING							
AERATION							
HOLDING							
FILTER							

PUMP / SIPHON INFORMATION

Manufacturer:	Model No.	Demand in GPM	TDH - Design

FORCE MAIN INFORMATION			**FRICTION LOSS (FT)**			
Length	Diameter	Dist. To Well	Component Head	Force Main Losses	Vert. Lift	TDH - As Built

SOIL ABSORPTION COMPONENT

TYPE OF COMPONENT:				COVER MATERIAL:		
Cell Width	Cell Length	Cell Depth	Cell Spacing	No. of Cells		
UNIT		Manufacturer: Eljen Corporation			Model No.	
SETBACK INFO. (FT)	Property Line	Bldg.	Well		Water Line	OHWM

DISTRIBUTION COMPONENT

Elevation data on back of form

Header / Manifold		Distribution Lateral(s)			Orifice size	Orifice Spacing	Obs. Pipes Inst. & No.
Length	Dia.	Length	Dia.	Spacing			

SOIL COVER

Depth over center of cell:	Depth over edge of cell:	Depth of Cover material	Texture	Seeded / Sodded	Mulched

DEVIATIONS FROM APPROVED PLAN

DATE OF INST. DIRECTIVE:	DATE OF ENFORCEMENT ORDER:
DATE OF REFERRAL TO LEGAL COUNSEL:	

COMMENTS (Persons present, discrepancies, etc.)

COMPONENTS NOT INSPECTED

Plan Revision Required ☐ Yes ☐ No	Date:	Signature of Inspector:	Cert. Number

Sketch on other side

ELEVATION DATA

Point	Back sight	Height of instrument	Foresight	Elevation	Comments
Bench mark					
Bldg. Sewer					
Tank inlet					
Tank outlet					
Tank inlet					
Tank outlet					
Dose tank					
Bottom of dose					
Dist. lateral 1					
System elev. 1					
Dist. lateral 2					
System elev. 2					
Dist. lateral 3					
System elev. 3					
Grade elev. 1					
Grade elev. 2					
Grade elev. 3					

SKETCH OF COMPONENT & ADDITIONAL COMMENT

FINAL

Onsite Wastewater Technology Testing Report

Massachusetts Alternative Septic System Test Center
Air Station Cape Cod, Massachusetts 02542
Telephone: 508-563-6757
MASSTC@cape.com

Massachusetts
Alternative
Septic
System
Test
Center

-- March 2008 --

Eljen™ Geotextile Sand Filter
Timed Pressure Dosed Mode

Technology Vendor

Eljen Corporation
125 McKee Street
East Hartford, Connecticut
Telephone: 800-444-1359
Facsimile: 860-610-0427
http://www.eljen.com/

I certify that I represent the Massachusetts Alternative Septic System Test Center, a project of the Barnstable County Department of Health and Environment, Barnstable County Massachusetts. I further certify that I am authorized to report the testing results for this proprietary treatment product. I attest that the details described in this report to include details regarding the test protocol and results are true and accurate to the best of my knowledge.

George Heufelder

George Heufelder, M.S., R.S.
Director, Barnstable County Department of Health and Environment
Massachusetts Alternative Septic System Test Center

Glossary of Terms

Biochemical Oxygen Demand ($BOD_{5\text{-}day}$) – Alternately known as 5-day BOD. The concentration of oxygen (expressed in mg/L) utilized by microorganisms in the oxidation of organic matter during a five-day period at a temperature of 20 °C.

Carbonaceous Biochemical Oxygen Demand ($cBOD_{5\text{-}day}$) – Alternately known as 5-day cBOD. The concentration of oxygen (expressed in mg/L) utilized by microorganisms in the non-nitrogenous oxidation of organic matter during a 5-day period at a temperature of 20 °C.

Colony Forming Units (CFU) – This is a measure based on the ability of a bacterium in a sample to form a colony on poured plate media. The colony is visible to the human eye after 24 hours. The visible colony represents one bacterium in the original sample. Thus, a count of colonies after the incubation period is an indication of the number of bacteria originally present. All fecal coliform counts are expressed as CFU per 100 ml of sample by convention despite the volume actually filtered.

Total Suspended Solids (TSS) – Those solids (expressed in mg/L) which are retained by a glass fiber filter and dried to constant weight at 103–105 ^{o}C.

Section 1.0 Introduction

The Massachusetts Alternative Septic System Test Center (MASSTC) is located at the Otis Air National Guard military base in Falmouth, Massachusetts. The Test Center, also known as the Buzzards Bay Test Facility, is operated by the Barnstable County Department of Health and Environment under the direction of a Steering Committee with members from the Massachusetts Department of Environmental Protection, the United States Environmental Protection Agency, Barnstable County, Massachusetts Coastal Zone Management and the University of Massachusetts School of Marine Science and Technology.

The mission of MASSTC is to provide a location for the verification and testing of onsite wastewater treatment technologies and components. The facility conducts testing under various protocols, some of which are widely recognized. Of note, the National Sanitation Foundation International (NSF) has employed MASSTC to conduct its standard protocol NSF-40 on a number of onsite septic system technologies. In addition, a number of verification tests were performed in accordance with a nutrient testing protocol jointly developed with industry, NSF and USEPA known as the Environmental Technology Verification Program (ETV). Finally, MASSTC has been used to conduct the more recently developed nitrogen reduction standard NSF/ANSI 245.

This report describes testing of the Eljen GSF/A42 Geotextile Sand Filter. The Eljen GSF is a modular treatment component integrated with a soil absorption system comprised of an anti-siltation fabric, perforated pipe, Bio-Matt™ fabric and a cuspated plastic core. The modules are placed onto a layer of clean sand situated above native soil. The manufacturer claims that the modules, in conjunction with specified sand, are essentially bottomless treatment units capable of achieving reductions comparable with secondary treatment in Biochemical Oxygen Demand ($BOD_{5\text{-day}}$) and Total Suspended Solids (TSS). In order to test this claim, MASSTC oversaw the construction of a test cell equipped with an underdrain capable of supplying representative samples.

Section 2.0 Dimensions and Description of Test Unit

2.1 Test Cell Construction

In normal field installations, Eljen GSF modules are variously arranged atop a specified soil (such as ASTM C33 sand) that has been leveled above a native receiving soil. In this case, for purpose of testing, a test cell capable of collecting a representative sample from beneath the entire system was constructed. The lined test cell was constructed of 30 mil PVC liner with the approximate dimensions 10 feet x 28 feet. The bottom of the cell was sloped and equipped with a four-inch slotted PVC collection pipe positioned longitudinally in the middle of the test cell and sloped toward a low point in the liner basin. All areas in the liner were sloped toward the collection pipe and the low point in the liner basin. A drain pipe penetrated the liner by means of a bulkhead watertight fitting connecting the drain to the four-inch slotted PVC pipe. The four-inch slotted PVC pipe and the bottom of the liner were covered with two to six inches of double washed 1/8 inch aggregate. During construction, this aggregate was washed again for the purpose of removing all fine material and verifying the proper free drainage of the test cell. Twelve inches of ASTM C33 sand were then placed above the aggregate and compacted in six inch lifts. A vibratory compactor was used for compaction, and a laser level ensured that the base for the test units was level. Figures 1–6 illustrate the construction of the test cell.

Figure 1. A wooden frame was constructed to hold an impervious liner in place. The ground beneath the liner was prepared to slope toward the center collection drain. A groove in the supporting soil was installed and sloped toward the sampling point.

Figure 2. The four-inch underdrain is connected to a watertight bulkhead fitting. The drain pipe on the outside fitting is directed into a distribution box for sample collection.

Figure 3. Two to six inches (six inches in the center low point to two inches on the upslope of each side) of washed 1/8 inch aggregate is placed at the bottom of the liner to allow for free flow of percolate toward the collection drain.

Figure 4. Twelve inches of sand are placed over the 1/8 inch aggregate (left-hand cell), compacted in six-inch lifts. The right-hand cell is ready for initial sand placement. The prepared sand area is leveled and readied for the placement of the Eljen GSF modules.

Figure 5. Eljen GSF modules are placed on the prepared test cell.

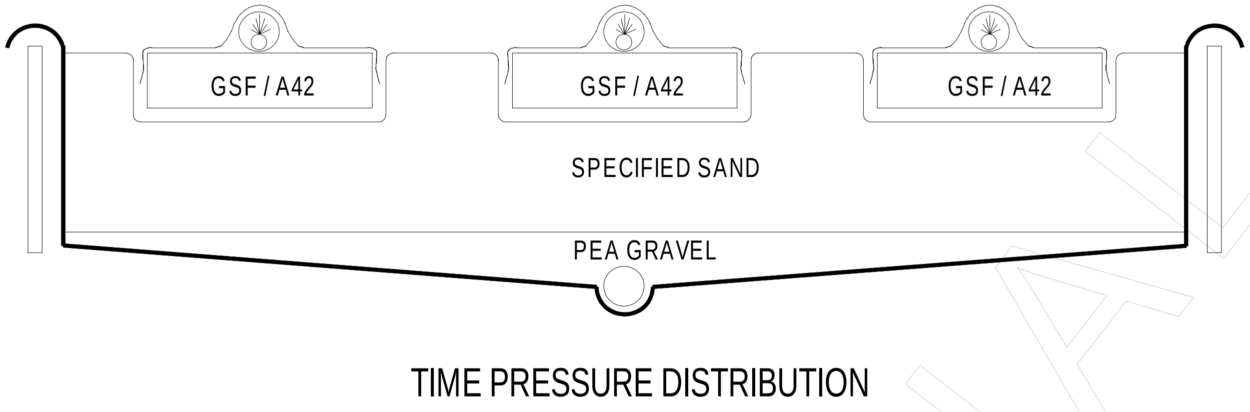

Figure 6. Cross sectional schema of the test modules situated within the test cell.

2.2 Test Unit Description

The system tested was comprised of a 1,000 gallon single-compartment septic tank (incorporating an eight-inch diameter Biotube™ effluent filter with a 1/8 inch screen), a 500 gallon pump chamber, a distribution box, and three rows of Eljen GSF/A42 Geotextile Sand Filter modules (each module was 48 inches in length) placed over one foot of ASTM C33 Sand. Each of the three rows was 24 feet in length. Pressure one-inch laterals were placed inside each of the three four-inch perforated pipes (Figure 6) and connected to a common pressure manifold. Dosing to the laterals was timed and activated by an enabling float in the pump chamber was observed to enable 39-40 times daily during testing. Each dose from the pump chamber to the distribution box was therefore approximately 11.5 gallons (although doses to the septic tank portion of the system did not exceed 10 gallons, 45 times per day for a total of 450 gallons per day as described below). The schema of the system is presented in Figure 7.

The Eljen GSF/A42 Geotextile Sand Filter module is the only proprietary product that may not be substituted in field installations. Non-proprietary components of the tested unit include the septic tank, pump chamber, pumps, distribution box, controller and control floats. These components can be substituted with any equivalent units from a variety of manufacturers.

2.3 Influent Wastewater Source

Initially the septic tank was filled with 1/3 clean water and 2/3 wastewater. Influent wastewater for these tests originated from residential households. Wastewater was dosed to the septic tank using timed pumps which were calibrated for accuracy within 10% of the desired rate on a weekly basis. Design loading was apportioned during the day with 35% of the flow administered between 0600h and 0900h, 25% between 1100h and 1400h, and 40% between 1700h and 2000h. The total daily inflow to each tank was 450 gallons. The maximum dose volume to the septic tank was 10 gallons. Wastewater characteristics are described below.

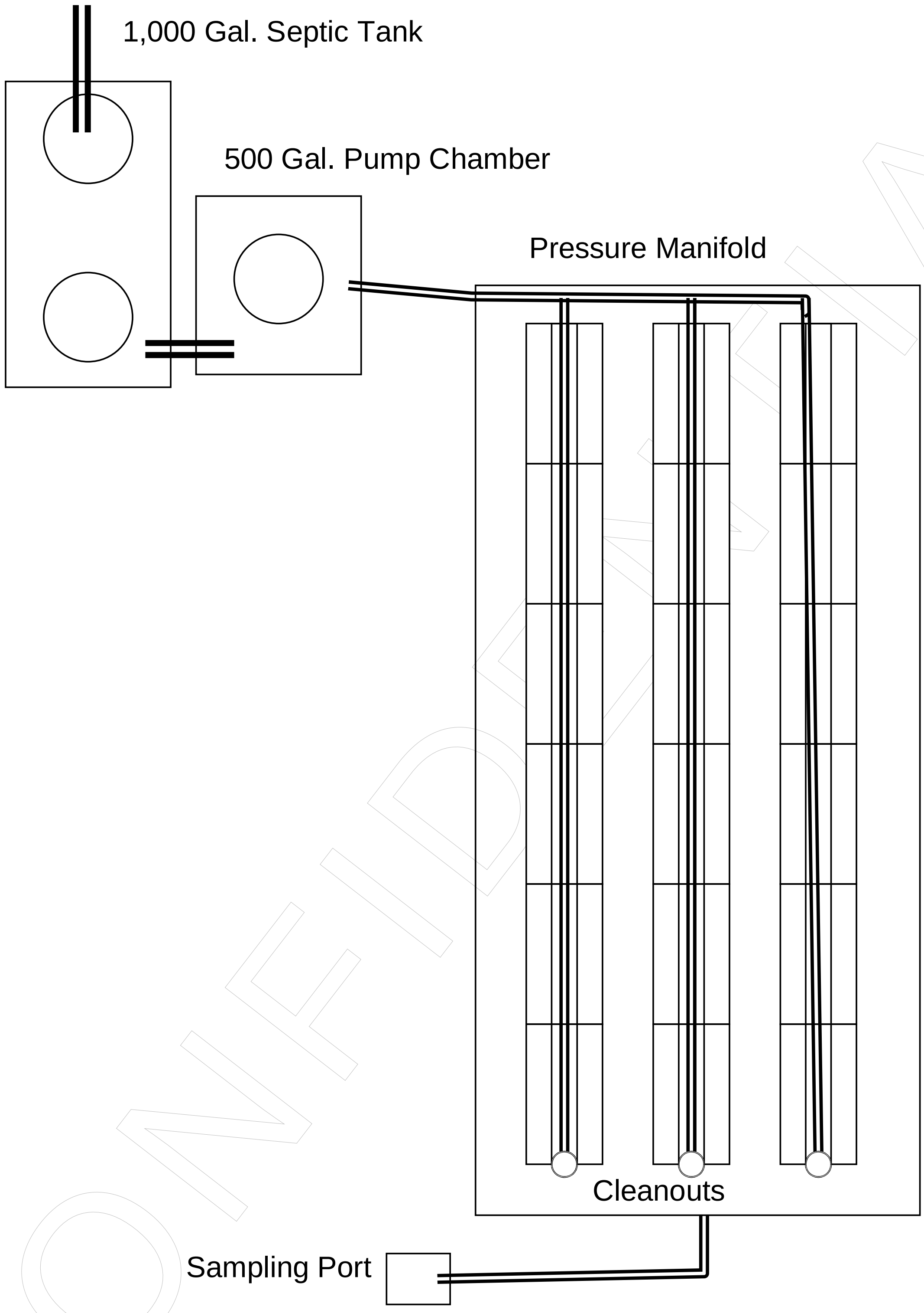

Figure 7. Schema of Eljen GSF/A42 Geotextile Sand Filter modules as configured for testing at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008.

Section 3. Test Description

3.1 Testing Protocol

During the testing period reported here, the test unit was supplied with wastewater for approximately 32 weeks initiated during the week of June 6, 2007 and ending the week of January 6, 2008 (the final sample was reported on January 14, 2008). It should be noted however that at the vendor's request, samples continue to be taken to this date. Influent and effluent samples were processed for biochemical oxygen demand ($BOD_{5\text{-day}}$ on influent and $cBOD_{5\text{-day}}$ on effluent) and total suspended solids (TSS). Beginning in mid-July 2007, fecal coliform were processed three times weekly during a different dosing period. All samples with the exception of fecal coliform were taken using composite samplers and assayed using the appropriate methods in APHA's Standard Methods for the Examination of Water and Wastewater. Fecal coliform assays were performed on grab samples.

During the 32 weeks of testing, samples were collected daily except where noted and during stress loading periods. Four stress events were performed. The first stress period (September 24–28, 2007) involved the inclusion of three laundry wash loads (three wash cycles and six rinse cycles) introduced during the first two dosing periods of the day. This was conducted for three days during a five-day period. The second stress sequence (October 8–13, 2007) involved providing the septic tank with 40% of the daily flow between 0600h and 0900h. The remaining 60% of capacity was introduced to the septic tank between 1700h and 2000h and included one wash load (one wash cycle and two rinse cycles). The third stress sequence (October 19–21, 2007) involved the introduction of 40% of the daily flow between 1700h and 2000h on the day that the power was turned off to the pump chamber at 2100h. The flow to the system was interrupted for 48 hours and 60% of the daily flow was introduced to the septic tank within a three-hour period, which included one wash load (one wash cycle and two rinse cycles). The final stress event (October 28–November 6, 2007) involved normal dosing during the first two dosing periods of the day (35% of hydraulic capacity between 0600h and 0900h; 25% of hydraulic capacity between 1100h and 1400h), and a discontinuation of dosing for eight consecutive days. On the ninth day, 60% of the hydraulic capacity was dosed to the system between 1700h and 2000h and included three laundry wash loads (three wash cycles and six rinse cycles). Samples were taken for five consecutive days following 24 hours of the first stress event, five consecutive days following the second stress event, five days following the power interruption stress, and six consecutive days following the final stress event.

All influent and effluent samples were composite flow-proportional 24-hour samples.

3.2 Data Inclusion

All data collected from the test were included. No data required exclusion due to QA/QC indications of the Test Center laboratories. The detection limit for $cBOD_{5\text{-day}}$ in effluent samples was 2.0 mg/L. For purposes of data analysis, all samples assayed having $cBOD_{5\text{-}}$

$_{day}$ levels below the detection limit were reported as 1.0 mg/L. Similarly, the detection limit for TSS was 5.0 mg/L, and those assays below this limit were reported as 2.5 mg/L.

Quality assurance sample duplicates were submitted to the laboratories on the dates indicated below for $cBOD_{5\text{-}day}$ and TSS. No duplicates were significantly different than the primary sample (Table 1).

ELJEN ETPD CBOD (mg/L) Duplicate QA

Date	ELJ ETPD	ELJ ETPD QA
8/6/07	1.00	1.00
8/23/07	1.00	1.00
8/30/07	1.00	1.00
9/6/07	1.00	1.00
9/13/07	1.00	1.00
9/20/07	2.20	1.00
9/27/07	1.00	1.00
10/4/07	1.00	1.00
10/18/07	1.00	1.00
10/25/07	2.30	1.00
11/20/07	1.00	1.00
12/6/07	3.40	4.30
12/18/07	3.40	3.30

ELJEN ETPD TSS (mg/L) Duplicate QA

Date	ELJ ETPD	ELJ ETPD QA
8/6/07	2.50	2.50
8/23/07	2.50	2.50
8/30/07	2.50	2.50
9/6/07	2.50	2.50
9/13/07	2.50	2.50
9/20/07	2.50	2.50
9/27/07	2.50	2.50
10/4/07	2.50	2.50
10/18/07	2.50	2.50
10/25/07	2.50	2.50
11/20/07	2.50	2.50
12/6/07	2.50	2.50
12/18/07	2.50	2.50

Table 1. Quality assurance results for $cBOD_{5\text{-}day}$ and TSS samples taken from the Eljen GSF/A42 Geotextile Sand Filter timed pressure-dosed modules during test period.

4.0 Results

4.1 Influent Verification

One hundred and twenty six (n=126) influent wastewater observations for $BOD_{5\text{-}day}$ and TSS were made between June 6, 2007 and January 14, 2008 (222 days or ~32 weeks), concurrent with effluent sampling, to confirm that the wastewater was of adequate strength. The overall mean TSS was 193 mg/L with a median TSS of 190 mg/L. The overall mean $BOD_{5\text{-}day}$ was 201 mg/L with a median $BOD_{5\text{-}day}$ of 180 mg/L.

Dissolved oxygen in influent wastewater ranged between 0.04 and 1.30 mg/L with a mean and median of 0.23 and 0.15 mg/L respectively. The pH of the influent ranged from 6.67 to 7.56 units with a mean and median of 7.17 and 7.21 respectively.

Volume of influent was confirmed within 5% of the design volume for the test period through weekly pump calibrations. All influent and effluent raw data are presented in Appendix 1.

4.2 Performance Data

4.21 $cBOD_{5\text{-day}}$ and TSS

Over the entire test period reported here (222 days or ~32 weeks), $cBOD_{5\text{-day}}$ and TSS values of the percolate from the Eljen GSF/A42 Geotextile Sand Filter modules did not exceed 14 mg/L, even during post stress sampling events. The mean percolate $cBOD_{5\text{-day}}$ value of 2.6 mg/L included 56 observations (42%) below the detection limit of 2.0 mg/L. The mean TSS of 2.7 mg/L included 115 observations (94%) below the detection limit of 5.0 mg/L. The distributions of observations for $cBOD_{5\text{-day}}$ and TSS are shown in Figures 8 and 9.

The initial two stress events exhibited no apparent effect on $cBOD_{5\text{-day}}$ and TSS discharge, as all observations during post stress sampling were below the detection limit of 2.0 mg/L and 5.0 mg/L respectively. Testing following the second two stress periods (power interruption and flow interruption with subsequent laundry loads) showed elevations in $cBOD_{5\text{-day}}$ and TSS to levels of 12.0 mg/L and 7.0 mg/L respectively, although no elevations in TSS above the detection limit were observed following the power interruption stress.

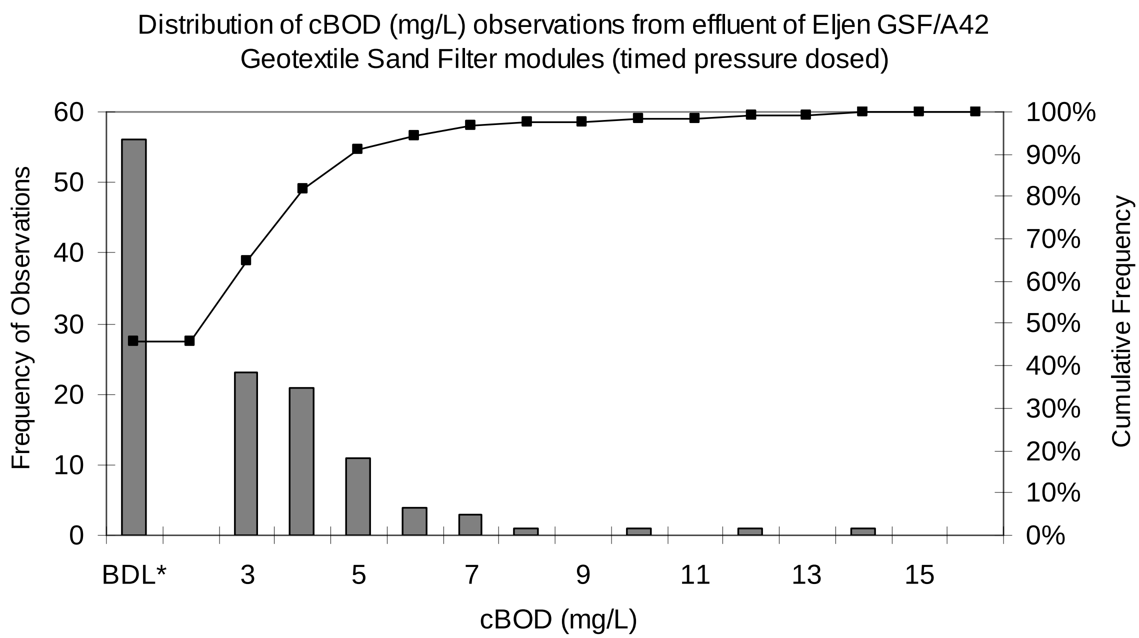

Figure 8. Frequency distribution of $cBOD_{5\text{-day}}$ (mg/L) observations for discharge samples of Eljen GSF/A42 Geotextile Sand Filter modules during testing at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008. BDL= Below Detection Limit of 2 mg/L.

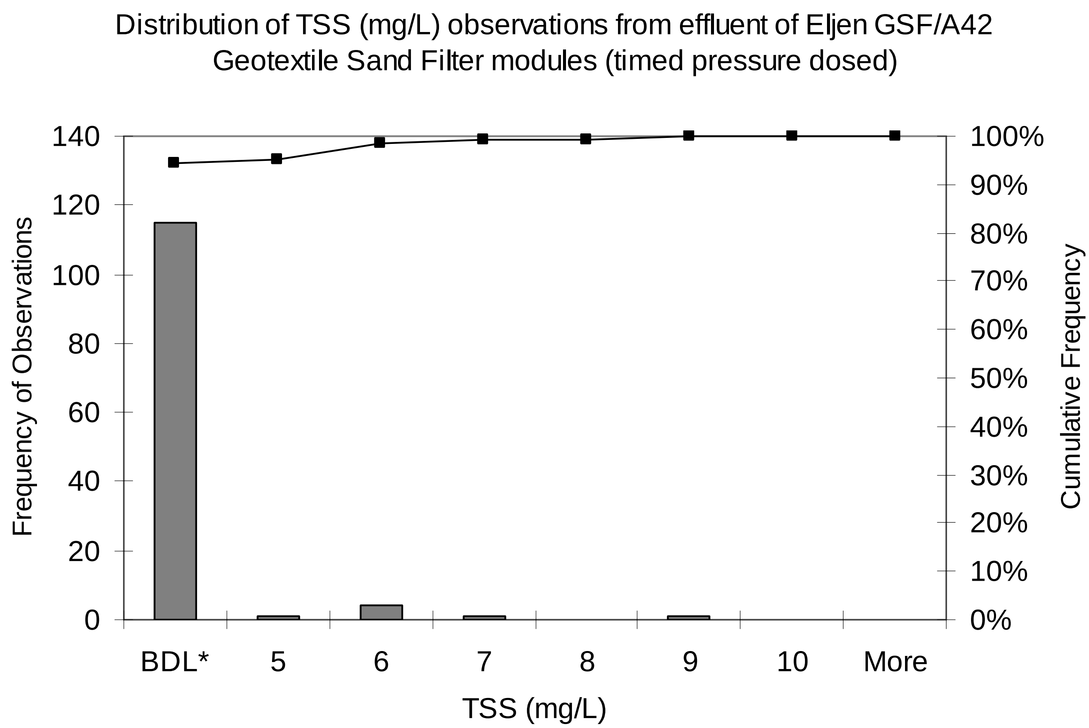

Figure 9. Frequency distribution of TSS (mg/L) observations for discharge samples of Eljen GSF/A42 Geotextile Sand Filter modules during testing at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008. BDL= Below Detection Limit of 5 mg/L.

4.22 Dissolved Oxygen and pH

Dissolved oxygen in the percolate exhibited a mean level of 6.3 mg/L and a minimum value of 4.2 mg/L. By comparison, the dissolved oxygen in the influent exhibited a mean level of 0.23 mg/L. Throughout the observation period, the dissolved oxygen in the percolate only depressed below 5.0 mg/L on four occasions. The pH values in the percolate varied between 5.29 and 7.74 pH units (Figure 10). For comparison of pH, Figure 11 shows the pH values collected beneath five 24-foot gravel trenches and five 12-foot gravelless trenches in a separate series of tests. The tests were conducted beneath two feet of sand having the same specification sand as used in the Eljen GSF/A42 Geotextile Sand Filter module tests. The pH levels in the GSF percolate remained above 6.0 in response to increased influent alkalinity that occurred after November 28, 2007. This suggests that influent alkalinity is a prime determinant for pH in the percolate.

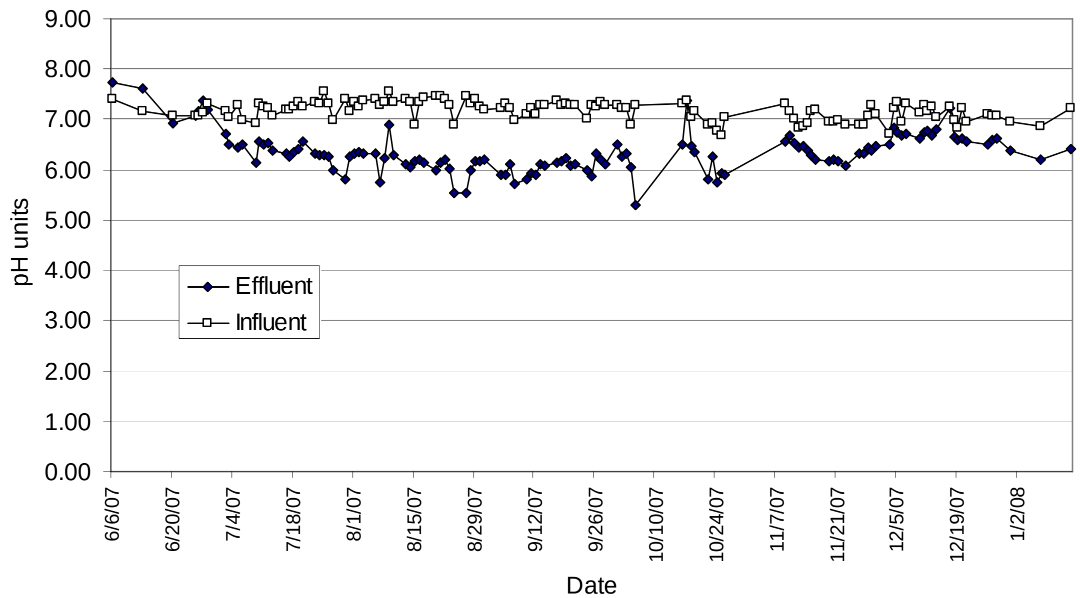

Figure 10. pH values of influent and percolate (effluent) for the Eljen GSF/A42 Geotextile Sand Filter modules during testing at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008.

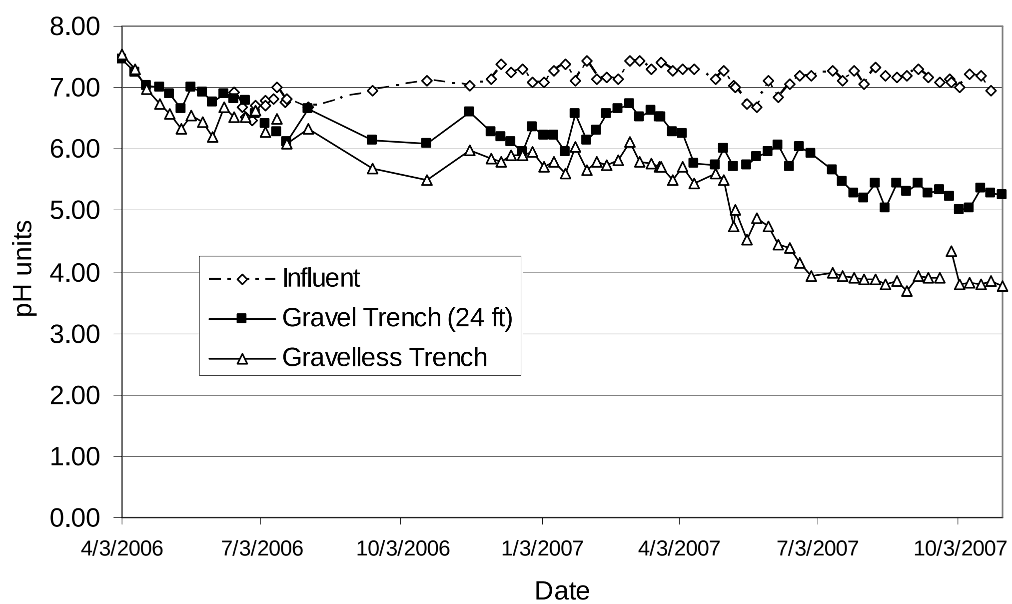

Figure 11. pH fluctuation in a standard 24 foot pipe-in-aggregate trench and a 12 foot gravelless trench. Levels presented are mean values of five replicates each. Tests were performed separately and are presented for comparison only.

4.23 Fecal Coliform.

Fecal coliform densities of influent wastewater ranged from 10^6 to 10^7 CFU/100 ml at morning, afternoon and evening sampling times (Appendix 2, 3 and 4) with a $\log_{10}$ mean of 5 X 10^6 CFU/100 ml. The log mean reduction in fecal coliform for the Eljen GSF/A42 Geotextile Sand Filter modules was 3.1 (99.92% reduction) with a range of 1.8–5.1 (98.415%–99.999% reduction) (Figure 12).

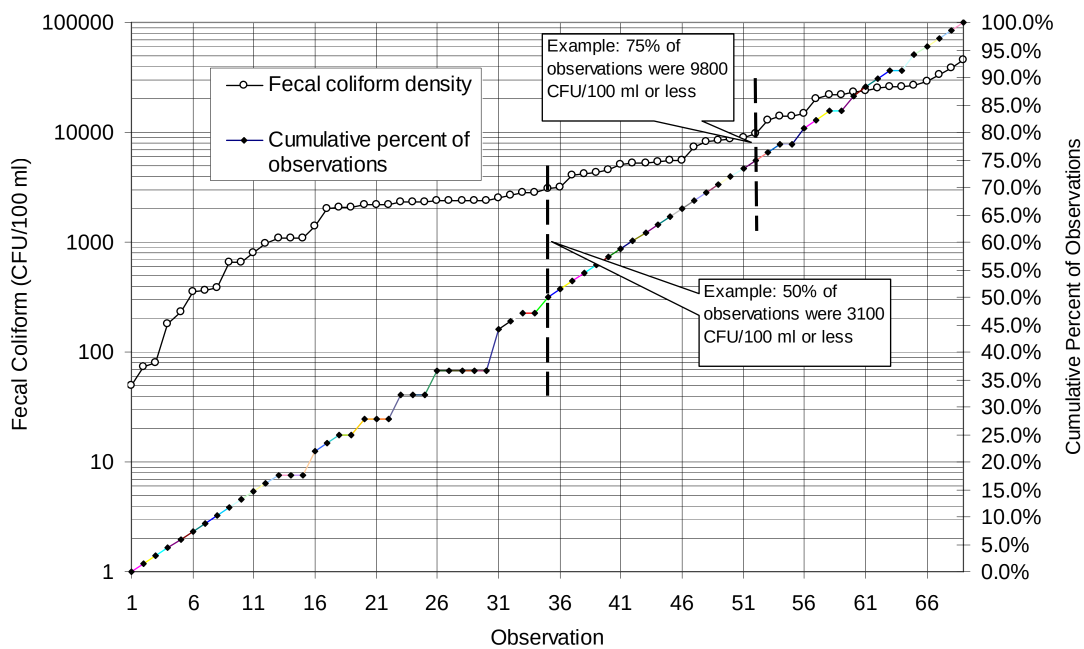

Figure 12. Fecal coliform reductions for the Eljen GSF/A42 Geotextile Sand Filter modules in timed dosed mode during testing at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008.

5.0 Observations

The Eljen GSF/A42 Geotextile Sand Filter modules exhibited no signs of surface breakout or failure of any kind during the test period.

6.0 Power Usage

Approximately 21 KwH of electricity were used during the six-month test. Assuming a cost of $0.18/KwH, this equates to less than $8/year for cost of operation.

7.0 Discussion

The Eljen GSF/A42 Geotextile Sand Filter (GSF) is basically a passive treatment system situated between the effluent distribution pipe and the underlying soil. The matrix of cuspated plastic, fabric material and specified sand provides a substrate for the growth of organisms that break down and stabilize wastewater constituents such as biodegradable solids, BOD, ammonium and others. The tests performed suggest that treatment in the GSF exceeds EPA secondary treatment guideline parameters by a considerable margin. These guidelines specify that the 7-day average of $CBOD_{5\text{-day}}$ concentrations of effluent samples shall not exceed 40 mg/L, whereas the GSF did not exceed a 6.5 mg/L level in this regard. Similarly, EPA guidelines require that the 7-day average of TSS concentrations of effluent samples shall not exceed 45 mg/L, and the GSF did not exceed 5.0 mg/L. The EPA guidelines 30-day averages of 25 mg/L cBOD and 30 mg/L TSS were not exceeded by similar margins.

The manufacturer has requested comment from the Test Center regarding the scalability of the technology. As tested, the Eljen GSF/A42 Geotextile Sand Filter modules were configured as three lines, each 24 feet long, two feet wide and separated by one foot of sand. Each of the three lines was equally supplied septic tank effluent from a distribution box. The data and observations do not contradict the claim that the module configuration is scalable. Twice the number of modules is likely capable of accepting twice the flow and so on provided that the spacing between the modules is *at least* that of the tested units.

Appendix 1.

Eljen GSF/A42 Geotextile Sand Filter modules in timed pressure dosing mode at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008

Raw Data

	Eljen GSF / A42 Geotextile Sand Filter modules						Influent					
DATE	CBOD (mg/L)	TSS (mg/L)	Discharge Temperature ^oC	Sp Cond(uS)	Dissolved Oxygen	pH	BOD5 (mg/L)	TSS (mg/L)	Discharge Temperature ^oC	Sp Cond(uS)	Dissolved Oxygen	pH
6/6/07	6.20	2.50	17.0	305	4.20	7.74	110	92	16.7	409	0.10	7.39
6/13/07	2.5	2.5	16.5	307	7.60	7.61	130	76	16.1	370	0.20	7.15
6/20/07	6.4	2.5	17.2	603	8.10	6.93	230	240	18.0	604	0.10	7.06
6/25/07	2.9	2.5	18.6	930	7.10	7.08	250	260	18.9	614	0.20	7.06
6/26/07	1.0	2.5	19.8	626	5.40	7.17	160	230	19.0	520	0.10	7.06
6/27/07	14.0	5.0	20.2	614	5.80	7.36	160	150	19.7	515	0.20	7.14
6/28/07	10.0	2.5	19.8	565	5.40	7.19	190	76	19.7	534	0.20	7.32
7/2/07	5.1	2.5	19.7	398	5.10	6.72	110	62	18.4	364	0.10	7.17
7/3/07	3.9	2.5	19.4	504	5.60	6.49	270	230	18.5	531	0.10	7.03
7/5/07	5.1	2.5	19.5	488	7.20	6.45	160	150	20.0	550	0.20	7.29
7/6/07	1.0	2.5	19.7	461	6.20	6.50	270	270	19.1	520	0.20	6.98
7/9/07	3.1	2.5	20.5	457	5.60	6.13	150	130	19.7	463	0.10	6.91
7/10/07	3.4	2.5	20.6	469	5.80	6.56	130	140	19.5	481	0.10	7.32
7/11/07	3.2	2.5	22.1	455	5.90	6.50	200	98	19.9	433	0.10	7.24
7/12/07	2.9	2.5	21.3	429	5.70	6.53	280	320	20.4	500	0.20	7.23
7/13/07	1.0	2.5	21.4	611	5.40	6.39	220	230	19.7	671	0.10	7.07
7/16/07	2.8	2.5	21.8	624	5.90	6.31	130	86	20.1	736	0.10	7.20
7/17/07	2.7	2.5	22.1	497	5.00	6.25	160	180	21.3	582	0.20	7.19
7/18/07	1.0	2.5	22.3	462	4.60	6.34	300	270	20.6	530	0.20	7.24
7/19/07	3.3	2.5	22.2	391	5.20	6.40	160	170	20.8	424	0.10	7.33
7/20/07	2.5	2.5	22.2	371	5.40	6.56	230	180	20.7	454	0.10	7.25
7/23/07	1.0	2.5	21.5	356	6.10	6.32	150	100	20.4	388	0.10	7.33
7/24/07	2.1	2.5	21.5	335	6.40	6.30	170	160	20.7	382	0.10	7.31
7/25/07	2.2	2.5	21.9	328	5.80	6.29	240	310	20.8	361	0.20	7.56
7/26/07	2.1	2.5	22.1	316	5.90	6.25	180	210	20.9	370	0.10	7.32
7/27/07	1.0	2.5	22.4	294	5.60	5.98	230	200	21.2	397	0.20	6.99
7/30/07	1.0	2.5	23.1	442	5.40	5.81	150	110	21.5	498	0.20	7.39
7/31/07	1.0	2.5	23.0	434	5.00	6.25	320	310	21.4	515	0.10	7.16
8/1/07	1.0	2.5	23.3	414	5.50	6.31	240	250	21.5	481	0.10	7.34
8/2/07	1.0	2.5	23.2	427	5.70	6.35	220	210	21.5	500	0.10	7.24
8/3/07	1.0	2.5	23.4	409	5.50	6.32	170	180	22.0	462	0.10	7.37
8/6/07	1.0	2.5	23.6	421	5.40	6.33	150	140	21.9	506	0.10	7.40
8/7/07	1.0	9.0	24.5	446	5.40	5.74	210	310	21.9	558	0.20	7.28
8/8/07	1.0	2.5	23.6	462	5.20	6.24	200	200	22.0	568	0.10	7.35
8/9/07	3.6	2.5	22.8	446	5.30	6.90	200	280	22.0	523	0.10	7.56
8/10/07	2.1	2.5	22.9	425	5.50	6.28	260	170	21.9	512	0.10	7.35
8/13/07	1.0	2.5	22.7	486	5.30	6.10	200	120	21.9	625	0.10	7.41
8/14/07	1.0	2.5	22.3	453	5.60	6.05	180	270	21.8	597	0.10	7.35
8/15/07	1.0	2.5	22.1	489	5.30	6.18	210	250	21.8	649	0.10	6.90
8/16/07	1.0	2.5	22.8	464	5.60	6.19	290	260	22.3	562	0.20	7.33
8/17/07	1.0	2.5	22.9	468	5.70	6.14	180	210	22.7	566	0.20	7.43
8/20/07	1.0	2.5	22.2	460	5.20	6.00	150	120	21.6	540	0.10	7.47
8/21/07	1.0	2.5	22.1	443	5.40	6.14	180	180	21.4	536	0.10	7.45
8/22/07	1.0	2.5	22.0	435	5.80	6.20	180	210	21.3	505	0.10	7.40
8/23/07	1.0	2.5	21.9	427	6.10	6.03	170	180	21.2	492	0.20	7.29
8/24/07	1.0	2.5	22.9	390	5.70	5.55	160	190	21.7	502	0.10	6.89
8/27/07	1.0	2.5	22.6	436	6.10	5.55	170	120	22.1	639	0.10	7.45
8/28/07	1.0	2.5	22.8	467	5.50	5.98	180	220	21.2	574	0.10	7.32
8/29/07	1.0	2.5	23.2	458	5.70	6.17	190	200	21.5	551	0.10	7.39
8/30/07	1.0	2.5	23.2	439	5.06	6.18	170	200	21.9	517	0.10	7.25
8/31/07	1.0	2.5	23.2	434	5.73	6.21	360	320	22.2	500	0.20	7.19

	Eljen GSF / A42 Geotextile Sand Filter modules						Influent					
DATE	CBOD (mg/L)	TSS (mg/L)	Discharge Temperature °C	Sp Cond(uS)	Dissolved Oxygen	pH	BOD5 (mg/L)	TSS (mg/L)	Discharge Temperature °C	Sp Cond(uS)	Dissolved Oxygen	pH
9/4/07	1.0	2.5	22.7	399	6.33	5.90	160	160	21.9	453	0.19	7.21
9/5/07	1.0	2.5	22.1	376	6.36	5.91	150	210	21.6	457	0.10	7.30
9/6/07	1.0	2.5	22.6	369	5.90	6.10	160	210	21.6	467	0.10	7.21
9/7/07	2.8	2.5	22.3	350	6.27	5.73	320	310	21.8	456	0.11	6.97
9/10/07	1.0	2.5	22.8	405	5.95	5.81	170	120	21.7	521	0.11	7.10
9/11/07	1.0	2.5	22.9	421	5.92	5.94	150	210	21.9	520	0.13	7.21
9/12/07	2.4	2.5	22.2	471	5.36	5.90	300	280	21.6	503	0.14	7.11
9/13/07	1.0	2.5	22.2	355	5.82	6.11	140	200	21.4	423	0.08	7.29
9/14/07	3.9	2.5	22.0	413	5.30	6.09	230	190	21.9	543	0.16	7.28
9/17/07	1.0	2.5	20.9	453	5.20	6.14	220	150	20.8	607	0.08	7.37
9/18/07	1.0	2.5	20.5	442	5.67	6.18	190	210	21.1	506	0.06	7.28
9/19/07	1.0	2.5	20.0	433	5.95	6.24	150	190	20.6	496	0.16	7.30
9/20/07	2.2	2.5	19.9	373	5.78	6.07	140	100	20.8	451	0.15	7.29
9/21/07	1.0	2.5	20.1	362	5.60	6.12	140	160	20.0	438	0.10	7.27
9/24/07	1.0	2.5	20.3	419	5.85	5.98	150	110	21.0	497	0.09	7.01
9/25/07	1.0	2.5	20.9	452	5.04	5.86	150	170	20.9	508	0.12	7.29
9/26/07	1.0	2.5	21.0	496	5.94	6.33	170	180	20.9	555	0.11	7.25
9/27/07	1.0	2.5	21.3	484	5.89	6.19	100	150	20.9	529	0.20	7.33
9/28/07	1.0	2.5	21.4	488	5.66	6.11	330	480	21.0	518	0.12	7.27
10/1/07	1.0	2.5	20.1	454	5.60	6.49	170	140	20.4	525	0.17	7.28
10/2/07	1.0	2.5	20.6	466	4.95	6.27	190	240	20.4	537	0.10	7.21
10/3/07	1.0	2.5	20.4	472	4.75	6.33	160	220	20.5	496	0.21	7.22
10/4/07	1.0	2.5	20.5	435	5.16	6.04	220	240	20.6	470	0.09	6.88
10/5/07	1.0	2.5	20.6	447	5.31	5.29	240	210	20.7	485	0.18	7.27
10/16/07	1.0	2.5	17.5	469	6.16	6.50	230	230	19.8	505	0.37	7.30
10/17/07	1.0	2.5	16.9	498	6.16	7.36	180	180	19.5	519	0.27	7.37
10/18/07	1.0	2.5	18.0	300	5.49	6.46	220	190	19.9	479	0.13	7.03
10/19/07	1.0	2.5	17.6	302	5.87	6.36	150	140	19.5	336	0.11	7.15
10/22/07	4.8	2.5	18.5	378	5.95	5.80	150	130	19.6	412	0.16	6.89
10/23/07	8.0	2.5	18.3	323	6.52	6.26	150	130	19.2	312	0.13	6.92
10/24/07	3.4	2.5	18.6	327	5.55	5.75	170	180	19.6	313	0.16	6.76
10/25/07	2.3	2.5	18.4	369	5.70	5.94	160	160	19.3	362	0.12	6.67
10/26/07	4.8	2.5		355	6.81	5.90	240	220	19.0	344	0.04	7.03
11/9/07	12.0	5.5	13.7	545	7.60	6.56	240	220	16.5	506	0.05	7.30
11/10/07	3.6	5.6	13.1	527	8.21	6.69	120	62	16.7	503	0.36	7.15
11/11/07	3.0	2.5	11.4	551	8.47	6.52	89	96	16.4	473	0.32	7.02
11/12/07	2.6	7.0	12.5	522	7.76	6.45	320	410	16.3	508	0.24	6.83
11/13/07	2.4	6.0	12.4	523	8.20	6.46	160	120	15.9	421	0.65	6.87
11/14/07	2.1	6.0	12.3	475	8.09	6.39	160	170	16.1	440	0.80	6.93
11/15/07	3.2	2.5	12.6	454	8.02	6.29	160	180	16.2	504	0.09	7.15
11/16/07	3.7	2.5	12.8	362	6.63	6.21	180	210	16.1	424	0.08	7.20
11/19/07	1.0	2.5	11.5	417	7.29	6.17	140	190	15.4	444	0.29	6.94
11/20/07	1.0	2.5	11.1	382	7.04	6.21	170	190	15.4	392	0.10	6.96
11/21/07	2.9	2.5	11.3	391	6.44	6.17	180	170	15.2	407	0.44	6.98
11/23/07	4.2	2.5	10.9	374	7.30	6.07	210	150	15.1	515	0.05	6.88
11/26/07	2.5	2.5	10.8	402	6.75	6.33	250	200	13.8	386	1.05	6.89
11/27/07	1.0	2.5	11.0	425	7.56	6.32	340	330	14.7	421	0.32	6.90
11/28/07	3.6	2.5	10.6	424	7.01	6.43	350	210	14.5	558	0.24	7.06
11/29/07	4.7	2.5	11.1	448	6.60	6.39	140	160	14.4	605	0.19	7.27
11/30/07	6.4	2.5	10.9	455	7.19	6.48	310	210	13.8	500	0.11	7.09
12/3/07	3.6	2.5	9.8	450	6.83	6.49	150	180	13.5	439	0.97	6.72
12/4/07	4.0	2.5	8.0	450	7.68	6.84	920	360	13.0	470	0.51	7.23
12/5/07	4.5	2.5	8.3	564	8.01	6.74	180	160	13.2	690	0.47	7.33
12/6/07	3.4	2.5	8.5	644	8.36	6.69	150	110	12.8	592	0.62	6.94
12/7/07	4.6	2.5	8.3	639	7.42	6.70	370	380	12.7	660	0.24	7.31
12/10/07	5.2	2.5	7.7	617	7.53	6.63	160	160	12.5	630	0.20	7.12
12/11/07	4.7	2.5	7.3	627	8.86	6.73	180	180	12.4	890	0.61	7.27
12/12/07	4.8	2.5	7.7	646	7.95	6.78	310	310	12.3	639	0.64	7.15
12/13/07	4.3	2.5	7.9	675	7.30	6.68	310	270	12.1	448	1.05	7.24
12/14/07	4.9	2.5	7.7	658	7.49	6.81	180	180	11.9	464	1.30	7.05
12/17/07	3.2	2.5	7.6	708	6.89	7.21	180	200	11.0	508	0.58	7.26
12/18/07	3.4	2.5	6.2	456	8.89	6.64	160	140	11.0	524	0.91	6.97
12/19/07	2.4	2.5	6.4	507	8.56	6.58	180	250	11.2	612	0.41	6.83
12/20/07	2.9	2.5	6.4	603	8.41	6.62	180	200	10.9	610	0.30	7.21
12/21/07	4.9	2.5	6.3	630	8.54	6.56	100	50	10.6	400	0.15	6.96
12/26/07	3.4	2.5	7.0	443	7.97	6.50	280	200	10.5	590	0.41	7.11
12/27/07	2.1	2.5	7.1	468	6.97	6.60	200	230	10.4	566	0.21	7.08
12/28/07	3.7	2.5	7.5	429	8.09	6.61	96	95	10.6	591	0.19	7.08
12/31/07	5.9	2.5	7.1	462	7.74	6.38	210	150	10.1	430	0.39	6.94
1/7/08	3.6	2.5	5.6	473	8.57	6.21	160	150	9.9	398	0.93	6.87
1/14/08	3.5	2.5	6.5	480	7.18	6.41	190	140	9.9	451	0.82	7.22

	Eljen GSF / A42 Geotextile Sand Filter modules						Influent					
	CBOD (mg/L)	TSS (mg/L)	Discharge Temperature °C	Sp Cond(uS)	Dissolved Oxygen (mg/L)	pH	BOD5 (mg/L)	TSS (mg/L)	Discharge Temperature °C	Sp Cond(uS)	Dissolved Oxygen (mg/L)	pH
Mean	2.6	2.7	N/A	460.1	6.3	6.35	201	193	N/A	503	0.23	7.17
Median	2.2	2.5	N/A	450.0	5.9	6.32	180	190	N/A	505	0.15	7.21
Min value	1.0	2.5	5.6	294.0	4.2	5.29	89	50	9.9	312	0.04	6.67
Max Value	14.0	9.0	24.5	930.0	8.9	7.74	920	480	22.7	890	1.30	7.56
Count	122	122	121	122	122	122	122	122	122	122	122	122

Appendix 2.

Eljen GSF/A42 Geotextile Sand Filter modules in timed pressure dosing mode at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008

Fecal Coliform Raw Data

	Eljen GSF / A42 Geotextile Sand Filter			Influent		
DATE	Morning Fecal (CFU/100mL)	Afternoon Fecal (CFU/100mL)	Evening Fecal (CFU/100mL)	Morning Fecal (CFU/100mL)	Afternoon Fecal (CFU/100mL)	Evening Fecal (CFU/100mL)
6/6/07	8300			3100000		
6/13/07	1400			2900000		
6/20/07	2800			3000000		
6/27/07	9000			5000000		
7/5/07	50			5900000		
7/9/07	81			2800000		
7/10/07	74				2400000	2400000
7/12/07	350			2300000		
7/16/07	230			5700000		
7/17/07			2800		2700000	3100000
7/18/07		2300			3000000	
7/23/07	390			2200000		
7/24/07			790		4300000	4800000
7/25/07		1100			2700000	
7/30/07	1100			5200000		7200000
7/31/07			2400		3800000	5200000
8/1/07		970			4800000	
8/6/07	4200			11000000		
8/7/07			7400		5100000	8900000
8/8/07		2400			11000000	
8/13/07	8500			25000000		
8/14/07			2400		9600000	27000000
8/15/07		2200			12000000	
8/20/07	2400			5500000		
8/22/07		650	1100		5000000	5000000
8/27/07	2100			7200000		4800000
8/28/07			2700		6600000	7000000
8/29/07	2100			7200000		
9/4/07	180		2300	7900000	6900000	
9/5/07		660			9400000	
9/10/07	360			14000000		
9/12/07		5200	8800		7100000	9500000
9/17/07	2500			7800000		
9/19/07		5500	5100		4400000	7100000
9/24/07	3200			6900000		
9/25/07			4500		8200000	6500000
9/26/07		2200			2800000	
10/1/07	2200			6000000		
10/2/07			5300		5200000	6500000
10/3/07		2300			5000000	
10/16/07			4100			4100000
10/17/07		2400			4200000	
10/22/07	23000			2700000		
10/23/07			24000		4100000	6500000
10/24/07		14000			4900000	
11/13/07	13000			1200000		
11/14/07			20000			4300000
11/19/07		29000	33000		4100000	4400000
11/20/07	22000			1500000		
11/27/07	15000			3300000		
11/28/07		26000	46000		3500000	3400000
12/3/07	25000			3500000		
12/4/07			26000		3800000	5000000
12/5/07		22000			3900000	
12/10/07	5600			4500000		
12/12/07		27000	9800		4700000	2700000
12/17/07	3100			2100000		
12/18/07			4300		5400000	3100000
12/19/07		5400			2300000	
12/26/07	2000	14000	38000	6100000	3400000	3100000
1/14/08	2200			1400000		

Appendix 3

Eljen GSF/A42 Geotextile Sand Filter modules in timed pressure dosing mode at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008

Fecal Coliform Reductions

	Eljen GSF / A42 Geotextile Sand			Influent			Reductions		
DATE	Morning Fecal (CFU/100mL)	Afternoon Fecal (CFU/100m	(10)Evening Fecal (CFU/100mL)	Morning Fecal (CFU/100mL)	Afternoon Fecal (CFU/100mL)	(10)Evening Fecal (CFU/100m	Log Reduction Morning	Log Reduction Afternoon	Log Reduction Evening
6/6/07	3.9			6.5			2.6		
6/13/07	3.1			6.5			3.3		
6/20/07	3.4			6.5			3.0		
6/27/07	4.0			6.7			2.7		
7/5/07	1.7			6.8			5.1		
7/9/07	1.9			6.4			4.5		
7/10/07	1.9				6.4	6.4			
7/12/07	2.5			6.4			3.8		
7/16/07	2.4			6.8			4.4		
7/17/07			3.4		6.4	6.5			3.0
7/18/07		3.4			6.5			3.1	
7/23/07	2.6			6.3			3.8		
7/24/07			2.9		6.6	6.7			3.8
7/25/07		3.0			6.4			3.4	
7/30/07	3.0			6.7		6.9	3.7		
7/31/07			3.4		6.6	6.7			3.3
8/1/07		3.0			6.7			3.7	
8/6/07	3.6			7.0			3.4		
8/7/07			3.9		6.7	6.9			3.1
8/8/07		3.4			7.0			3.7	
8/13/07	3.9			7.4			3.5		
8/14/07			3.4		7.0	7.4			4.1
8/15/07		3.3			7.1			3.7	
8/20/07	3.4			6.7			3.4		
8/22/07		2.8	3.0		6.7	6.7		3.9	3.7
8/27/07	3.3			6.9		6.7	3.5		
8/28/07			3.4		6.8	6.8			3.4
8/29/07	3.3			6.9			3.5		
9/4/07	2.3		3.4	6.9	6.8		4.6		
9/5/07		2.8			7.0			4.2	
9/10/07	2.6			7.1			4.6		
9/12/07		3.7	3.9		6.9	7.0		3.1	3.0
9/17/07	3.4			6.9			3.5		
9/19/07		3.7	3.7		6.6	6.9		2.9	3.1
9/24/07	3.5			6.8			3.3		
9/25/07			3.7		6.9	6.8			3.2
9/26/07		3.3			6.4				
10/1/07	3.3			6.8			3.4		
10/2/07			3.7		6.7	6.8			3.1
10/3/07		3.4			6.7			3.3	
10/16/07			3.6			6.6			3.0
10/17/07		3.4			6.6			3.2	
10/22/07	4.4			6.4			2.1		
10/23/07			4.4		6.6	6.8			2.4
10/24/07		4.1			6.7			2.5	
11/13/07	4.1			6.1			2.0		
11/14/07			4.3			6.6			2.3
11/19/07		4.5	4.5		6.6	6.6		2.2	2.1
11/20/07	4.3			6.2			1.8		
11/27/07	4.2			6.5			2.3		
11/28/07		4.4	4.7		6.5	6.5		2.1	1.9
12/3/07	4.4			6.5			2.1		
12/4/07			4.4		6.6	6.7			2.3
12/5/07		4.3			6.6			2.2	
12/10/07	3.7			6.7			2.9		
12/12/07		4.4	4.0		6.7	6.4		2.2	2.4
12/17/07	3.5			6.3			2.8		
12/18/07			3.6		6.7	6.5			2.9
12/19/07		3.7			6.4			2.6	
12/26/07	3.3	4.1	4.6	6.8	6.5	6.5	3.5	2.4	1.9
1/14/08	3.3			6.1			2.8		
							Log Reduction Morning	Log Reduction Afternoon	Log Reduction Evening
			Mean	**6.6**	**6.7**	**6.7**	**3.3**	**3.0**	**2.9**
			Median	**6.7**	**6.7**	**6.7**	**3.4**	**3.1**	**3.0**
			Min value	**6.1**	**6.4**	**6.4**	**1.8**	**2.1**	**1.9**
			Max Value	**7.4**	**7.1**	**7.4**	**5.1**	**4.2**	**4.1**
			Count	**29**	**32**	**23**	**29**	**18**	**20**

Appendix 4

Eljen GSF/A42 Geotextile Sand Filter modules in timed pressure dosing mode at the Massachusetts Alternative Septic System Test Center June 2007 to January 2008

Fecal Coliform Discharge Densities with Associated Cumulative Observation Percentiles

Observation	Fecal coliform CFU/100 ml	Cumulative Percent
1	50	0.0%
2	74	1.4%
3	81	2.9%
4	180	4.4%
5	230	5.8%
6	350	7.3%
7	360	8.8%
8	390	10.2%
9	650	11.7%
10	660	13.2%
11	790	14.7%
12	970	16.1%
13	1100	17.6%
14	1100	17.6%
15	1100	17.6%
16	1400	22.0%
17	2000	23.5%
18	2100	25.0%
19	2100	25.0%
20	2200	27.9%
21	2200	27.9%
22	2200	27.9%
23	2300	32.3%
24	2300	32.3%
25	2300	32.3%
26	2400	36.7%
27	2400	36.7%
28	2400	36.7%
29	2400	36.7%
30	2400	36.7%
31	2500	44.1%
32	2700	45.5%
33	2800	47.0%
34	2800	47.0%
35	3100	50.0%
36	3200	51.4%
37	4100	52.9%
38	4200	54.4%
39	4300	55.8%
40	4500	57.3%
41	5100	58.8%
42	5200	60.2%
43	5300	61.7%
44	5400	63.2%
45	5500	64.7%
46	5600	66.1%
47	7400	67.6%
48	8300	69.1%
49	8500	70.5%
50	8800	72.0%
51	9000	73.5%
52	9800	75.0%
53	13000	76.4%
54	14000	77.9%
55	14000	77.9%
56	15000	80.8%
57	20000	82.3%
58	22000	83.8%
59	22000	83.8%
60	23000	86.7%
61	24000	88.2%
62	25000	89.7%
63	26000	91.1%
64	26000	91.1%
65	27000	94.1%
66	29000	95.5%
67	33000	97.0%
68	38000	98.5%
69	46000	100.0%

The Presby Wastewater Treatment System

Wisconsin

Advanced Enviro-Septic®

In-Ground Component Manual

✓ **Minimizes the Expense** ✓ **Protects the Environment** ✓ **Preserves the Site**

Presby Environmental, Inc.

The Next Generation of Wastewater Treatment Technology

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The information in this manual is subject to change without notice. We recommend that you check your State's page on our website on a regular basis for updated information. Your suggestions and comments are welcome. Please contact us at: 800-473-5298

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The products and methods depicted in this manual are protected by one or more patents. For more information: Pat. www.presbyeco.com/patents.

IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® Wastewater Treatment Systems. The use of this Manual with any other product is prohibited. The processes and design criteria contained herein are based solely on our experience with and testing of Advanced Enviro-Septic®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

Date of Issue: February 15, 2017

TABLE OF CONTENTS

1.0 Background

Liquid that exits from a septic tank ("effluent") contains suspended solids that can cause traditional systems to fail prematurely. Solids can overload bacteria, cut off air required for aerobic bacterial activity, and/or seal the underlying soil, interfering with its ability to absorb liquid.

1.1 What Our System Does

By utilizing simple yet effective natural processes, the Presby Treatment System treats septic tank effluent in a manner that prevents suspended solids from sealing the underlying soil, increases system aeration, and provides a greater bacterial treatment area ("biomat") than traditional systems.

1.2 Why Our System Excels

The Presby Treatment System retains solids in its pipe and provides multiple bacterial surfaces to treat effluent prior to its contact with the soil. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. This all combines to create a unique eco-system that no other passive wastewater treatment system is designed to offer. The result is a system that excels by being more efficient, lasting longer, and has a minimal environmental impact.

1.3 System Advantages

a) costs less than traditional systems
b) eliminates the need for washed stone
c) often requires a smaller area
d) installs more easily and quickly than traditional systems
e) adapts easily to residential and commercial sites of virtually any size
f) adapts well to difficult sites
g) develops a protected receiving surface preventing sealing of the underlying soil
h) blends "septic mounds" into sloping terrain
i) increases system performance and longevity
j) tests environmentally safer than traditional systems
k) recharges groundwater more safely than traditional systems
l) made from recycled plastic

1.4 Patented Presby Technology

At the heart of Advanced Enviro-Septic® is a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges. All Presby Pipe is surrounded by one or more filtering, treatment and dispersal layers. Presby Systems are completely passive, requiring no electricity, motors, alarms, computers, etc. Presby Pipes are assembled and installed in a bed of specified System Sand which can either be below the ground or above.

1.5 Advanced Enviro-Septic® (AES)

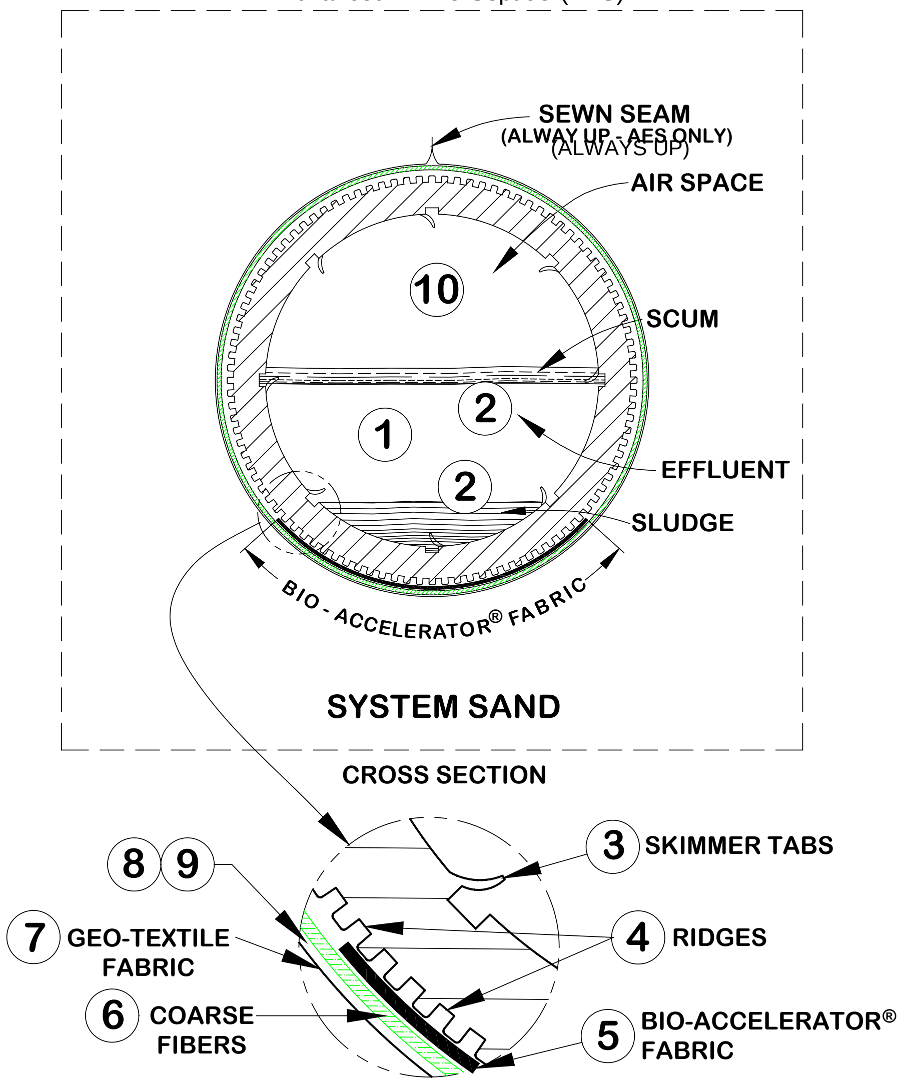
The Advanced Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I (a certification typically given to mechanical aeration devices), BNQ of Quebec, Class I, II, III and Cebedeau, Belgium standards. Advanced Enviro-Septic® is comprised of corrugated, perforated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. Advanced Enviro-Septic® creates an eco-system designed to simultaneously purify and disperse effluent after primary treatment by a septic tank. Advanced Enviro-Septic® is the "next generation" of our Enviro-Septic® technology. The AES product incorporates Bio-Accelerator®, a proprietary enhancement that screens additional solids from effluent, accelerates treatment processes, assures even distribution and provides additional surface area. Each foot of Advanced Enviro-Septic® pipe provides over 40 sq ft of total surface area for bacterial activity.

2.0 Ten Stages of Wastewater Treatment

The Presby Wastewater Treatment System's

10 STAGES OF TREATMENT

Advanced Enviro-Septic® (AES)



Stage 1: Warm effluent enters the pipe and is cooled to ground temperature.

Stage 2: Suspended solids separate from the cooled liquid effluent.

Stage 3: Skimmers further capture grease and suspended solids from the existing effluent.

Stage 4: Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.

Stage 5: Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable.

Stage 6: A mat of coarse, randomly-oriented fibers separates more suspended solids from the effluent.

Stage 7: Effluent passes into the geo-textile fabrics and grows a protected bacterial surface.

Stage 8: Sand wicks liquid from the geo-textile fabrics and enables air to transfer to the bacterial surface.

Stage 9: The fabrics and fibers provide a large bacterial surface to break down solids.

Stage 10: An ample air supply and fluctuating liquid levels increase bacterial efficiency.

3.0 Presby System Components

3.1 Advanced Enviro-Septic® Pipe

a) Presby pipe required is calculated at 3 GPD/ft for both residential and commercial applications. This assumes residential strength effluent.
b) Plastic pipe made with a significant percentage of recycled material
c) 10 ft sections (can be cut to any length)
d) Ridged and perforated, with skimmer tabs on interior
e) Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
f) Surrounded by a mat of randomly-oriented plastic fibers
g) Wrapped in a non-woven geo-textile fabric stitched in place
h) Exterior diameter of 12 in.
i) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
j) A 10 ft length of AES pipe is flexible enough to bend up to 90°

3.2 Offset Adapter

An offset adapter is a plastic fitting 12 in. in diameter with an inlet hole designed to accept a 4-inch sewer line, raised connection or vent pipe. The hole is to be installed in the 12 o'clock position. The distance from the bottom of the Offset Adapter to the bottom of its inlet hole is 7 in. When assembling pipes into rows, note that the geo-textile fabrics are placed over the edges of the Offset Adapter and Couplings.

Double Offset Adapter

A double offset adapter is a plastic fitting 12 in. in diameter with two 4 in. holes designed to accept a 4-inch inlet pipe, raised connection, vent or vent manifold, and/or bottom drain, depending upon the particular requirements of the design configuration. The 4 in. holes are to be aligned in the 12 o'clock and 6 o'clock positions. The holes are positioned 1 in. from the outside edge of the double offset adaptor and 2 in. from each other.

3.3 Coupling

A coupling is a plastic fitting used to create a connection between two pieces of Presby Pipe. Note that the couplings are wide enough to cover 1 or 2 pipe corrugations on each of the two pipe ends being joined. The couplings feature a snap-lock feature that requires no tools. When assembling pipes into rows, note that the geo-textile fabric does not go under couplings. Pull fabric back, install coupling, and then pull fabric over coupling. Also, note, during installation in cold weather, couplings are easier to work with if stored in a heated location (such as a truck cab) before use.

3.4 Distribution Box

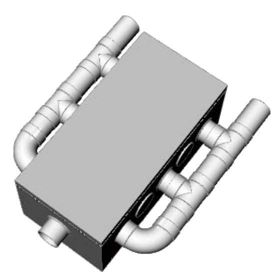
A Distribution Box, also called a "D-box," is a device used to distribute effluent coming from the septic tank in a system that contains more than one section or more than one bed. D-boxes are also sometimes used for velocity reduction. D-boxes come in various sizes and with a varying number of outlets. Concrete D-boxes are preferred; some are made of plastic. Flow equalizers (see below) are installed in the D-box openings to equalize distribution; they help ensure equal distribution in the event that the D-box settles or otherwise becomes out of level. Unused openings in D-boxes are to be covered, plugged or mortared. A distribution box is only required when dividing flow to more than one section of the Presby bed.

3.5 Flow Equalizers

All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever flow is divided. Each Bed or section of Combination Serial distribution is limited to a maximum of 15 gallons per minute, due to the flow constraints of the equalizers. Example: pumping to a combination system with 3 sections (using 3 D-Box outlets). The maximum delivery rate is (3 x 15) = 45 GPM. Always provide a means of velocity reduction when needed.

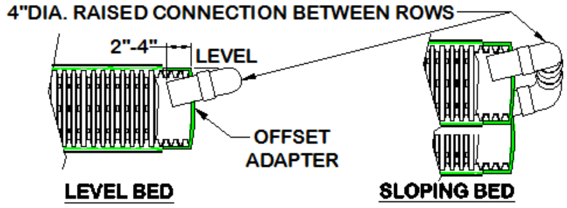
3.6 Manifolded Splitter Box

A manifolded splitter box joins several outlets of a D-box to help divide flow more accurately. Dividing flow to multiple beds is a common use of splitter boxes. All outlets delivering effluent to the Presby field must have a flow equalizer. Do not place an equalizer on vent outlets.



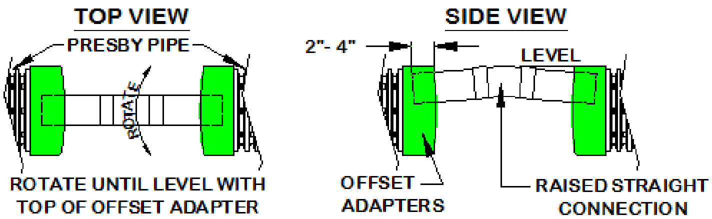
3.7 Raised Connection

A raised connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows. Raised connections extend 2 in. to 4 in. into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened.



3.8 Raised Straight Connection

A raised straight connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows that are placed end to end along the same contour. Raised straight connections extend 2 in. to 4 in. into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened. Offset Adapters will accept 4 inch schedule 40 PVC if the edge to be inserted into the adapter is rounded.



3.9 Septic Tank

The Advanced Enviro-Septic® System is designed to treat effluent that has received “primary treatment” in a standard septic tank. Septic tank capacity is determined by state and/or local rules. Septic tanks must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Presby pipes. Effluent filters are not recommended by Presby Environmental, Inc. due to their tendency to clog, which cuts off the oxygen supply that is essential to the functioning of the Presby System. If you are required to use an effluent filter in a gravity fed system due to State or local requirements, the effluent filter selected must allow the free passage of air to ensure the proper functioning of the system.

3.10 System Sand

The System Sand that surrounds the Presby pipes is an **essential** component of the system. It is **critical** that the correct type and amount of System Sand is used during construction. System Sand must be coarse to very coarse, clean, granular sand, free of organic matter. System Sand is placed a minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above from the Presby pipes. It must adhere to **all** of the following percentage and quality restrictions:

Presby System Sand Specification

Sieve Size	Percent Retained on Sieve (by weight)
3/4 in. (19 mm)	0
#10 (2 mm)	0 - 35
#35 (0.50 mm)	40 - 90
Note: not more than 3% allowed to pass the #200 sieve (verified by washing sample per requirements of ASTM C-117)	

3.11 System Sand Acceptable Alternative

ASTM C-33 (concrete sand), natural or manufactured sand, with not more than 3% passing the #200 sieve (verified by washing the sample per the requirements of ASTM C-117 as noted in the ASTM C-33 specification) may be used as an acceptable alternate material for use as System Sand.

4.0 **Table A – Soil Application Rate by Soil Characteristics** (from Wisconsin Table SPS 383.44-1)

<table>
<tr><th colspan="3">Soil Characteristics</th><th colspan="2" rowspan="3">Soil Application Rate (GPD/sq ft)</th></tr>
<tr><th rowspan="2">Texture</th><th colspan="2">Structure</th></tr>
<tr><th>Shape</th><th>Grade</th></tr>
<tr><td>Coarse Sand,
Sand,
Loamy Coarse Sand,
Loamy Sand</td><td>-</td><td>Structureless</td><td>1.6[a]</td><td>0.5[b]</td></tr>
<tr><td>Fine Sand,
Loamy Fine Sand</td><td>-</td><td>Structureless</td><td colspan="2">1.0</td></tr>
<tr><td>Very Fine Sand,
Loamy Very Fine Sand</td><td>-</td><td>Structureless</td><td colspan="2">0.6</td></tr>
<tr><td rowspan="5">Coarse Sandy Loam,
Sandy Loam</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.6</td></tr>
<tr><td rowspan="2">Platy</td><td>Weak</td><td colspan="2">0.6</td></tr>
<tr><td>Moderate, Strong</td><td colspan="2">0.2</td></tr>
<tr><td rowspan="2">Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.7</td></tr>
<tr><td>Moderate, Strong</td><td colspan="2">1.0</td></tr>
<tr><td rowspan="4">Fine Sandy Loam,
Very Fine Sandy Loam</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.5</td></tr>
<tr><td>Platy</td><td>Moderate, Strong</td><td colspan="2">0.2</td></tr>
<tr><td>Platy, Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.6</td></tr>
<tr><td>Prismatic, Blocky, Granular</td><td>Moderate, Strong</td><td colspan="2">0.8</td></tr>
<tr><td rowspan="4">Loam</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.5</td></tr>
<tr><td>Platy</td><td>Moderate, Strong</td><td colspan="2">0.2</td></tr>
<tr><td>Platy, Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.6</td></tr>
<tr><td>Prismatic, Blocky, Granular</td><td>Moderate, Strong</td><td colspan="2">0.8</td></tr>
<tr><td rowspan="4">Silt Loam</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.2</td></tr>
<tr><td>Platy</td><td>Moderate, Strong</td><td colspan="2">0.2</td></tr>
<tr><td>Platy, Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.6</td></tr>
<tr><td>Prismatic, Blocky, Granular</td><td>Moderate, Strong</td><td colspan="2">0.8</td></tr>
<tr><td>Silt</td><td>-</td><td>-</td><td colspan="2">0.0</td></tr>
<tr><td rowspan="4">Sandy Clay Loam,
Clay Loam,
Silty Clay Loam</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.0</td></tr>
<tr><td>Platy</td><td>Weak, Moderate, Strong</td><td colspan="2">0.2</td></tr>
<tr><td rowspan="2">Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.3</td></tr>
<tr><td>Moderate, Strong</td><td colspan="2">0.6</td></tr>
<tr><td rowspan="4">Sandy Clay,
Clay,
Silty Clay</td><td>-</td><td>Structureless, Massive</td><td colspan="2">0.0</td></tr>
<tr><td>Platy</td><td>Weak, Moderate, Strong</td><td colspan="2">0.0</td></tr>
<tr><td rowspan="2">Prismatic, Blocky, Granular</td><td>Weak</td><td colspan="2">0.0</td></tr>
<tr><td>Moderate, Strong</td><td colspan="2">0.3</td></tr>
</table>

a = with ≤60% rock fragments and b = with >60% to <90% rock fragments

Note: Soil application rates shown above and below assume residential strength effluent (see para. 11.7, page 12 for definition of residential strength). Contact Presby Environmental for technical assistance with high strength wastewater.

5.0 Table B – Soil Application Rate using Percolation Rate (from Wisconsin Table SPS 383.44-2)

Percolation Rate Minutes per Inch (MPI)	Soil Application Rate Gallons per Day per Sq Ft (GPD/sq ft)
0 to less than 10	1.2
10 to less than 30	0.9
30 to less than 45	0.7
45 to less than 60	0.5
60 to 120	0.3

6.0 Table C: Slope Requirements

Soil Application Rate (GPD/sq ft)	Maximum System Slope (%)	Maximum Site Slope (%)
1.6 – 0.6	25	33
0.5	15	20
0.3 – 0.2	5	5

7.0 Table D: Row Length and Pipe Layout Width (Single Level)

Row Length (ft)	Total Linear Feet of Presby Pipe													
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
30	60	90	120	150	180	210	240	270	300	330	360	390	420	450
35	70	105	140	175	210	245	280	315	350	385	420	455	490	525
40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
45	90	135	180	225	270	315	360	405	450	495	540	585	630	675
50	100	150	200	250	300	350	400	450	500	550	600	650	700	750
55	110	165	220	275	330	385	440	495	550	605	660	715	770	825
60	120	180	240	300	360	420	480	540	600	660	720	780	840	900
65	130	195	260	325	390	455	520	585	650	715	780	845	910	975
70	140	210	280	350	420	490	560	630	700	770	840	910	980	1,050
75	150	225	300	375	450	525	600	675	750	825	900	975	1,050	1,125
80	160	240	320	400	480	560	640	720	800	880	960	1,040	1,120	1,200
85	170	255	340	425	510	595	680	765	850	935	1,020	1,105	1,190	1,275
90	180	270	360	450	540	630	720	810	900	990	1,080	1,170	1,260	1,350
95	190	285	380	475	570	665	760	855	950	1,045	1,140	1,235	1,330	1,425
100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
# of Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.50' C/L	2.50	4.00	5.50	7.00	8.50	10.00	11.50	13.00	14.50	16.00	17.50	19.00	20.50	22.00
1.75' C/L	2.75	4.50	6.25	8.00	9.75	11.50	13.25	15.00	16.75	18.50	20.25	22.00	23.75	25.50
2.00 C/L	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00
2.25 C/L	3.25	5.50	7.75	10.00	12.25	14.50	16.75	19.00	21.25	23.50	25.75	28.00	30.25	32.50
2.50 C/L	3.50	6.00	8.50	11.00	13.50	16.00	18.50	21.00	23.50	26.00	28.50	31.00	33.50	36.00
	*Pipe Layout Width (ft) = Outermost edge of first row to outermost edge of last row													

*Formula for single level Pipe Layout Width = [Row Spacing x (# of Rows - 1)] + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer. To use Table D: select a row length and move right until the minimum amount of pipe is found (more is allowed). Then move down to find the number of rows required. Continue downward in the same column until adjacent to the row spacing and find the pipe layout width.

8.0 Design Worksheet (Single Level Systems)

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

8.1 Design Example (single level)

Single family residence, (3) bedrooms (300 GPD), Application Rate for LFS (Loamy Fine Sandy), 10% sloping site, serial distribution layout, single level.

Step #1: **300** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **300** sq ft sand bed area min.

Step #2: **300** GPD ÷ 3 GPD/ft = **100** ft of Presby pipe minimum

Step #3: **300** GPD ÷ 750 GPD/section = **0.4→1** sections required.

Step #4: **100** ft Presby pipe (Step #2) ÷ **50** ft row length = 2 rows required

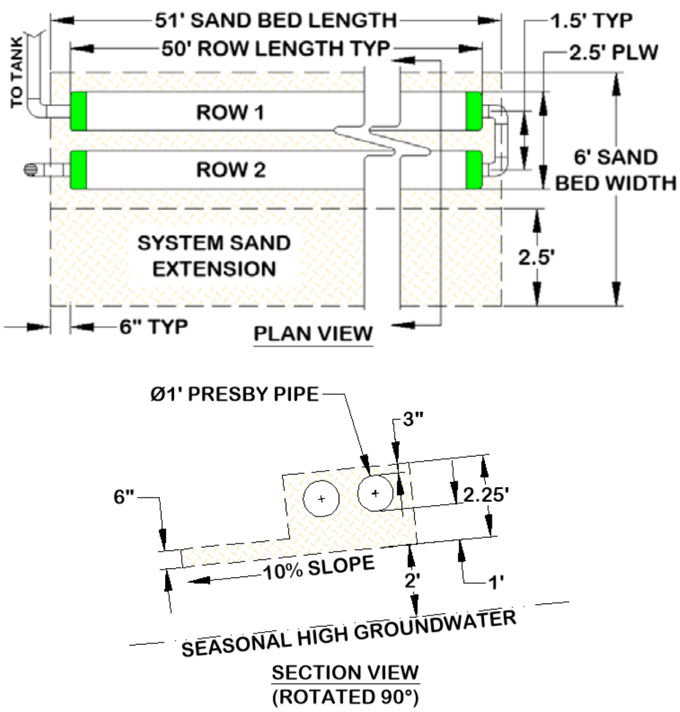
Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **10**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 5.9 ft sand bed width min.
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum **(use 5.9 ft from 7a above)**

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed
b) 5.9 ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1) = less than zero (no System Sand extension required)

Illustration of Example #1, Basic Serial Distribution:



Notes: A distribution box could have been used (parallel layout) with the distribution box being placed in-line with the highest row and then connecting to all the rows individually. Whenever possible eliminate the need for a distribution box and use a serial layout. This will insure air passes equally through every foot of Presby pipe.

8.2 Design Example #2 (Single Level):

Single family residence, (4) bedrooms (400 GPD), Application Rate of 0.5 GPD/sq ft for 60 MPI soils, level site, serial distribution layout, single level.

Step #1: **400** GPD ÷ **0.5** GPD/sq ft Application Rate (Table A) = **800** sq ft sand bed area min.

Step #2: **400** GPD ÷ 3 GPD/ft = **134** ft of Presby pipe minimum

Step #3: **400** GPD ÷ 750 GPD/section = **0.54→1** sections required.

Step #4: **134** ft Presby pipe (Step #2) ÷ **70** ft row length = 1.9**→2** rows required

Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **0**% system slope (Table C allows up to 15%)

Step #7: Calculate System Sand bed width –

Beds sloping 10% or less, use the larger of (a) or (b) below:

a) **800** sq ft sand bed area (Step #1) ÷ (**70** ft row length + 1 ft) = 11.3 ft sand bed width **(use this value)**

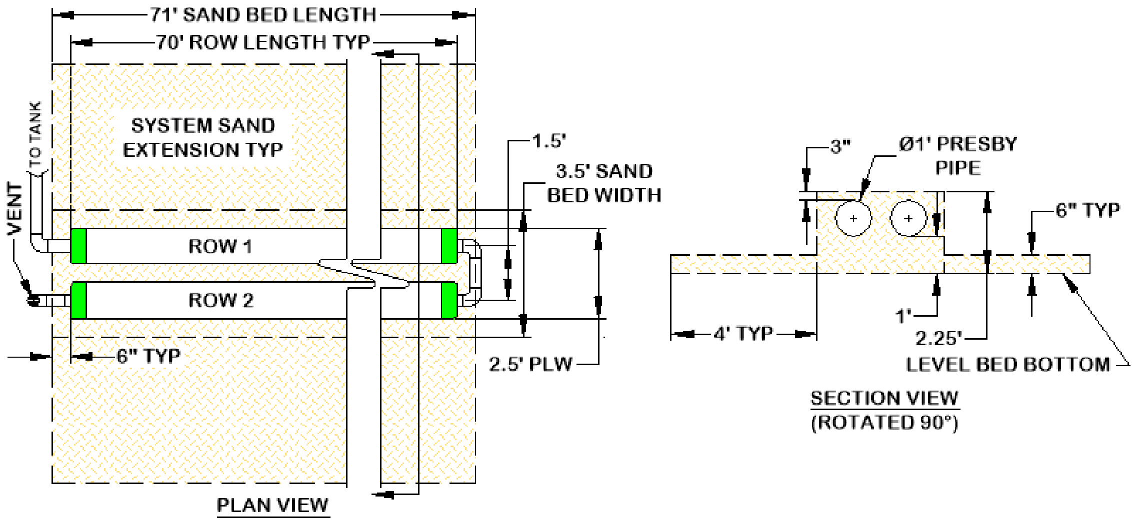
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **11.3** ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) ÷ 2 = 3.9 ft round up to **4** ft for ease of construction.

Illustration of Example #2, Basic Serial Distribution:



8.3 Design Example #3 (Single Level):

Commercial system, 770 GPD, Application Rate of 0.8 GPD/sq ft for Very Fine Sandy Loam soils, 12% sloping terrain and system, serial distribution layout.

Step #1: **770** GPD ÷ **0.8** GPD/sq ft Application Rate (Table A) = **962.5** sq ft sand bed area min.

Step #2: **770** GPD ÷ 3 GPD/ft = **257** ft of Presby pipe minimum

Step #3: **770** GPD ÷ 750 GPD/section = **1.1→2** sections required.

Step #4: **257** ft Presby pipe (Step #2) ÷ **65** ft row length = 3.9**→4** rows required

Step #5: **5.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **12**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –

Beds sloping over 10%, use the larger of (c) or (d) below:

c) **962.5** sq ft sand bed area (Step #1) ÷ (**65** ft row length + 1 ft) = **14.6** ft sand bed width **(use this value)**

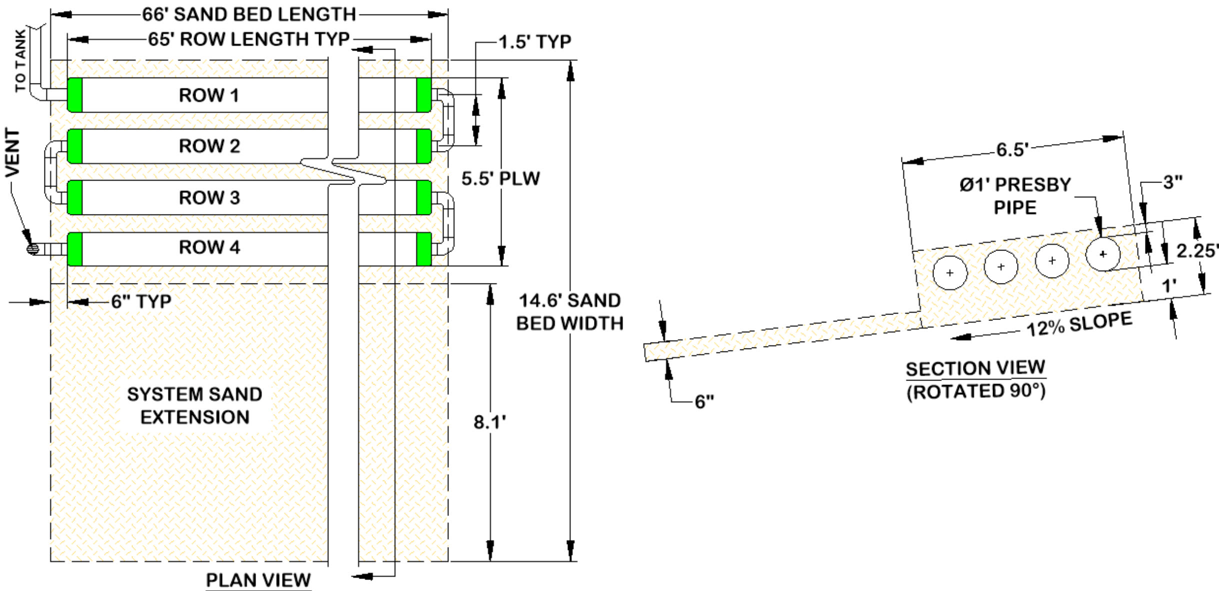
d) **5.5** ft PLW (Step #5) + 4.5 ft = **10** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **14.6** ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1 ft) = **8.1** ft

Illustration of Example #3, Commercial, Combination Serial Distribution:



9.0 Table E: Row Length and Pipe Layout Width (Multi-Level™)

		Total Linear Feet of Presby Pipe													
Row Length (ft)	**20**	40	60	80	100	120	140	160	180	200	220	240	260	280	300
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450
	35	70	105	140	175	210	245	280	315	350	385	420	455	490	525
	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
	45	90	135	180	225	270	315	360	405	450	495	540	585	630	675
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750
	55	110	165	220	275	330	385	440	495	550	605	660	715	770	825
	60	120	180	240	300	360	420	480	540	600	660	720	780	840	900
	65	130	195	260	325	390	455	520	585	650	715	780	845	910	975
	70	140	210	280	350	420	490	560	630	700	770	840	910	980	1,050
	75	150	225	300	375	450	525	600	675	750	825	900	975	1,050	1,125
	80	160	240	320	400	480	560	640	720	800	880	960	1,040	1,120	1,200
	85	170	255	340	425	510	595	680	765	850	935	1,020	1,105	1,190	1,275
	90	180	270	360	450	540	630	720	810	900	990	1,080	1,170	1,260	1,350
	95	190	285	380	475	570	665	760	855	950	1,045	1,140	1,235	1,330	1,425
	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
# of Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.5' C/L		1.75	2.50	3.25	4.00	4.75	5.50	6.25	7.00	7.75	8.50	9.25	10.00	10.75	11.50
2.0' C/L		2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
2.50' C/L		2.25	3.50	4.75	6.00	7.25	8.50	9.75	11.00	12.25	13.50	14.75	16.00	17.25	18.50
2.75' C/L		2.38	3.75	5.13	6.50	7.88	9.25	10.63	12.00	13.38	14.75	16.13	17.50	18.88	20.25
		*Pipe Layout Width (ft) = Outermost edge of Upper Level to Outermost edge of Lower Level													

Formula for Multi-Level™ Pipe Layout Width (3 rows or more) = { [Row Spacing x (# of Rows - 1)] / 2 } + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer.

10.0 Design Worksheet for Multi-Level™ Systems

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table E (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

10.1 Design Example #4 (Multi-Level™)

Single family residence, (6) bedrooms (600 GPD), Application Rate for LFS (Loamy Fine Sandy), level site, serial distribution layout.

Step #1: **600** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **600** sq ft sand bed area min.

Step #2: 6**00** GPD ÷ 3 GPD/ft = **200** ft of Presby pipe minimum

Step #3: 6**00** GPD ÷ 750 GPD/section = **0.8→1** sections required.

Step #4: **200** ft Presby pipe (Step #2) ÷ **50** ft row length = 4 rows required

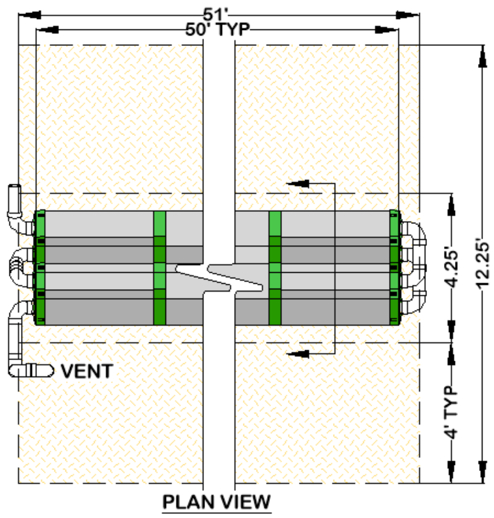
Step #5: **3.25** ft PLW from Table D (at 1.5 ft spacing)

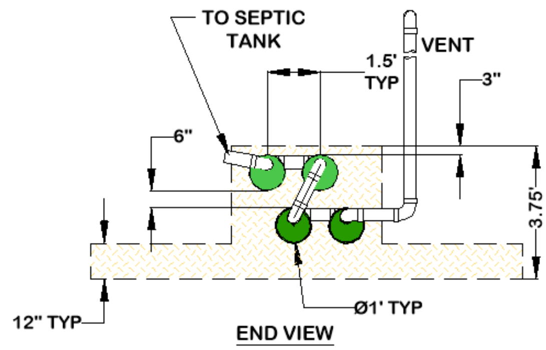
Step #6: **0**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **600** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 11.8 ft sand bed width min. **(<u>use this value</u>)**
b) **3.25** ft PLW (Step #5) + 1 ft = **4.25** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):
b) [**11.8** ft SSBW (Step #7) – (**3.25** ft PLW Step #5 + 1)] ÷ 2= 3.775 ft (round up to 4 ft for ease of construction).

Illustration of Example #4, Basic Serial Distribution, Multi-Level™





11.0 Design Criteria

11.1 Advanced Enviro-Septic® Pipe Requirements

a) Sewn seam must be oriented in the 12 o'clock position. This correctly orients the Bio-Accelerator® fabric in the 6 o'clock position.
b) Venting is always required regardless of vertical separation to restrictive features.

11.2 Barrier Materials over System Sand

No barrier materials (hay, straw, tarps, etc.) are to be placed between the System Sand and cover material; such materials may cut off necessary oxygen supply to the system. The only exception is the placement of the specified fabric to achieve H-20 loading requirements. See section 22.0, page 19.

11.3 Certification Requirements

Any designers and installers who have not previously attended a Presby Environmental, Inc. Certification Course are required to obtain Presby Certification. Certification is obtained by attending a Certification Course presented by Presby Environmental, Inc. or its sanctioned representative. Certification can also be obtained by viewing tutorial videos on our website (high speed connection required) and then successfully passing a short assessment test, which is also available through regular mail. All professionals involved in the inspection, review or certification of AES systems should also become Presby Certified. Professionals involved in the design or installation of Multi-Level™ systems must be Presby Certified.

11.4 Converging Flows Restriction

Presby Systems must not be located where surface or ground waters will converge, causing surface water flow to become concentrated or restricted within the soil absorption field.

11.5 Daily Design Flow

Residential daily design flow for Presby Systems is calculated in accordance with State rules. The minimum daily design flow for any single-family residential system is two bedrooms and 200 GPD for any commercial system.

a) Certain fixtures, such as jetted tubs, may require an increase in the size of the septic tank.
b) Daily design flow for a single bedroom apartment with a kitchen connected to a residence (also sometimes referred to as a “studio” or “in-law apartment”) shall be calculated by adding two additional bedrooms.
c) When daily design flow is determined by water meter for commercial systems, refer to the State Rules.

d) PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of 2 to 3 times.
e) Note that “daily design flows” are calculated to assume occasional “peak” usage and a factor of safety; Systems are not expected to receive continuous dosing at full daily design load.

11.6 End-to-End Preferred Over Side-to-Side

If site conditions permit, End-to-End multiple bed configurations are preferable to Side-to-Side configurations (see para. 18.0, page 18).

11.7 Effluent (Wastewater) Strength

The Presby pipe requirement for Bed or Trench systems is based on residential strength effluent, which has received primary treatment in a septic tank. Residential strength effluent (measured after the septic tank) cannot exceed a concentration of 240 mg/L, when adding together the values for the 5-day biochemical oxygen demand (BOD5) and the total suspended solids (TSS). Typically, this corresponds to an influent strength of 300 mg/L BOD5 and 350 mg/L TSS prior to the septic tank. Designing a system that will treat higher strength wastes requires additional Presby pipe. In these situations, consult our Technical Advisors at (800) 473-5298 for recommendations.

11.8 Filters, Alarms & Baffles

a) Effluent Filters are **not** recommended for use with Presby Systems.
b) If used, effluent filters must be maintained on at least an annual basis. Follow manufacturer’s instructions regarding required inspections, cleaning and maintenance of the effluent filter. Please consult PEI for the most compatible filter recommendations.
c) Effluent Filters must allow the free passage of air to ensure the proper functioning of the system. A blocked filter in any on-site septic system could interfere with venting, causing the system to convert to an anaerobic state and result in a shortened life.
d) All pump systems to have a high-water alarm float or sensor installed inside the pump chamber.
e) All septic tanks must be equipped with baffles to prevent excess solids from entering the Presby System.
f) Charcoal filters in vent stacks (for odor control) are not recommended by PEI. They can block air flow and potentially shorten system life. Contact PEI for recommendations to correct odor problems.

11.9 Flow Equalizers Required

All distribution boxes used to divide effluent flow require flow equalizers in their outlets. Flow equalizers are limited to a maximum of 15 GPM per equalizer.

11.10 Garbage Disposals (a.k.a. Garbage Grinders)

No additional Presby Pipe is required when using a garbage disposal (grinder). If a garbage disposal is utilized, follow the State’s requirements regarding septic tank sizing. Multiple compartment septic tanks or multiple tanks are preferred and should be pumped as needed.

11.11 Presby Pipe Requirement (Single & Multi-Level™)

See Section 11.1, on page 11 for additional Advanced Enviro-Septic® requirements. Presby Pipe requirements are as follows and require a 1.5 ft minimum row spacing:

a) Residential systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
b) Commercial systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
c) Contact Presby Environmental, Inc. when treating high strength effluent.

11.12 Presby Environmental Standards and Technical Support

All Presby Systems must be designed and installed in compliance with the procedures and specifications described in this Manual and in the product’s State approval. This Manual is to be used in conjunction with the State Department of Safety and Professional Services Administrative Rules. In the event of contradictions between this Manual and State regulations, Presby Environmental, Inc. should be contacted for technical assistance at (800) 473-5298. Exceptions to any State rules other than those specifically discussed in this Manual require a State waiver.

11.13 Pressure Distribution

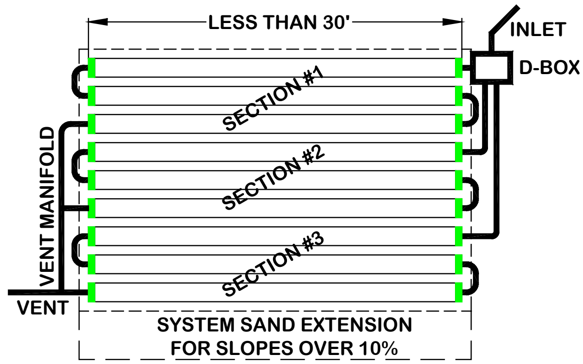
The use of pressure distribution lines in Presby Systems is **prohibited**. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the Presby Field.

11.14 Row Requirements

a) All beds must have at least 2 rows.
b) Maximum row length for any system is 100 ft.
c) Recommended minimum row length is 30 ft.
d) A combination (or D-Box) distribution system must be used if any row length is less than 30 ft. The D-Box must feed at least 30 ft of Presby Pipe, a minimum of two D-Box outlets must be used and the field must be vented.

e) Row Center-to-Center Spacing is 1.5 ft min. for all systems. Row spacing may be increased to accommodate greater basal area spacing requirements if desired.
f) For level beds: the Presby Rows are centered in the middle of the System Sand bed area and any System Sand extensions divided evenly on both sides.
g) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing. All rows to be grouped at the high side of the System Sand bed area with any System Sand extensions placed entirely on the downslope side.
h) All rows must be laid level to within +/- ½ in. (total of 1 in.) of the specified elevation and preferably should be parallel to the contour of the site.
i) It is easier if row lengths are designed in exact 10 ft increments since Presby Pipe comes in 10 ft sections. However, if necessary, the pipe is easily cut to any length to meet site constraints.

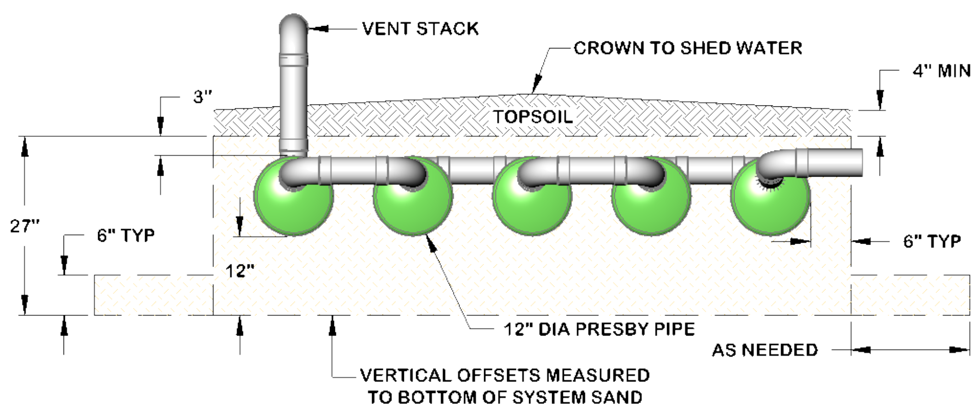
Illustration of row lengths less than 30ft:



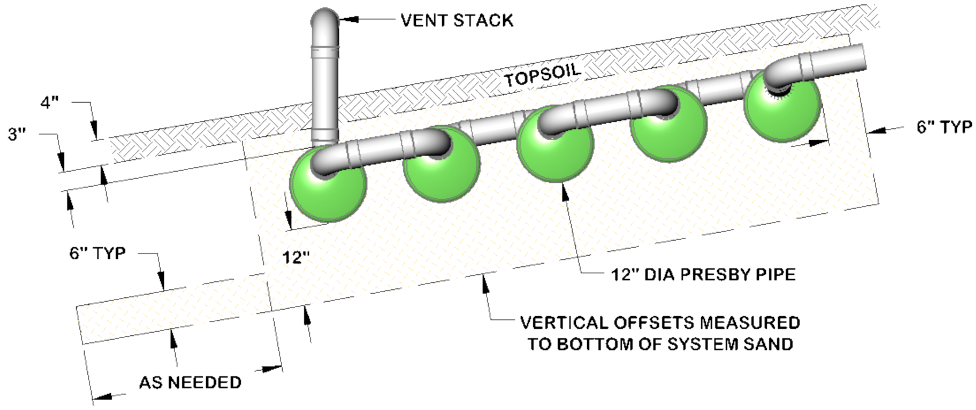
11.15 Separation Distances (Horizontal and Vertical)
Separation distances to the seasonal high water table (SHWT) or other restrictive features are measured from the outermost edge of the System Sand.

11.16 Sloping Sites and Sloping Systems
a) The percentage of slope in all system drawings refers to the slope of the Presby System, not the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
b) The system slope and the site slope do not have to be the same (see illustration in para.18.2, page 19).
c) Maximum site slope is 33% and maximum system slope is 25% (without a State waiver).

11.17 System Sand Bed Height Dimensions
The height of a Presby Sand Bed measures 27 in. minimum (not including cover material):
a) 12 in. minimum of System Sand below the Presby Pipe;
b) 12 in. diameter of the pipe; and
c) 3 inches minimum of System Sand above the Presby Pipe; also
d) When System Sand Extensions are required, they must be a minimum of 6 inches thick.

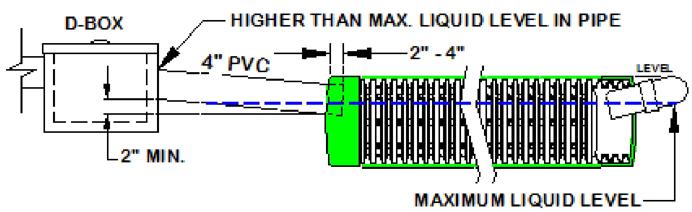


e) Sloping systems require any System Sand extension to be placed on the down slope side of the field. If the system slope is over 10% the sand extension must be at least 2.5 ft.



11.18 Two Inch Rule

The outlet of a septic tank or distribution box (if used) must be set at least 2 inches above the highest inlet of the Presby Row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.) See illustration of 2 in. rule below:



11.19 Topographic Position Requirement

The system location must be located in an area that does not concentrate water, both surface and subsurface. If allowed by State and local authorities, altering the terrain upslope of a system may alleviate this requirement if the waters are sufficiently altered to redirect flows away from the field.

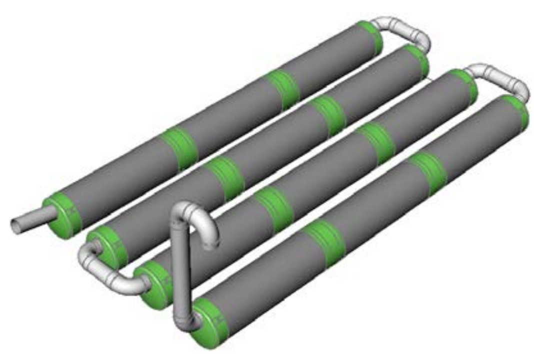
11.20 Water Purification Systems

a) Water purification systems and water softeners should **not** discharge into any Presby System. This "backwash" does not require treatment and the additional flow may overload the system.
b) If there is no alternative means of disposing of this backwash other than in the Presby System, then the system will need to be "oversized." Calculate the total amount of backwash in GPD, multiply by 3, and add this amount to the daily design flow when determining the field and septic tank sizing.
c) Water purification systems and water softeners require regular routine maintenance; consult and follow the manufacturer's maintenance recommendations.

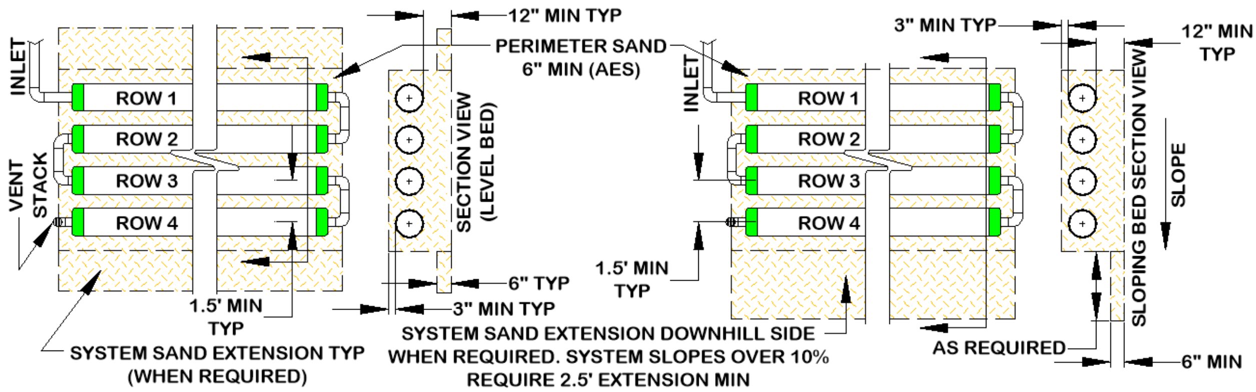
12.0 Basic Serial Distribution (Single Level)

AES rows are connected in series at the ends with raised connections, using offset adapters. Basic Serial distribution systems are quick to develop a strong biomat in the first row, provide a longer flow route, improved effluent treatment and ensure air will pass through all the Presby Rows. Other criteria:

a) May be used for single beds of 750 GPD or less.
b) Incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Flow Equalizers are not required for Basic Serial systems.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
h) Illustrations of Basic Serial Systems:



Level Beds Sloping Beds

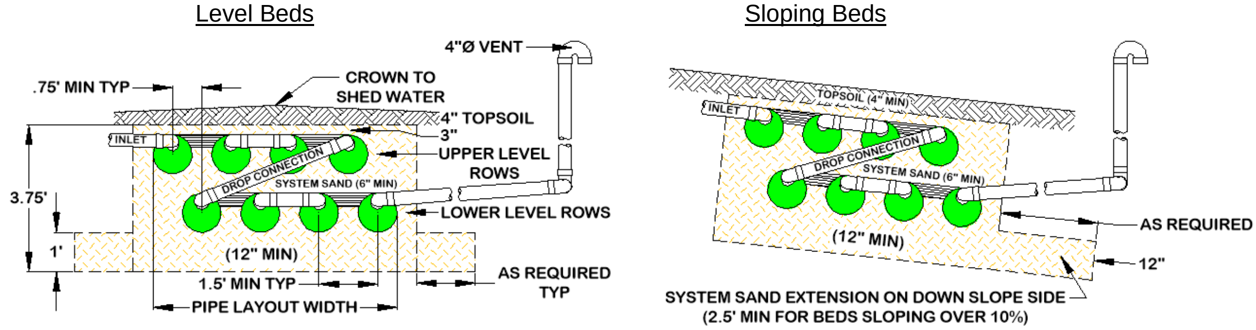


13.0 Basic Serial Distribution (Multi-Level™)

Basic Serial Multi-Level™ systems must conform to the requirements for single level basic serial systems except:

a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) When a System Sand Extension is required, it must be 12 inches thick.
d) A minimum of 6 inches of System Sand separates the Upper and Lower Level Rows.
e) Effluent is delivered first to the Upper Rows, which then connects to the Lower Level Rows by way of a Drop Connection.
f) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
g) Multi-Level™ systems are not allowed in H-20 applications.
h) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
i) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
j) System Sand extensions for Multi-Level™ systems must be 12 inches thick.
k) Illustrations of Multi-Level™ Basic Serial Systems:

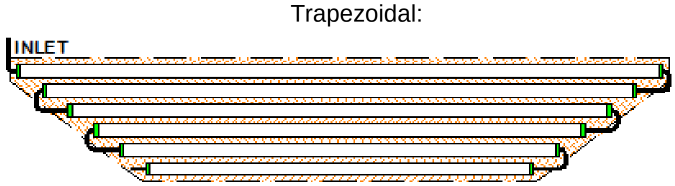
Level Beds Sloping Beds



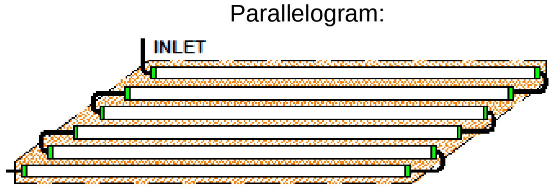
13.1 Basic Serial Configuration with Unusual Shapes:

Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

Trapezoidal:

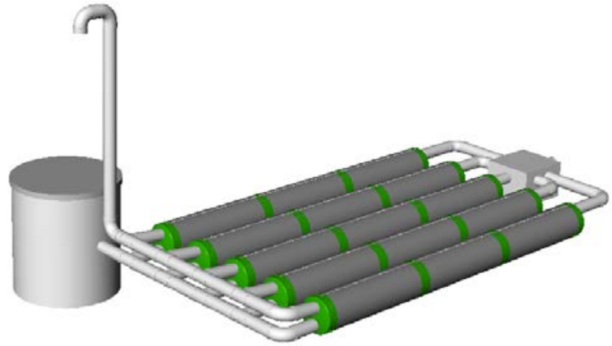


Parallelogram:



14.0 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-box Distribution or Combination Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation. There must be 18 inches from the bottom of the sump to the bottom of the drain. The sump should be brought above the final grade and have a locking or mechanically fastened cover.



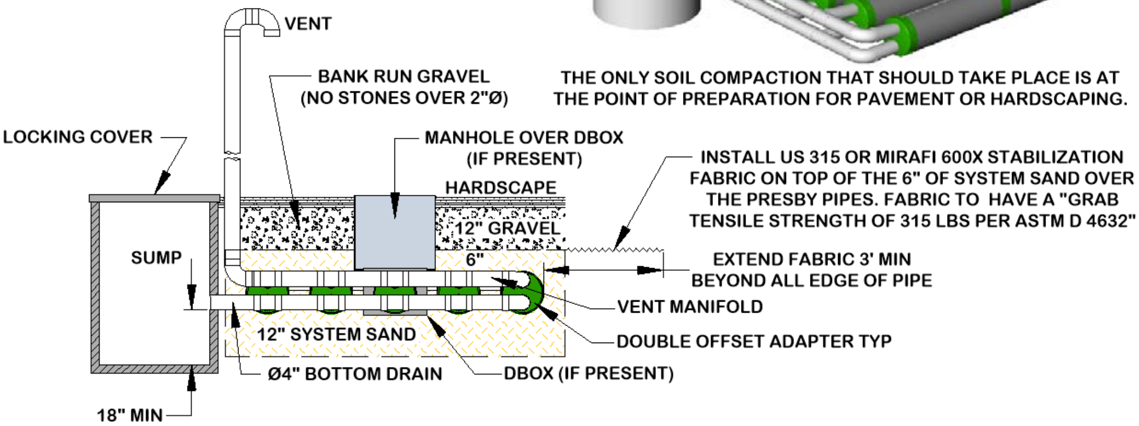
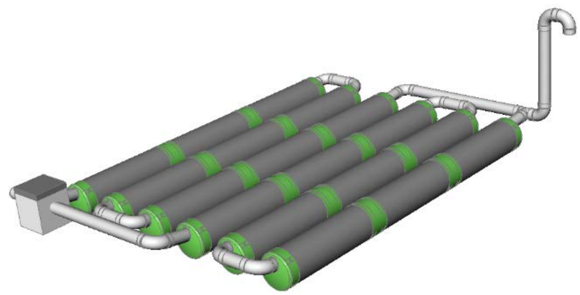


Illustration of a bottom drain used for H-20 system (End View):

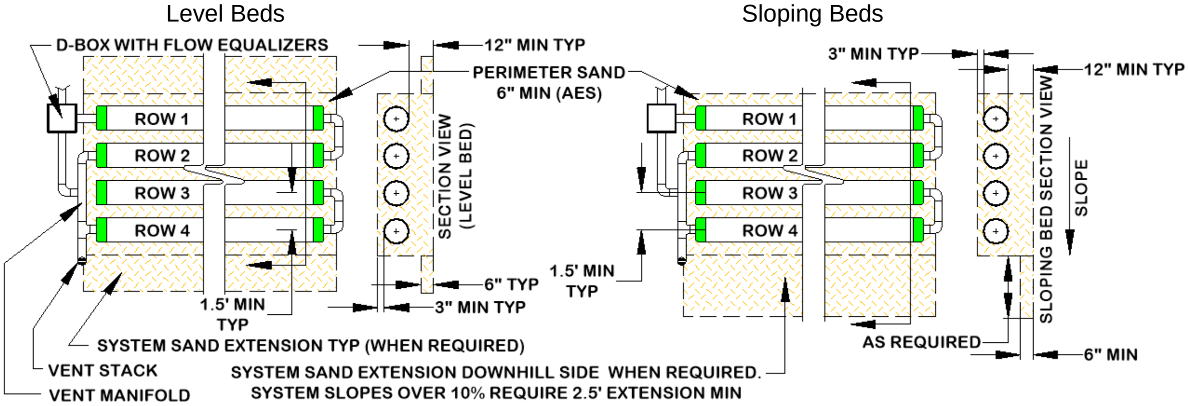
15.0 Combination Serial Distribution (Single Level)

Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 GPD. Combination Serial distribution is quick to develop a strong biomat in the first row of each section, providing improved effluent treatment. Each Combination Serial section is limited to a maximum loading of 750 gallons/day.



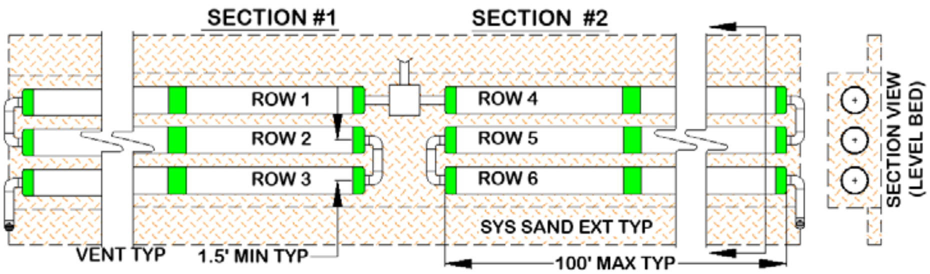
a) Combination Serial distribution consists of two or more serial sections installed in a single bed.
b) Each section in a Combination Serial system consists of a series of Presby Rows connected at the ends with raised connections, using offset adapters and PVC sewer and drain pipe.
c) Maximum length of any row is 100 ft.
d) There is no limit on the number of Combination Serial Sections within a bed.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) When the vent manifold is on the same side as the serial section inlets, the manifold runs over the top of these inlets (as shown below).
h) Combination systems require the use of an adequately sized D-Box.
i) Illustrations of Single Level Combination Serial Systems:

Level Beds　　　　Sloping Beds



15.1 Butterfly Configuration

a) A "butterfly configuration," is considered a single bed system with two or more sections (can also be D-Box or Combination configurations).
b) Maximum length of any row is 100 ft.
c) Serial Section loading limit is 750 GPD.
d) Beds can contain any number of serial sections.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Illustration of a level bed Butterfly configuration (plan view):



15.2 Section Loading

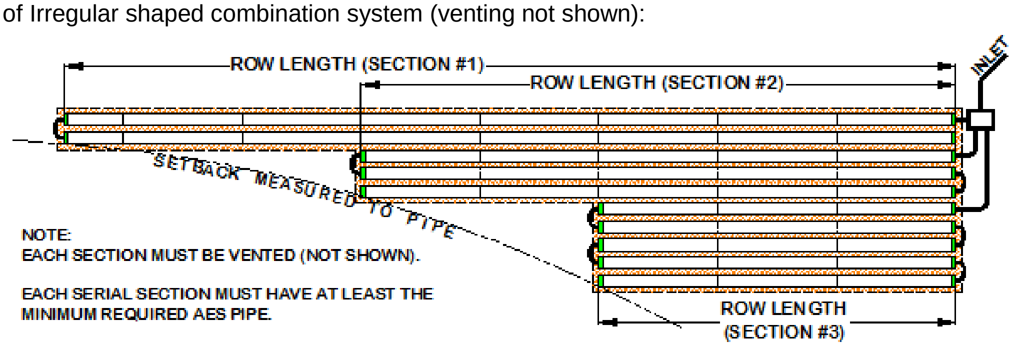
Each section in a Combination Serial system has a maximum daily design flow of 750 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 1,000 GPD requires (1,000 ÷ 750) = 1.4, use 2 sections minimum. Combination systems are only required if the daily design flow exceeds 750 GPD.

15.3 Section Length Requirement

a) Each section must have the same minimum linear feet of pipe.
b) The minimum linear feet of pipe per section is determined by dividing the total linear feet required in the Presby System by the number of sections required.
c) A section may exceed the minimum linear feet required.
d) Rows within a section may vary in length to accommodate site constraints.

15.4 Irregular Shaped Combination Serial Configuration

Illustration of Irregular shaped combination system (venting not shown):



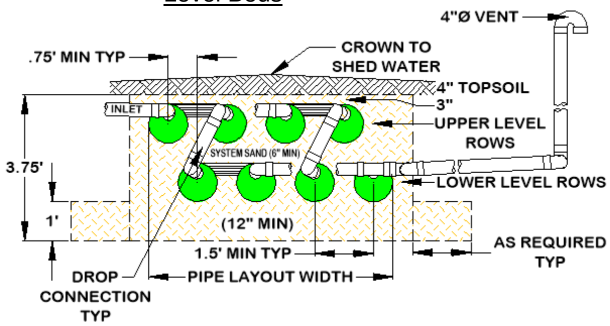
16.0 Combination Serial Distribution (Multi-Level™)

Combination Multi-Level™ systems must conform to the requirements for single level combination systems except:

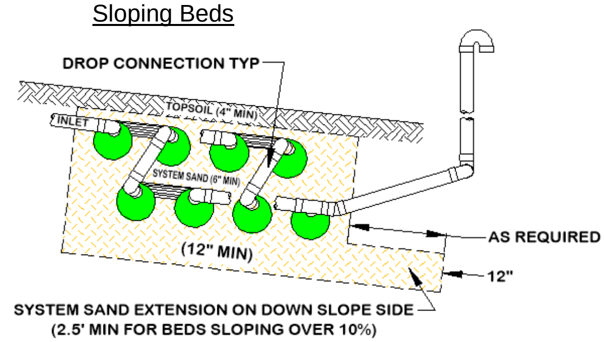
a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) If a System Sand Extension is required, it must be 12 in. thick
d) Effluent must be delivered to the Upper Level Rows from the D-Box. A Drop Connection delivers effluent from the Upper Level rows to the Lower Level rows.
e) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
f) Multi-Level™ systems are not allowed in H-20 applications.
g) The ends of all serial sections on the Lower Level are manifolded and taken to a vent stack. Each serial section may be vented separately.
h) A minimum of 6 in. of System Sand separates the Upper Level Rows from the Lower Level Rows.
i) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
j) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
k) System Sand extensions for Multi-Level™ systems must be 12 inches thick.

l) Illustrations of Multi-Level™ Combination Serial Systems:

Level Beds

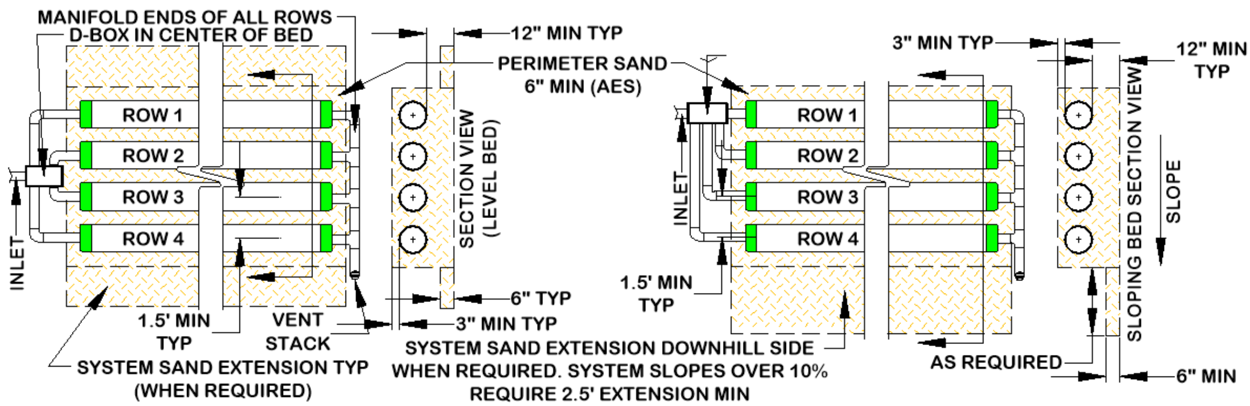


Sloping Beds



17.0 D-Box Distribution (Single Level)

a) All rows in this configuration must be the same length.
b) Flow equalizers must be used in the D-Box.
c) Use a Manifold to connect the ends of all rows. Manifold to be sloped toward Presby Pipes.
d) Maximum row length is 100 ft.
e) Place the D-Box on level, firmly compacted soil.
f) All rows must be laid level end-to-end.
g) A 2-inch min. drop is required between the D-box outlets and the Presby Pipe inlets.
i) D-Box systems are not recommended for use in Multi-Level™ beds.
j) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
k) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
h) Illustrations for D-Box (Parallel) Distribution:



18.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds (Single Level or Multi-Level™), each bed with Basic Serial, Combination Serial, or D-Box distribution, and each receiving an equal amount of effluent from a D-Box. Multiple beds may be oriented along the contour of the site or along the slope of the site.

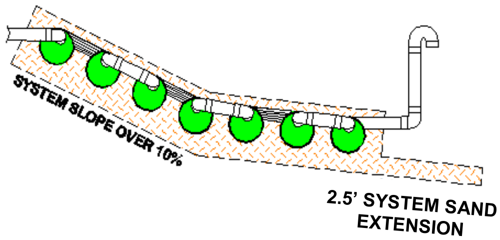
a) Each bed must have the same minimum linear feet of pipe. The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the Presby System by the number of beds.
b) Rows within a bed may vary in length to accommodate site constraints, except with D-Box configuration which requires all rows to be the same length.
c) End-to-End configurations are preferred to Side-to-Side configurations.
d) In Side-to-Side configuration, one bed is placed beside another or one bed is placed down slope of another. Bed separation distance is measured from pipe-to-pipe and is dependent on soil hydrology and State requirements.
e) Multi-Level™ may be used in multiple bed systems.

18.1 System Sand Extension

In systems where SSBA is greater the PLW + 1' (see para. 8.0, page 9, step #9). In systems sloping more than 10%, a 3 ft minimum System Sand extension is required. The System Sand extension area is placed on the down slope side of all sloping systems. For level systems, the System Sand Extension is divided equally and placed on both sides. The System Sand extension area is a minimum of 6 inches deep (12 inches for Multi-Level™ beds). For beds with multiple slopes, if any portion of the bed has a system slope greater than 10% a system sand extension is required. Illustration of bed with multiple slopes below.

18.2 Total Linear Feet Requirement

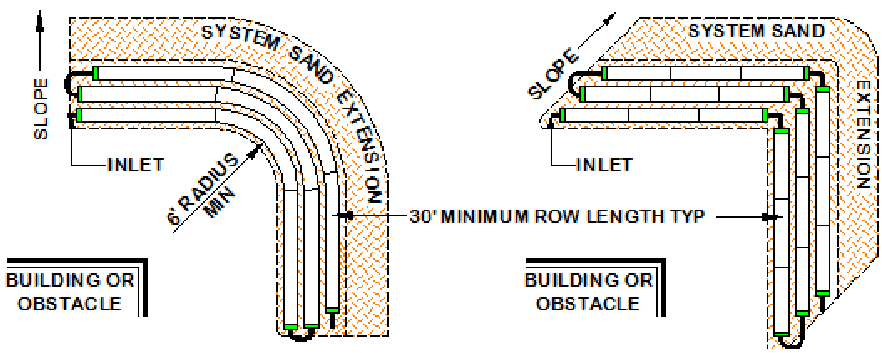
a) Maximum row length is 100 ft.
b) Each section or bed must have at least the minimum linear feet of pipe (total feet of pipe required divided by number of sections equals the minimum number of feet required for each section or bed).
c) A section or bed may exceed the minimum linear length.
d) Rows within a section or bed may vary in length (except D-Box configurations) to accommodate site constraints.



19.0 Angled and Curving Beds

Angled configurations are used to avoid obstacles.

a) Rows should follow the contour of the site as much as possible
b) Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters
c) Row lengths are required to be a minimum of 30 ft
d) Multi-Level™ systems may take advantage of angled bed configurations.
e) Illustrations of Angled Beds:

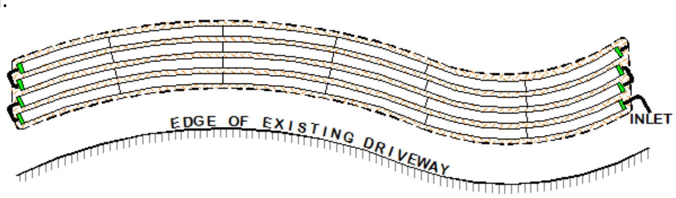


19.1 Trench Systems

Presby pipe may be installed in trench configurations on level or sloping terrain and may utilize serial, combination or parallel distribution. Trench systems may incorporate one or two rows of Presby pipe. A minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above of System Sand are required for all Presby pipes. Consult regulatory rules for required trench separation.

20.0 Curved Beds

Curved configurations work well around structures, setbacks, and slopes. Multiple curves can be used within a system to accommodate various contours of the site.



21.0 Non-Conventional System Configurations

Non-conventional system configurations may have irregular shapes to accommodate site constraints. A site-specific waiver from the state may be required for non-conventional configurations.

22.0 H-20 Loading

If a system is to be installed below an area that will be subjected to vehicular traffic, it must be designed and constructed as depicted below in order to protect the system from compaction and/or damage. Note that a layer of stabilization fabric is added between the System Sand and the cover material. All H-20 systems require venting. See para. 14.0 on page 16 for illustration of H-20 loading requirements.

23.0 Pumped System Requirements
Pumped systems supply effluent to the Presby System using a pump and distribution box when site conditions do not allow for a gravity system. Dosing siphons are also an acceptable means of delivering effluent to the system.

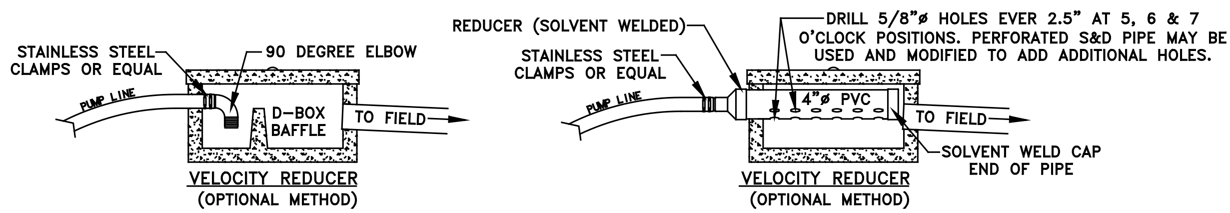
23.1 Alarm
States require all pump systems to have a high-water alarm float or sensor installed inside the pump chamber.

23.2 Differential Venting
All pump systems must use differential venting (see illustration, para.25.2, page 21).

23.3 Distribution Box
All pump systems require a distribution box with some means of velocity reduction for the effluent entering the D-Box.

23.4 Velocity Reduction
The rate at which effluent enters the Presby Pipe must be controlled. Excessive effluent velocity can disrupt solids that settle in the pipes.

a) Effluent must never be pumped directly into Presby Pipe.
b) A distribution box or tank must be installed between the pumping chamber and the Presby Pipe to reduce effluent velocity.
c) Force mains must discharge into a distribution box (or equivalent) with velocity reducer and a baffle, 90° bend, tee or equivalent (see illustrations on next page).
   Two methods of velocity reduction:



CONCRETE DISTRIBUTION BOX SET ON FIRMLY COMPACTED SOIL & LAID LEVEL. USE OVERSIZED BOX FOR STABILITY. INSTALL EQUALIZERS ON ALL D-BOX OUTLETS

23.5 Dose Volume
a) Pump volume per dose must be no greater than 1 gallon times the total linear feet of Presby Pipe.
b) Pump dosing should be designed for a minimum of 6 cycles per day.
c) If possible, the dosing cycle should provide one hour of drying time between doses.

23.6 Basic Serial Distribution Limit
Pumped systems with Basic Serial distribution are limited to a maximum dose rate of 40 gallons per minute and do not require the use of a flow equalizer on the D-Box outlet. Never pump directly into Presby Pipe.

23.7 Combination and Multiple-Bed Distribution Limit
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. Each Bed or section of Combination Serial distribution is limited to a maximum of 15 gallons per minute, due to the flow constraints of the equalizers. Example: pumping to a combination system with 3 sections (using 3 D-Box outlets). The maximum delivery rate is (3 x 15) = 45 GPM. Always provide a means of velocity reduction.

24.0 System Sand and Sand Fill Requirements for All Beds
It is critical to the proper functioning of Presby Systems that the proper amount and type of System Sand be installed.

24.1 Quantity of System Sand
System Sand is placed a minimum of 12 in. below, 3 in. above and 6 in. between the Presby Rows and a minimum of 6 in. horizontally around the perimeter of the Advanced Enviro-Septic® rows.

24.2 Sand Fill
Sand fill meeting state and local requirements is used to raise the elevation of the system in order to meet the required separation distance from the SHWT or other restrictive feature. No organic material or stones larger than 6 in. are allowed in the Sand Fill. System Sand may be used in place of sand fill; however, this may increase material costs.

25.0 Venting Requirements
An adequate air supply is essential to the proper functioning of Presby Systems. Venting is always required. Including the following requirements:

a) Pump systems must utilize Differential Venting.

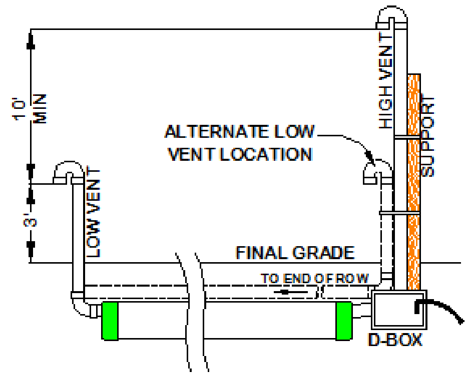
b) Vents for Multi-Level™ beds must connect to the lower level rows.

25.1 General Rules

a) Vent openings must be located to ensure the unobstructed flow of air through the entire Presby System.
b) The low vent inlet must be a minimum of 1 ft above final grade or anticipated snow level.
c) One 4 in. vent is required for every 1,000 ft of Presby Pipe.
d) A single 6 in. vent may be installed in place of up to three 4 in. vents.
e) If a vent manifold is used, it must be at least the same diameter as the vent(s).
f) When venting multiple beds, it is preferred that each bed be vented separately rather than manifolding bed vents together.
g) Sch. 40 PVC or equivalent should be used for all vent stacks.
h) Remote Venting may be utilized to minimize the visibility of vent stacks.

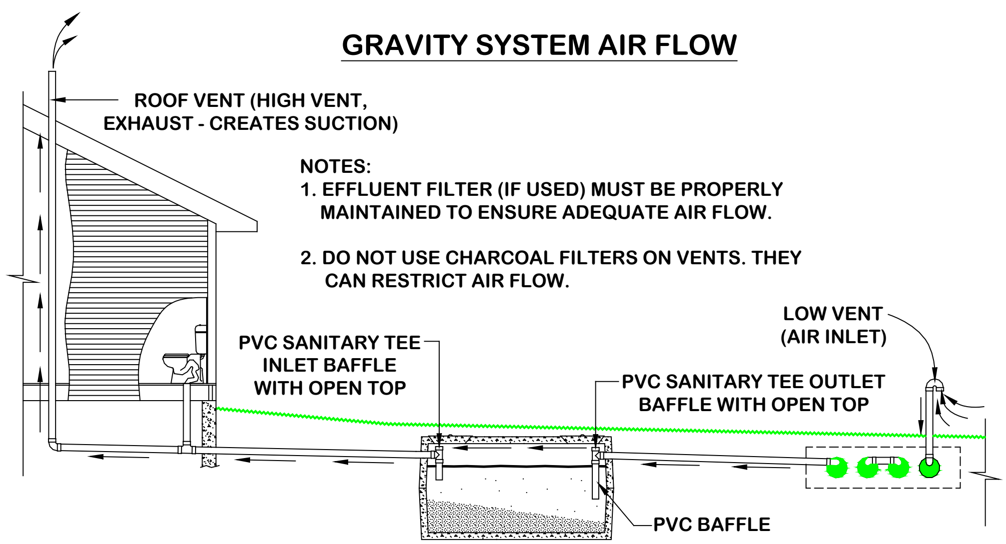
25.2 Differential Venting

a) Differential venting is the use of high and low vents in a system.
b) In a gravity system, the roof stack acts as the high vent.
c) High and low vent openings must be separated by a minimum of 10 vertical feet.
d) If possible, the high and low vents should be of the same capacity.



25.3 Vent Locations for Gravity Systems

a) A low vent is installed at the end of the last row of each section or the end of the last row in a Basic Serial bed, or at the end of each row in a D-Box Distribution Configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
b) The house (roof) vent functions as the high vent as long as there are no restrictions or other vents between the low vent and the house (roof) vent.
c) When the house (roof) vent functions as the high vent, there must be a minimum of a 10 ft vertical differential between the low and high (roof) vent openings.
d) Illustration of gravity system air flow:



VENTING IS ESTABLISHED THROUGH SUCTION (CHIMNEY EFFECT) CREATED BY THE DRAW OF AIR FROM THE HIGH VENT, WHICH DRAWS AIR INTO THE LOW VENT AT THE LEACH FIELD THEN THROUGH THE SEPTIC TANK AND EXHAUSTED THROUGH THE (HIGH) ROOF VENT.

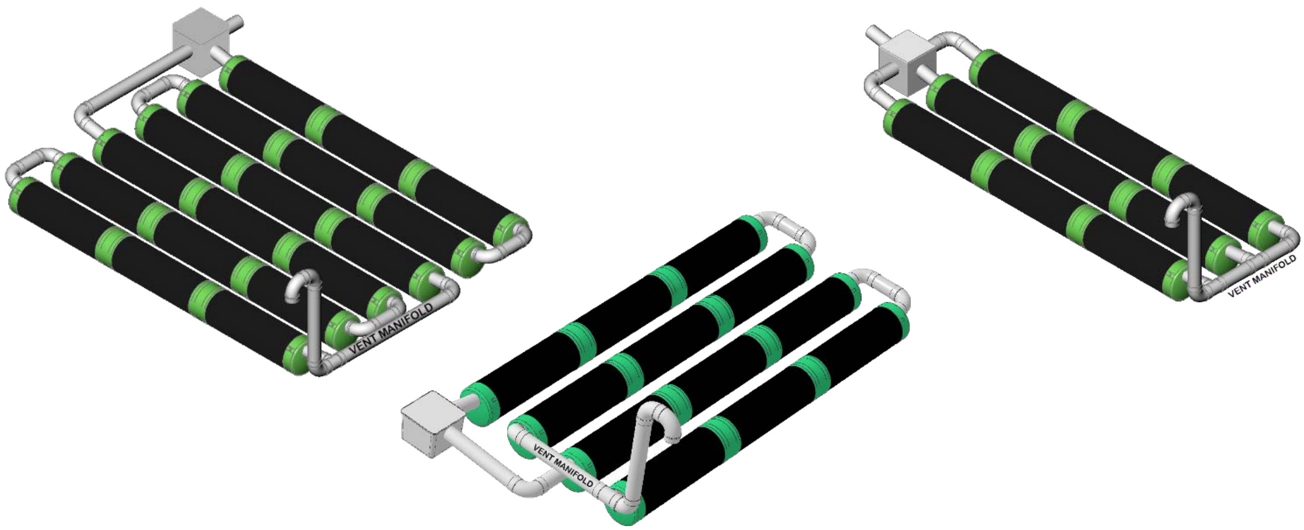
25.4 Pump System Vent Locations

a) A low vent is installed through an offset adapter at the end of each section, Basic Serial bed or attached to a vent manifold.
b) A high vent is attached to an unused distribution box outlet.
c) A 10 ft minimum vertical differential is required between high and low vent openings.
d) When venting multiple beds, it is preferred that each bed be vented separately (have their own high and low vents) rather than manifolding bed vents together.

e) The Low and High vents may be swapped proved the distribution box is insulated against freezing in cold climates.
f) See Remote Venting (para. 25.7, page 22) and Bypass Venting (para. 25.8, page 23) for options to relocate or eliminate the High Vent.

25.5 Vent Manifolds

A vent manifold may be incorporated to connect the ends of a number of sections or rows of Presby Pipe to a single vent opening. Slope the lines connecting the manifold to the Presby pipes to drain condensation. See diagrams below:



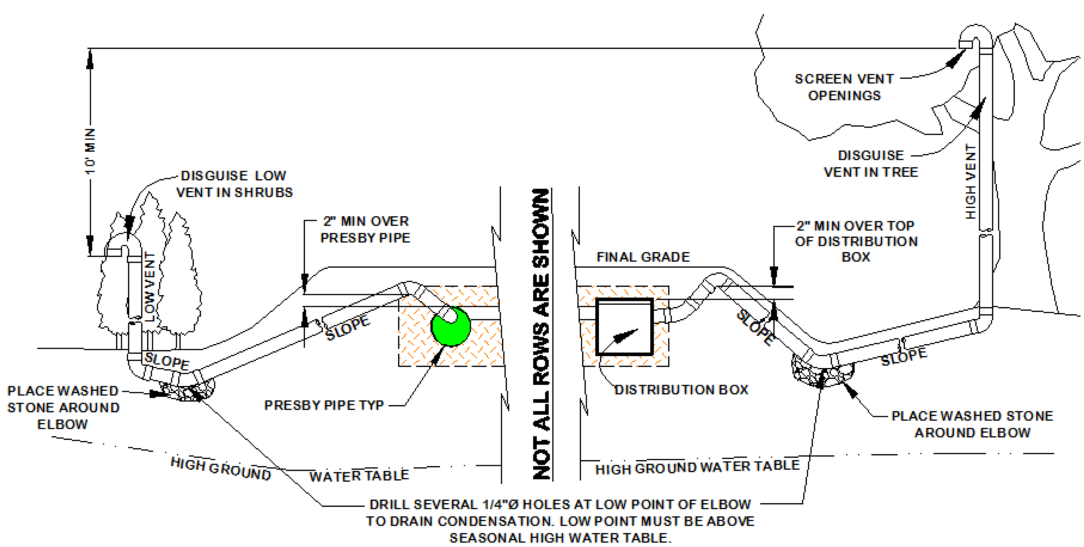
25.6 Vent Piping Slope

Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.

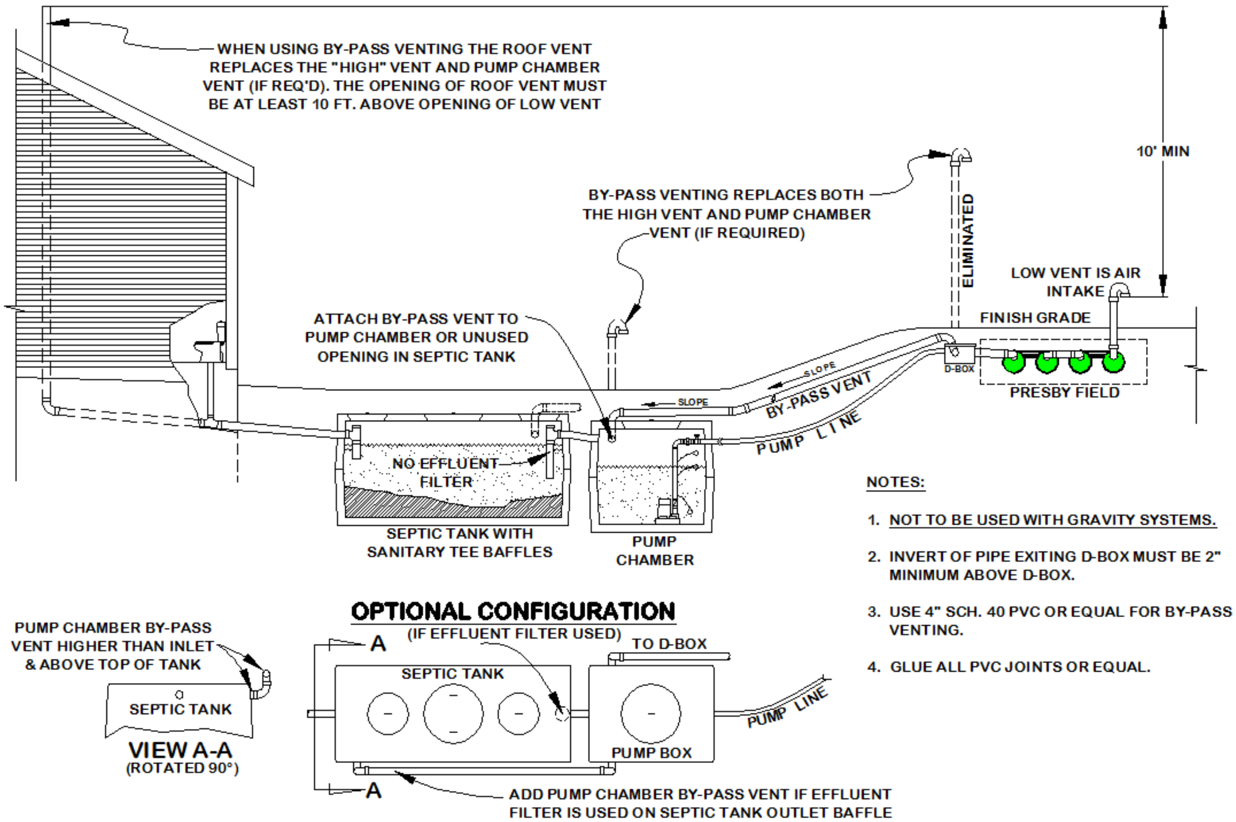
25.7 Remote Venting

If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in. holes to allow drainage of condensation. This procedure may only be used if the vent pipe connecting to the system has:

a) A **high point** that is above the highest point of all Presby Pipes or the Distribution Box; and,
b) A **low point** opened for drainage which is above the SHWT. (See diagram below.)



25.8 By-Pass Venting



26.0 Site Selection

26.1 Determining Site Suitability
Refer to State or local rules regarding site suitability requirements.

26.2 Topography
Locate systems on convex, hill, slope or level locations that do not concentrate surface flows. Avoid swales, low areas, or toe-of-slope areas that may not provide sufficient drainage away from the system.

26.3 Surface Water Diversions
Surface water runoff must be diverted away from the system. Diversions must be provided up-slope of the system and designed to avoid ponding. Systems must not be located in areas where surface or groundwater flows are concentrated.

26.4 Containment
Systems should not be located where structures such as curbs, walls or foundations might adversely restrict the soil's ability to transport water away from the system.

26.5 Hydraulic loading
Systems should not be located where lawn irrigation, roof drains, or natural flows increase water loading to the soils around the system.

26.6 Access
Systems should be located to allow access for septic tank maintenance and to at least one end of all Presby Rows. Planning for future access will facilitate rejuvenation in the unlikely event the system malfunctions.

26.7 Rocky or Wooded Areas
Avoid locating systems in rocky or wooded areas that require additional site work, since this may alter the soil's ability to accept water. No trees or shrubs should be located within 10 ft of the system to prevent root infiltration.

26.8 Replacement System
In the event of system malfunction, contact PEI for technical assistance prior to attempting Rejuvenation procedures. In the unlikely event that a Presby System needs to be replaced …

a) It can be reinstalled in the same location, eliminating the need for a replacement field reserve area.

b) All unsuitable material must be removed prior to replacement system construction.
c) Disposal of hazardous materials to be in accordance with State and local requirements.
d) Permits may be required for system replacement; contact the appropriate local or state agency.

27.0 Installation Requirements, Component Handling and Site Preparation

27.1 Component Handling

a) Keep mud, grease, oil, etc. away from all components.
b) Avoid dragging pipe through wet or muddy areas.
c) Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
d) The outer fabric of the Presby Pipe is ultra-violet stabilized; however, this protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp if stored outdoors.

27.2 Critical Reminder to Prevent Soil Compaction

It is critical to keep excavators, backhoes, and other equipment off the excavated or tilled surface of a bed. Before installing the System Sand, excavation equipment should be operated around the bed perimeter; not on the bed itself.

27.3 Site Preparation Prior to Excavation

a) Locate and stake out the System Sand bed, extension areas and soil material cover extensions on the site according to the approved plan.
b) Install sediment/erosion control barriers prior to beginning excavation to protect the system from surface water flows during construction.
c) Do not travel across or locate excavation equipment within the portion of the site receiving System Sand.
d) Do not stockpile materials or equipment within the portion of the site receiving System Sand.
e) It is especially important to avoid using construction equipment down slope of the system to prevent soil compaction.

27.4 When to Excavate

a) Do not work wet or frozen soils. If a fragment of soil from about 9 in. below the surface can easily be rolled into a wire, the soil moisture content is too high for construction.
b) Do not excavate the system area immediately after, during or before precipitation.

27.5 Tree Stumps

Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance.

a) Do not locate equipment within the limits of the System Sand bed.
b) Avoid soil disturbance, relocation, or compaction.
c) Avoid mechanical leveling or tamping of dislodged soil.
d) Fill all voids created by stump or root removal with System Sand.

27.6 Organic Material Removal

Before tilling, remove all grass, leaves, sticks, brush and other organic matter or debris from the excavated system site. It is not necessary for the soil of the system site to be smooth when the site is prepared.

27.7 Raking and Tilling Procedures

All areas receiving System Sand, sand fill and fill extensions **must** be raked or tilled. If a backhoe/excavator is used to till the site, fit it with chisel teeth and till the site. The backhoe/excavator must remain outside of the proposed System Sand area and extensions. For in-ground bed systems, excavate the system bed as necessary below original grade. Using an excavator or backhoe, tilt the bucket teeth perpendicular to the bed and use the teeth to rake furrows 2 in.- 6 in. deep into the bottom of the entire area receiving System Sand or sand fill ("receiving area").

27.8 Install System Sand and/or Sand Fill Immediately After Excavation

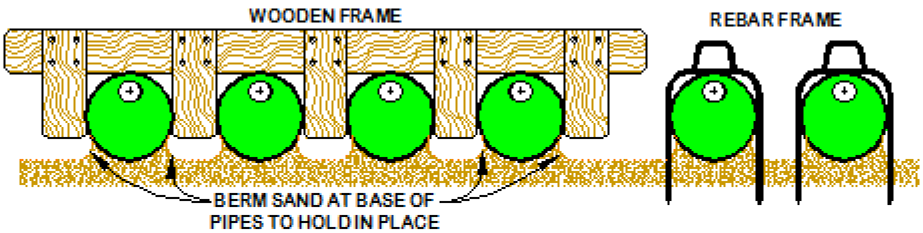
a) To protect the tilled area (System Sand bed area and System Sand extension area) from damage by precipitation, System Sand should be installed immediately after tilling.
b) Work off either end or the uphill side of the system to avoid compacting soil.
c) Keep at least 6 in. of sand between the vehicle tracks and the tilled soil of the site if equipment must work on receiving soil.
d) Track construction equipment should not travel over the installed system area until at least 12 in. of cover material is placed over the Presby Pipes.
e) Heavy equipment with tires must never enter the receiving area due to likely wheel compaction of underlying soil structures.

27.9 Distribution Box Installation
To prevent movement, be sure D-boxes are placed level on compacted soil, sand, pea gravel base, or concrete pad.

27.10 Level Row Tolerances
Use a laser level or transit to install rows level. Variations beyond 1 in. (±1/2") may affect system performance and are not acceptable.

27.11 Correct Alignment of Advanced Enviro-Septic® Bio-Accelerator® Fabric
The Bio-Accelerator® (white geo-textile fabric) is to be positioned centered along the bottom of the pipe rows (sewn seam up).

27.12 Row Spacers
System Sand may be used to keep pipe in place while covering, but simple tools may also be constructed for this purpose. Two examples are shown. One is made from rebar, the other from wood. Center-to-center row spacing may be larger than specified by this manual. Caution: Remove all tools used as row spacers before final covering.



27.13 Connect Rows Using Raised Connections
Raised connections consist of offset adapters, 4 in. PVC sewer and drain pipe, and 90° elbows. They enable greater liquid storage capacity and increase the bacterial surfaces being developed. Use raised connections to connect the rows of the Presby System (see para. 3.7 page 4). Glue or mechanically fasten all pipe connections.

27.14 Backfilling Rows
a) Spread System Sand between the rows.
b) Confirm pipe rows are positioned with Bio-Accelerator® along the bottom (sewn seam up).
c) Straddle each row of pipe and walk heel-to-toe its entire length, ensuring that System Sand fills all void spaces beneath the Presby Pipe.
d) Finish spreading System Sand to the top of the rows and leave them exposed for inspection purposes.

27.15 Backfilling and Final Grading
Spread System Sand to a minimum of 3 inches over the pipe and a minimum of 6 inches beyond Presby Pipes on all four sides beyond the Presby Pipes. Spread soil material free of organics, stones over 4 inches and building debris, having a texture similar to the soil at the site, without causing compaction. Construction equipment should not travel over the installed system area until at least 12 inches of cover material is placed over the Presby Pipes (H-10 Loading). 18 inches of cover material over the Presby System is required for H-20 loading (see para. 22.0, page 19).

27.16 System Soil Cover Material
A minimum of 4 inches of suitable earth cover (topsoil or loam), with a texture similar to the soil at the site and capable of sustaining plant growth, must be placed above the installed system.

27.17 Erosion Control
To prevent erosion, soil cover above the system shall be planted with native, shallow-rooted vegetation such as grass, wildflowers and certain perennials or ground covers.

27.18 Trees and Shrubs
It is recommended that no trees or shrubs be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

28.0 System Bacteria Rejuvenation and Expansion
This section covers procedures for bacteria rejuvenation and explains how to expand existing systems.
Note: Presby Environmental, Inc. must be contacted for technical assistance prior to attempting rejuvenation procedures.

28.1 Why would System Bacteria Rejuvenation be needed?
Bacteria rejuvenation is the return of bacteria to an aerobic state. Flooding, improper venting, alteration or improper depth of soil material cover, use of incorrect sand, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to converting bacteria in any system from an aerobic to an anaerobic

state. This conversion severely limits the bacteria's ability to effectively treat effluent, as well as limiting liquids from passing through. A unique feature of the Presby System is its ability to be rejuvenated in place.

28.2 How to Rejuvenate System Bacteria

System bacteria are "rejuvenated" when they return to an aerobic state. By using the following procedure, this can be accomplished in most Presby Systems without costly removal and replacement.

1. Contact Presby Environmental before attempting Rejuvenation for technical assistance.
2. Determine and rectify the problem(s) causing the bacteria conversion.
3. Drain the system by excavating one end of all the rows and removing the offset adapters.
4. If foreign matter has entered the system, flush the pipes.
5. Safeguard the open excavation.
6. Guarantee a passage of air through the system.
7. Allow all rows to dry for 72 hours minimum. The System Sand should return to its natural color.
8. Re-assemble the system to its original design configuration. As long as there is no physical damage to the Presby components, the original components may be reused.

29.0 System Expansion

Presby Systems are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections. All system expansions must comply with State and local regulations. Permits may be required prior to system expansion.

29.1 Reusable Components

Presby Pipe and components are not biodegradable and may be reused. In cases of improper installation, it may be possible to excavate, clean, and reinstall all system components.

30.0 Operation & Maintenance

30.1 Proper Use

Presby Systems require minimal maintenance, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will guarantee system longevity. We encourage all system owners and service providers to obtain and review a copy of our Owner's Manual, available from our website www.PresbyEnvironmental.com or via mail upon request to (800) 473-5298 or info@presbyeco.com.

30.2 System Abuse Conditions

The following conditions constitute system abuse:

a) Liquid in high volume (excessive number of occupants and use of water in a short period of time, leaking fixtures, whirlpool tubs, hot tubs, water softening equipment or additional water discharging fixtures if not specified in system design).
b) Solids in high volume (excessive number of occupants, paper products, personal hygiene products, garbage disposals or water softening equipment if not specified in system design)
c) Antibiotics and medicines in high concentrations
d) Cleaning products in high concentrations
e) Fertilizers or other caustic chemicals in any amount
f) Petroleum products in any amount
g) Latex and oil paints
h) System suffocation (compacted soils, barrier materials, etc.) without proper venting

Note: PEI and most regulatory agencies do not recommend the use of septic system additives.

30.3 System Maintenance/Pumping of the Septic Tank

a) Inspect the septic tank at least once every two years under normal usage.
b) Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
c) If a garbage disposal is used, the septic tank will likely require more frequent pumping.
d) After pumping, inspect the septic tank for integrity to ensure that no groundwater is entering it. Also, check the integrity of the tank inlet and outlet baffles and repair if needed.
e) Inspect the system to ensure that vents are in place and free of obstructions.
f) Effluent filters require ongoing maintenance due to their tendency to clog and cut off oxygen to the System. Follow filter manufacturer's maintenance instructions and inspect filters frequently.

30.4 Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation, including the entire System Sand bed area, and areas impacted by side slope tapering and perimeter drains (if used). Roots can infiltrate and cause damage or clogging of system components. If a perimeter drain is used, it is important to make sure that the outfall pipes are screened to prevent animal activity. Also, check outfall pipes regularly to ensure that they are not obstructed in any way.

31.0 Glossary

This Manual contains terminology which is common to the industry and terms that are unique to Presby Systems. While alternative definitions may exist, this section defines how these terms are used in this Manual.

31.1 Advanced Enviro-Septic® (AES) Pipe

A single unit comprised of corrugated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. Each unit is 10 ft in length, with an outside diameter of 12 in. and a storage capacity of approximately 58 gallons. Each foot of Advanced Enviro-Septic® provides over 40 sq ft of total surface area for bacterial activity. The sewn seam is always oriented up (12 o'clock position) within the bed. A white tag is sewn into the seam indicating the product is Advanced Enviro-Septic® pipe. Pipes are joined together with couplings to form rows. Advanced Enviro-Septic® is a combined wastewater treatment and dispersal system.

31.2 Basic Serial Distribution

Basic Serial distribution incorporates Presby Rows in serial distribution in a single bed (see Basic Serial Distribution in para. 12.0, page 14).

31.3 Bio-Accelerator®

Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable. Bio-Accelerator® is only available with Advanced Enviro-Septic®.

31.4 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-Box Distribution Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation (see illustration in para. 14.0, page 16).

31.5 Butterfly Configuration

A variation of a standard, single bed system with the D-box located in the center, with rows oriented symmetrically on either side, and with each side or section receiving an equal volume of flow from the D-Box. See Butterfly Configuration (see para. 15.1, page 17).

31.6 Center-to-Center Row Spacing

The distance from the center of one Presby Row to the center of the adjacent row.

31.7 Coarse Randomized Fiber

A mat of coarse, randomly-oriented fibers which separates more suspended solids from the effluent protecting the bacterial surface in the geo-textile fabric (see illustration in para. 2.0, page 2).

31.8 Combination Serial Distribution

Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 750 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 750 GPD or less. See Combination Serial Distribution, para. 15.0, on page 16.

31.9 Cooling Ridges

Pipe ridges that allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling (see illustration in para. 2.0, page 2).

31.10 Coupling

A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.3.3, page 3).

31.11 Daily Design Flow

The peak daily flow of wastewater to a system, expressed in gallons per day (GPD); systems are typically sized based on the daily design flow. Design flow calculations are set forth in the State Rules. In general, actual daily use is expected to be one-half to two-thirds less than "daily design flow."

31.12 Differential Venting

A method of venting a Presby System utilizing high and low vents (see para. 25.2, page 21).

31.13 Distribution Box or "D-Box"
A device designed to divide and distribute effluent from the septic tank equally to each of the outlet pipes that carry effluent into the Presby System. D-Boxes are also used for velocity reduction, see Velocity Reduction, para. 23.4, page 20.

31.14 Drop Connection (Multi-Level™ Systems)
A drop connection is a PVC Sewer & Drain pipe configuration which is used to connect upper level rows to lower level rows in a Multi-Level™ bed. Drop connections extend 2 in. to 4 in. into the pipe and are installed with at least 2 in. of drop from the upper level row to the lower level row. All PVC joints should be glued or mechanically fastened.

31.15 D-Box Distribution Configuration
A design in which each Presby Row receives effluent from a distribution box outlet. Such a system is also called a "parallel system" or a "finger system." See D-Box (Parallel) Distribution, para. 17.0, page 18.

31.16 End-to-End Configuration
Consists of two or more beds constructed in a line (i.e., aligned along the width of the beds). See para. 18.0, page 18 and illustration on page 16.

31.17 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet.

31.18 GPD and GPM
An acronym for <u>G</u>allons <u>p</u>er <u>D</u>ay and <u>G</u>allons <u>p</u>er <u>M</u>inute respectively.

31.19 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 25.0, page 20.

31.20 High Strength Effluent
High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (BOD5) and total suspended solids (TSS) in excess of two-hundred and forty (240) mg/L.

31.21 Manifolded Splitter Box
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 3.6, on page 3.

31.22 Multi-Level™
A Multi-Level™ System is a patented process using Presby Pipe; it consists of essentially two Presby Systems installed in the same bed with one system on top of another with 6 in. of System Sand between the two levels. Multi-Level Systems are limited to soils with a Soil Application rate of 0.6 GDP/ft^2 and greater.

31.23 Multiple Bed Distribution
Incorporates two or more beds, each bed with Basic Serial, Combination Serial, or D-Box distribution and receiving effluent from a distribution box (see para. 18.0, page 18).

31.24 Non-Conventional Configurations
Have irregular shapes or row lengths shorter than 30 ft to accommodate site constraints (see para. 13.1, page 15).

31.25 Offset Adapter
A plastic fitting with a 4-inch hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 3.2, page 3).

31.26 Pressure Distribution
A pressurized, small-diameter pipe system used to deliver effluent to an absorption field. Pressure Distribution is not permitted to be used with the Presby System. Presby Systems are designed to promote even distribution without the need for pressure distribution.

31.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 23.0, page 20).

31.28 Raised Connection
A U-shaped, 4" diameter, PVC pipe configuration which is used to connect rows oriented in a serial configuration and to maintain the proper liquid level inside each row. See drawing in para.3.8, page 4.

31.29 Raking and Tilling
Refers to methods of preparing the native soil that will be covered with System Sand or Sand Fill, creating a transitional layer between the sand and the soil. See Installation Requirements para. 27.7, page 24.

31.30 Row
Consists of a number of Presby Pipe sections connected by couplings with an Offset Adapter on the inlet end and an Offset Adapter or End Cap on the opposite end. Rows are typically between 30 ft and 100 ft long (see Row Requirements in para. 11.14, page 12).

31.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 24.2, page 20. Sand fill is used to raise the elevation of the system to meet required separation distance or in side slope tapers. System Sand may be used in place of Sand Fill.

31.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 750 GPD daily design flow maximum.

31.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in sections 12.0 on page 14. Combination Serial distribution is described in detail in paragraphs 15.0 and 16.0, pages 16 and 17.

31.34 Skimmer Tabs
Projections into the AES pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

31.35 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another.

31.36 Slope (3:1)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. Example: A slope with a grade of (3:1) is the difference in horizontal distance of two (3) horizontal feet (run) over an elevation difference of one (1) ft (rise).

31.37 Slope (%)
Expressed as a **percent**, is the difference in elevation divided by the difference in horizontal distance between two points on the surface of a landform. Example: A site slope of one (1) percent is the difference in elevation of one (1) foot (rise) over a horizontal distance of one hundred (100) feet (run).

31.38 Smearing
The mechanical sealing of soil air spaces along an excavated, tilled or compressed surface. This is also referred to as “compacting.” In all installations, it is critical to avoid smearing or compacting the soils under and around the field.

31.39 Surface Diversion
A natural or manmade barrier that changes the course of water flow around an onsite system’s soil absorption field.

31.40 System Sand Bed
System Sand area required/used in Presby Systems. The System Sand bed extends a minimum of 12 in. below, 3 in. above and 6 in. horizontally from the outside edges of the Presby Pipes.

31.41 System Sand
System Sand must be clean, granular sand free of organic matter and must adhere to the Presby System Specification with no more than 3% passing the #200 sieve (see complete details in para. 3.10, page 4).

31.42 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep for Single Level systems and 12 in. deep for Multi-Level systems. The System Sand extension is placed on the down slope side of sloping systems. System sloping more than 10% require a 3 ft minimum extension. The System Sand extension is measured from the tall portion of the System Sand bed (see illustration in para. 18.1, page 19).

31.43 Topsoil (a.k.a. Loam or Soil Cover Material)
Topsoil, also known as Loam, is soil material cover capable of sustaining plant growth which forms the topmost layer of cover material above the system.

31.44 Velocity Reducer
Velocity reducer refers to any of the various components whose purpose is to reduce the velocity of effluent flow into the Presby Pipes. A distribution box with a baffle or inlet tee is sufficient for velocity reduction in most systems (see illustration in para. 23.4, page 20).

The Presby Wastewater Treatment System

Wisconsin

Advanced Enviro-Septic®

Mound Component Manual

✔ **Minimizes the Expense** ✔ **Protects the Environment** ✔ **Preserves the Site**

Presby Environmental, Inc.

The Next Generation of Wastewater Treatment Technology

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The information in this manual is subject to change without notice. We recommend that you check your State's page on our website on a regular basis for updated information. Your suggestions and comments are welcome. Please contact us at: 800-473-5298

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IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® Wastewater Treatment Systems. The use of this Manual with any other product is prohibited. The processes and design criteria contained herein are based solely on our experience with and testing of Advanced Enviro-Septic®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

Date of Issue: February 15, 2017

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1.0 Background

Liquid that exits from a septic tank ("effluent") contains suspended solids that can cause traditional systems to fail prematurely. Solids can overload bacteria, cut off air required for aerobic bacterial activity, and/or seal the underlying soil, interfering with its ability to absorb liquid.

1.1 What Our System Does

By utilizing simple yet effective natural processes, the Presby Treatment System treats septic tank effluent in a manner that prevents suspended solids from sealing the underlying soil, increases system aeration, and provides a greater bacterial treatment area ("biomat") than traditional systems.

1.2 Why Our System Excels

The Presby Treatment System retains solids in its pipe and provides multiple bacterial surfaces to treat effluent prior to its contact with the soil. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. This all combines to create a unique eco-system that no other passive wastewater treatment system is designed to offer. The result is a system that excels by being more efficient, lasting longer, and has a minimal environmental impact.

1.3 System Advantages

a) costs less than traditional systems
b) eliminates the need for washed stone
c) often requires a smaller area
d) installs more easily and quickly than traditional systems
e) adapts easily to residential and commercial sites of virtually any size
f) adapts well to difficult sites
g) develops a protected receiving surface preventing sealing of the underlying soil
h) blends "septic mounds" into sloping terrain
i) increases system performance and longevity
j) tests environmentally safer than traditional systems
k) recharges groundwater more safely than traditional systems
l) made from recycled plastic

1.4 Patented Presby Technology

At the heart of Advanced Enviro-Septic® is a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges. All Presby Pipe is surrounded by one or more filtering, treatment and dispersal layers. Presby Systems are completely passive, requiring no electricity, motors, alarms, computers, etc. Presby Pipes are assembled and installed in a bed of specified System Sand which can either be below the ground or above.

1.5 Advanced Enviro-Septic® (AES)

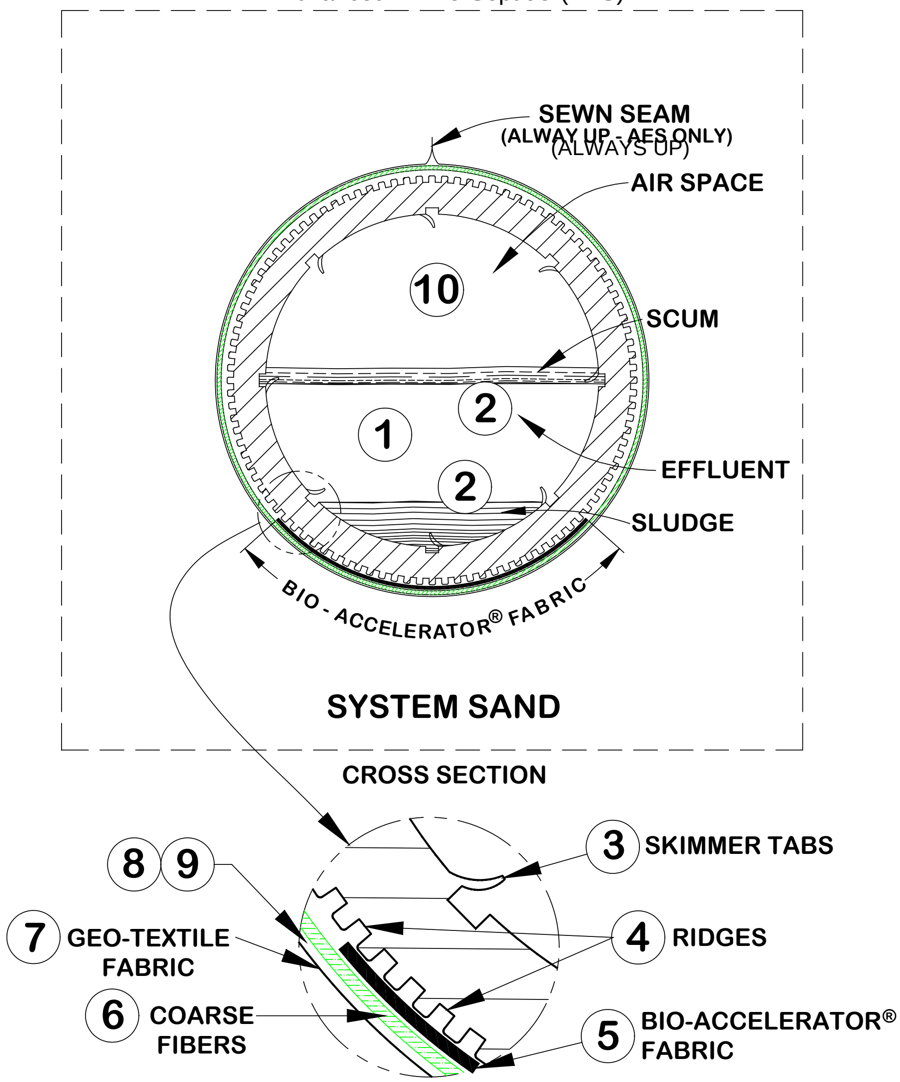
The Advanced Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I (a certification typically given to mechanical aeration devices), BNQ of Quebec, Class I, II, III and Cebedeau, Belgium standards. Advanced Enviro-Septic® is comprised of corrugated, perforated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. Advanced Enviro-Septic® creates an eco-system designed to simultaneously purify and disperse effluent after primary treatment by a septic tank. Advanced Enviro-Septic® is the "next generation" of our Enviro-Septic® technology. The AES product incorporates Bio-Accelerator®, a proprietary enhancement that screens additional solids from effluent, accelerates treatment processes, assures even distribution and provides additional surface area. Each foot of Advanced Enviro-Septic® pipe provides over 40 sq ft of total surface area for bacterial activity.

2.0 Ten Stages of Wastewater Treatment

The Presby Wastewater Treatment System's

10 STAGES OF TREATMENT

Advanced Enviro-Septic® (AES)



Stage 1: Warm effluent enters the pipe and is cooled to ground temperature.

Stage 2: Suspended solids separate from the cooled liquid effluent.

Stage 3: Skimmers further capture grease and suspended solids from the existing effluent.

Stage 4: Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.

Stage 5: Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable.

Stage 6: A mat of coarse, randomly-oriented fibers separates more suspended solids from the effluent.

Stage 7: Effluent passes into the geo-textile fabrics and grows a protected bacterial surface.

Stage 8: Sand wicks liquid from the geo-textile fabrics and enables air to transfer to the bacterial surface.

Stage 9: The fabrics and fibers provide a large bacterial surface to break down solids.

Stage 10: An ample air supply and fluctuating liquid levels increase bacterial efficiency.

3.0 Presby System Components

3.1 Advanced Enviro-Septic® Pipe

a) Presby pipe required is calculated at 3 GPD/ft for both residential and commercial applications. This assumes residential strength effluent.
b) Plastic pipe made with a significant percentage of recycled material
c) 10 ft sections (can be cut to any length)
d) Ridged and perforated, with skimmer tabs on interior
e) Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
f) Surrounded by a mat of randomly-oriented plastic fibers
g) Wrapped in a non-woven geo-textile fabric stitched in place
h) Exterior diameter of 12 in.
i) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
j) A 10 ft length of AES pipe is flexible enough to bend up to 90°

3.2 Offset Adapter

An offset adapter is a plastic fitting 12 in. in diameter with an inlet hole designed to accept a 4-inch sewer line, raised connection or vent pipe. The hole is to be installed in the 12 o'clock position. The distance from the bottom of the Offset Adapter to the bottom of its inlet hole is 7 in. When assembling pipes into rows, note that the geo-textile fabrics are placed over the edges of the Offset Adapter and Couplings.

Double Offset Adapter

A double offset adapter is a plastic fitting 12 in. in diameter with two 4 in. holes designed to accept a 4 inch inlet pipe, raised connection, vent or vent manifold, and/or bottom drain, depending upon the particular requirements of the design configuration. The 4 in. holes are to be aligned in the 12 o'clock and 6 o'clock positions. The holes are positioned 1 in. from the outside edge of the double offset adaptor and 2 in. from each other.

3.3 Coupling

A coupling is a plastic fitting used to create a connection between two pieces of Presby Pipe. Note that the couplings are wide enough to cover 1 or 2 pipe corrugations on each of the two pipe ends being joined. The couplings feature a snap-lock feature that requires no tools. When assembling pipes into rows, note that the geo-textile fabric does not go under couplings. Pull fabric back, install coupling, and then pull fabric over coupling. Also, note during installation in cold weather, couplings are easier to work with if stored in a heated location (such as a truck cab) before use.

3.4 Distribution Box

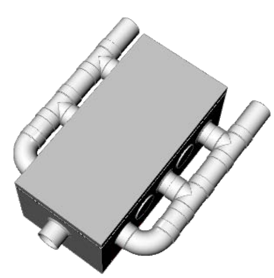
A Distribution Box, also called a "D-box," is a device used to distribute effluent coming from the septic tank in a system that contains more than one section or more than one bed. D-boxes are also sometimes used for velocity reduction. D-boxes come in various sizes and with a varying number of outlets. Concrete D-boxes are preferred; some are made of plastic. Flow equalizers (see below) are installed in the D-box openings to equalize distribution; they help ensure equal distribution in the event that the D-box settles or otherwise becomes out of level. Unused openings in D-boxes are to be covered, plugged or mortared. A distribution box is only required when dividing flow to more than one section of the Presby bed.

3.5 Flow Equalizers

All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever flow is divided. Each Bed or section of Combination Serial distribution is limited to a maximum of 15 gallons per minute, due to the flow constraints of the equalizers. Example: pumping to a combination system with 3 sections (using 3 D-Box outlets). The maximum delivery rate is (3 x 15) = 45 GPM. Always provide a means of velocity reduction when needed.

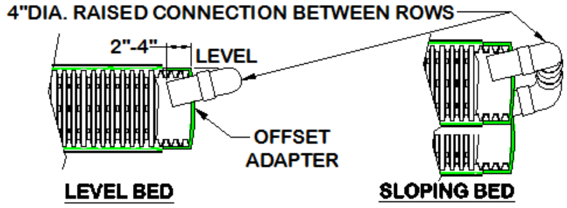
3.6 Manifolded Splitter Box

A manifolded splitter box joins several outlets of a D-box to help divide flow more accurately. Dividing flow to multiple beds is a common use of splitter boxes. All outlets delivering effluent to the Presby field must have a flow equalizer. Do not place an equalizer on vent outlets.



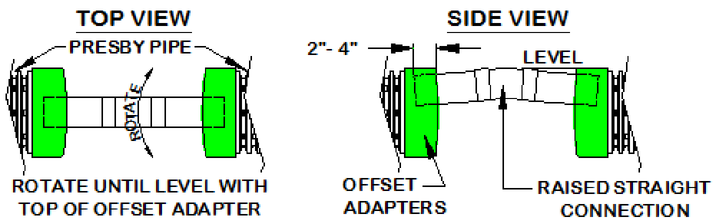
3.7 Raised Connection

A raised connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows. Raised connections extend 2 in. to 4 in. into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened.



3.8 Raised Straight Connection

A raised straight connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows that are placed end to end along the same contour. Raised straight connections extend 2 inches to 4 inches into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened. Offset Adapters will accept 4 inch schedule 40 PVC if the edge to be inserted into the adapter is rounded.



3.9 Septic Tank

The Advanced Enviro-Septic® System is designed to treat effluent that has received "primary treatment" in a standard septic tank. Septic tank capacity is determined by state and/or local rules. Septic tanks must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Presby pipes. Effluent filters are not recommended by Presby Environmental, Inc. due to their tendency to clog, which cuts off the oxygen supply that is essential to the functioning of the Presby System. If you are required to use an effluent filter in a gravity fed system due to State or local requirements, the effluent filter selected must allow the free passage of air to ensure the proper functioning of the system.

3.10 System Sand

The System Sand that surrounds the Presby pipes is an **essential** component of the system. It is **critical** that the correct type and amount of System Sand is used during construction. System Sand must be coarse to very coarse, clean, granular sand, free of organic matter. System Sand is placed a minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above from the Presby pipes. It must adhere to **all** of the following percentage and quality restrictions:

Presby System Sand Specification

Sieve Size	Percent Retained on Sieve (by weight)
3/4 in. (19 mm)	0
#10 (2 mm)	0 - 35
#35 (0.50 mm)	40 - 90
Note: not more than 3% allowed to pass the #200 sieve (verified by washing sample per requirements of ASTM C-117)	

3.11 System Sand Acceptable Alternative

ASTM C-33 (concrete sand), natural or manufactured sand, with not more than 3% passing the #200 sieve (verified by washing the sample per the requirements of ASTM C-117 as noted in the ASTM C-33 specification) may be used as an acceptable alternate material for use as System Sand.

4.0 **Table A – Soil Application Rate by Soil Characteristics** (from Wisconsin Table SPS 383.44-1)

Soil Characteristics			Soil Application Rate (GPD/sq ft)
Texture	**Structure: Shape**	**Structure: Grade**	
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	-	Structureless	1.6[a]; 0.5[b]
Fine Sand, Loamy Fine Sand	-	Structureless	1.0
Very Fine Sand, Loamy Very Fine Sand	-	Structureless	0.6
Coarse Sandy Loam, Sandy Loam	-	Structureless, Massive	0.6
	Platy	Weak	0.6
		Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.7
		Moderate, Strong	1.0
Fine Sandy Loam, Very Fine Sandy Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt Loam	-	Structureless, Massive	0.2
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt	-	-	0.0
Sandy Clay Loam, Clay Loam, Silty Clay Loam	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.3
		Moderate, Strong	0.6
Sandy Clay, Clay, Silty Clay	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.0
	Prismatic, Blocky, Granular	Weak	0.0
		Moderate, Strong	0.3

a = with ≤60% rock fragments and b = with >60% to <90% rock fragments

Note: Soil application rates shown above and below assume residential strength effluent (see para. 11.7, page 12 for definition of residential strength). Contact Presby Environmental for technical assistance with high strength wastewater.

5.0 Table B – Soil Application Rate using Percolation Rate (from Wisconsin Table SPS 383.44-2)

Percolation Rate Minutes per Inch (MPI)	Soil Application Rate Gallons per Day per Sq Ft (GPD/sq ft)
0 to less than 10	1.2
10 to less than 30	0.9
30 to less than 45	0.7
45 to less than 60	0.5
60 to 120	0.3

6.0 Table C: Slope Requirements

Soil Application Rate (GPD/sq ft)	Maximum System Slope (%)	Maximum Site Slope (%)
1.6 – 0.6	25	33
0.5	15	20
0.3 – 0.2	5	5

7.0 Table D: Row Length and Pipe Layout Width (Single Level)

Row Length (ft)	Total Linear Feet of Presby Pipe													
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
30	60	90	120	150	180	210	240	270	300	330	360	390	420	450
35	70	105	140	175	210	245	280	315	350	385	420	455	490	525
40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
45	90	135	180	225	270	315	360	405	450	495	540	585	630	675
50	100	150	200	250	300	350	400	450	500	550	600	650	700	750
55	110	165	220	275	330	385	440	495	550	605	660	715	770	825
60	120	180	240	300	360	420	480	540	600	660	720	780	840	900
65	130	195	260	325	390	455	520	585	650	715	780	845	910	975
70	140	210	280	350	420	490	560	630	700	770	840	910	980	1,050
75	150	225	300	375	450	525	600	675	750	825	900	975	1,050	1,125
80	160	240	320	400	480	560	640	720	800	880	960	1,040	1,120	1,200
85	170	255	340	425	510	595	680	765	850	935	1,020	1,105	1,190	1,275
90	180	270	360	450	540	630	720	810	900	990	1,080	1,170	1,260	1,350
95	190	285	380	475	570	665	760	855	950	1,045	1,140	1,235	1,330	1,425
100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
# of Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.50' C/L	2.50	4.00	5.50	7.00	8.50	10.00	11.50	13.00	14.50	16.00	17.50	19.00	20.50	22.00
1.75' C/L	2.75	4.50	6.25	8.00	9.75	11.50	13.25	15.00	16.75	18.50	20.25	22.00	23.75	25.50
2.00 C/L	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00
2.25 C/L	3.25	5.50	7.75	10.00	12.25	14.50	16.75	19.00	21.25	23.50	25.75	28.00	30.25	32.50
2.50 C/L	3.50	6.00	8.50	11.00	13.50	16.00	18.50	21.00	23.50	26.00	28.50	31.00	33.50	36.00
	*Pipe Layout Width (ft) = Outermost edge of first row to outermost edge of last row													

*Formula for single level Pipe Layout Width = [Row Spacing x (# of Rows - 1)] + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer. To use Table D: select a row length and move right until the minimum amount of pipe is found (more is allowed). Then move down to find the number of rows required. Continue downward in the same column until adjacent to the row spacing and find the pipe layout width.

8.0 Design Worksheet (Single Level Systems)

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

8.1 Design Example (single level)

Single family residence, (3) bedrooms (300 GPD), Application Rate for LFS (Loamy Fine Sandy), 10% sloping site, serial distribution layout, seasonal high groundwater at 30 inches.

Step #1: **300** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **300** sq ft sand bed area min.

Step #2: **300** GPD ÷ 3 GPD/ft = **100** ft of Presby pipe minimum

Step #3: **300** GPD ÷ 750 GPD/section = **0.4→1** sections required.

Step #4: **100** ft Presby pipe (Step #2) ÷ **50** ft row length = **2** rows required

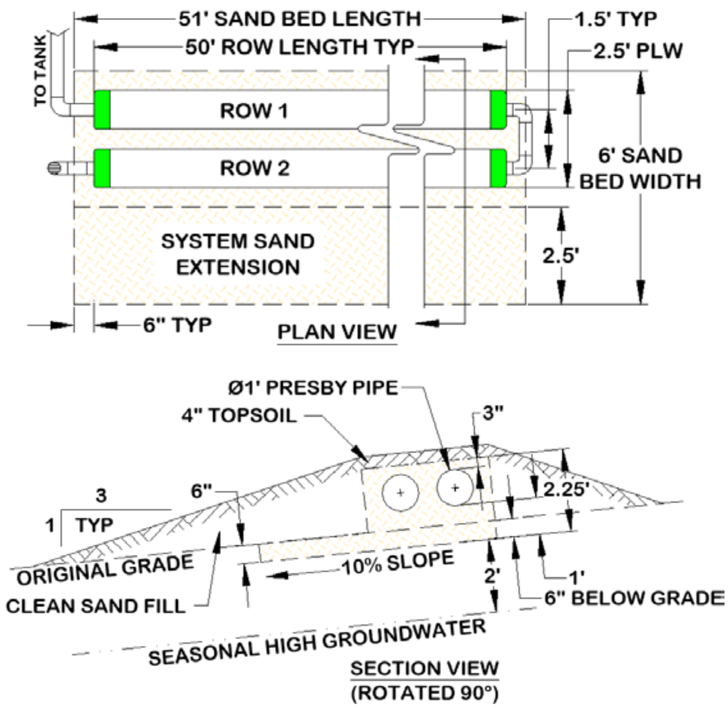
Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **10**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 5.9 ft sand bed width min.
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum **(use 5.9 ft from 7a above)**

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed when present
b) 5.9 ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) = 2.4 (use 2.5 ft System Sand extension for ease of construction)

Illustration of Example #1, Basic Serial Distribution:



Notes: A distribution box could have been used (parallel layout) with the distribution box being placed in-line with the highest row and then connecting to all the rows individually. Whenever possible eliminate the need for a distribution box and use a serial layout. This will insure air passes equally through every foot of Presby pipe.

8.2 Design Example #2 (Single Level):

Single family residence, (4) bedrooms (400 GPD), Application Rate of 0.5 GPD/sq ft for 60 MPI soils, level site, serial distribution layout, seasonal high groundwater at 18 inches.

Step #1: **400** GPD ÷ **0.5** GPD/sq ft Application Rate (Table A) = **800** sq ft sand bed area min.

Step #2: **400** GPD ÷ 3 GPD/ft = **134** ft of Presby pipe minimum

Step #3: **400** GPD ÷ 750 GPD/section = **0.54→1** sections required.

Step #4: **134** ft Presby pipe (Step #2) ÷ **70** ft row length = 1.9**→2** rows required

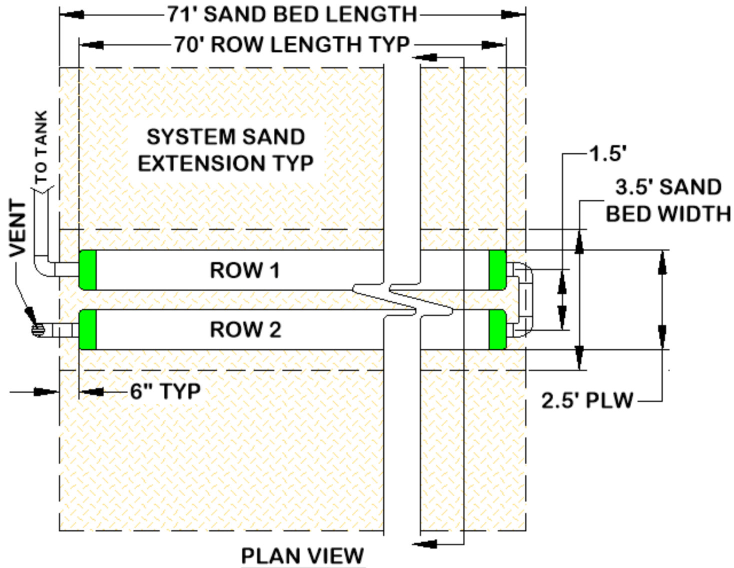
Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

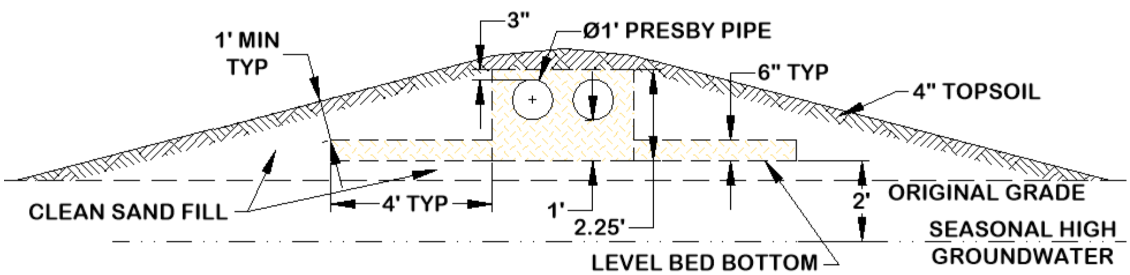
Step #6: **0**% system slope (Table C allows up to 15%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **800** sq ft sand bed area (Step #1) ÷ (**70** ft row length + 1 ft) = 11.3 ft sand bed width **(use this value)**
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed
a) **11.3** ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) ÷ 2 = 3.9 ft round up to **4** ft for ease of construction.

Illustration of Example #2, Basic Serial Distribution:





SECTION VIEW
(ROTATED 90°)

8.3 Design Example #3 (Single Level):

Commercial system, 770 GPD, Application Rate of 0.8 GPD/sq ft for Very Fine Sandy Loam soils, 12% sloping terrain and system, serial distribution layout, season high ground water at 24 inches.

Step #1: **770** GPD ÷ **0.8** GPD/sq ft Application Rate (Table A) = **962.5** sq ft sand bed area min.

Step #2: **770** GPD ÷ 3 GPD/ft = **257** ft of Presby pipe minimum

Step #3: **770** GPD ÷ 750 GPD/section = **1.1→2** sections required.

Step #4: **257** ft Presby pipe (Step #2) ÷ **65** ft row length = 3.9**→4** rows required

Step #5: **5.5** ft PLW from Table D (or calculated manually for larger row spacing)

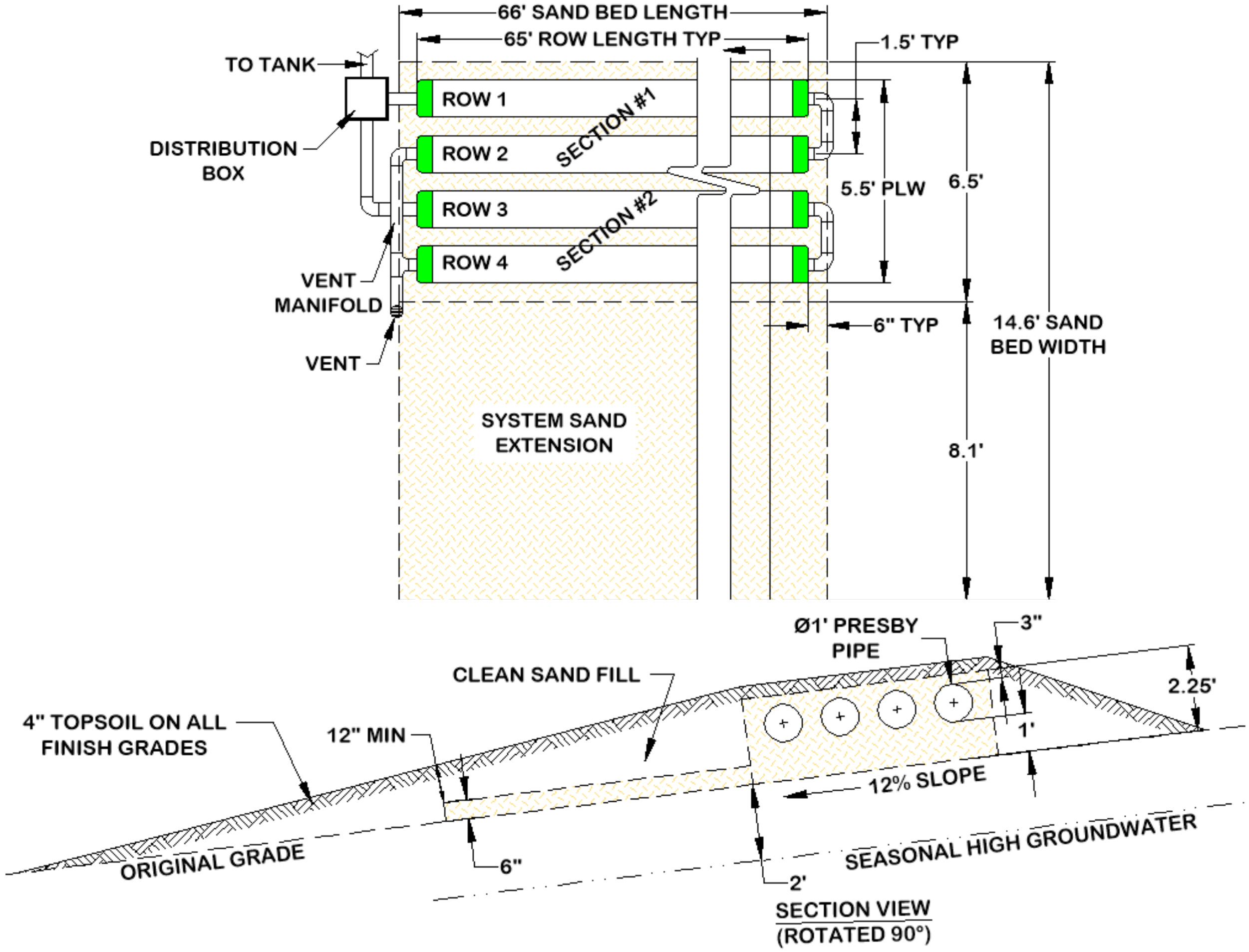
Step #6: **12**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping over 10%, use the larger of (c) or (d) below:
c) **962.5** sq ft sand bed area (Step #1) ÷ (**65** ft row length + 1 ft) = **14.6** ft sand bed width **(use this value)**
d) **5.5** ft PLW (Step #5) + 4.5 ft = **10** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed

a) **14.6** ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1 ft) = **8.1** ft

Illustration of Example #3, Commercial, Combination Serial Distribution:



9.0 Table E: Row Length and Pipe Layout Width (Multi-Level™)

		Total Linear Feet of Presby Pipe													
Row Length (ft)	**20**	40	60	80	100	120	140	160	180	200	220	240	260	280	300
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450
	35	70	105	140	175	210	245	280	315	350	385	420	455	490	525
	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
	45	90	135	180	225	270	315	360	405	450	495	540	585	630	675
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750
	55	110	165	220	275	330	385	440	495	550	605	660	715	770	825
	60	120	180	240	300	360	420	480	540	600	660	720	780	840	900
	65	130	195	260	325	390	455	520	585	650	715	780	845	910	975
	70	140	210	280	350	420	490	560	630	700	770	840	910	980	1,050
	75	150	225	300	375	450	525	600	675	750	825	900	975	1,050	1,125
	80	160	240	320	400	480	560	640	720	800	880	960	1,040	1,120	1,200
	85	170	255	340	425	510	595	680	765	850	935	1,020	1,105	1,190	1,275
	90	180	270	360	450	540	630	720	810	900	990	1,080	1,170	1,260	1,350
	95	190	285	380	475	570	665	760	855	950	1,045	1,140	1,235	1,330	1,425
	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
# of Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.5' C/L		1.75	2.50	3.25	4.00	4.75	5.50	6.25	7.00	7.75	8.50	9.25	10.00	10.75	11.50
2.0' C/L		2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
2.50' C/L		2.25	3.50	4.75	6.00	7.25	8.50	9.75	11.00	12.25	13.50	14.75	16.00	17.25	18.50
2.75' C/L		2.38	3.75	5.13	6.50	7.88	9.25	10.63	12.00	13.38	14.75	16.13	17.50	18.88	20.25
		*Pipe Layout Width (ft) = Outermost edge of Upper Level to Outermost edge of Lower Level													

Formula for Multi-Level™ Pipe Layout Width (3 rows or more) = { [Row Spacing x (# of Rows - 1)] / 2 } + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer.

10.0 Design Worksheet for Multi-Level™ Systems

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table E (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

10.1 Design Example #4 (Multi-Level™)

Single family residence, (6) bedrooms (600 GPD), Application Rate for LFS (Loamy Fine Sandy), level site, serial distribution layout, seasonal high ground water 36 inches.

Step #1: **600** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = 6**00** sq ft sand bed area min.

Step #2: **600** GPD ÷ 3 GPD/ft = 2**00** ft of Presby pipe minimum

Step #3: **600** GPD ÷ 750 GPD/section = **0.8→1** sections required.

Step #4: **200** ft Presby pipe (Step #2) ÷ **50** ft row length = **4** rows required

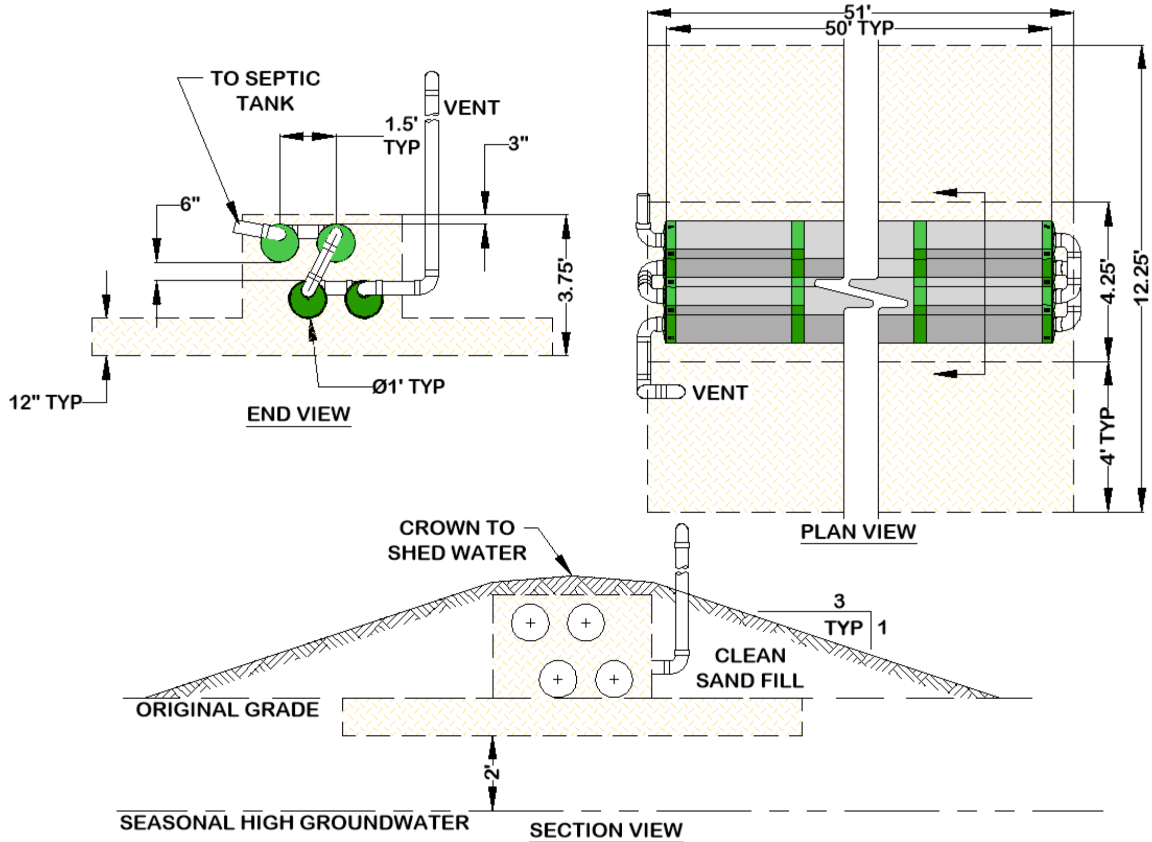
Step #5: **3.25** ft PLW from Table D (at 1.5 ft spacing)

Step #6: **0**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 11.8 ft sand bed width min.**(use this value)**
b) **3.25** ft PLW (Step #5) + 1 ft = **4.25** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):
b) [11.8 ft SSBW (Step #7) – (**3.25** ft PLW Step #5 + 1)] ÷ 2= 3.775 ft (round up to 4 ft for ease of construction).

Illustration of Example #4, Basic Serial Distribution, Multi-Level™



11.0 Design Criteria

11.1 Advanced Enviro-Septic® Pipe Requirements

a) Sewn seam must be oriented in the 12 o'clock position. This correctly orients the Bio-Accelerator® fabric in the 6 o'clock position.
b) Venting is always required regardless of vertical separation to restrictive features.

11.2 Barrier Materials over System Sand

No barrier materials (hay, straw, tarps, etc.) are to be placed between the System Sand and cover material; such materials may cut off necessary oxygen supply to the system. The only exception is the placement of the specified fabric to achieve H-20 loading requirements. See section 22.0, page 19.

11.3 Certification Requirements

Any designers and installers who have not previously attended a Presby Environmental, Inc. Certification Course are required to obtain Presby Certification. Certification is obtained by attending a Certification Course presented by Presby Environmental, Inc. or its sanctioned representative. Certification can also be obtained by viewing tutorial videos on our website (high speed connection required) and then successfully passing a short assessment test, which is also available through regular mail. All professionals involved in the inspection, review or certification of AES systems should also become Presby Certified. Professionals involved in the design or installation of Multi-Level™ systems must be Presby Certified.

11.4 Converging Flows Restriction

Presby Systems must not be located where surface or ground waters will converge, causing surface water flow to become concentrated or restricted within the soil absorption field.

11.5 Daily Design Flow

Residential daily design flow for Presby Systems is calculated in accordance with State rules. The minimum daily design flow for any single-family residential system is two bedrooms and 200 GPD for any commercial system.

a) Certain fixtures, such as jetted tubs, may require an increase in the size of the septic tank.
b) Daily design flow for a single bedroom apartment with a kitchen connected to a residence (also sometimes referred to as a "studio" or "in-law apartment") shall be calculated by adding two additional bedrooms.
c) When daily design flow is determined by water meter for commercial systems, refer to the State Rules.

d) PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of 2 to 3 times.
e) Note that "daily design flows" are calculated to assume occasional "peak" usage and a factor of safety; Systems are not expected to receive continuous dosing at full daily design load.

11.6 End-to-End Preferred Over Side-to-Side

If site conditions permit, End-to-End multiple bed configurations are preferable to Side-to-Side configurations (see para. 18.0, page 18).

11.7 Effluent (Wastewater) Strength

The Presby pipe requirement for Bed or Trench systems is based on residential strength effluent, which has received primary treatment in a septic tank. Residential strength effluent (measured after the septic tank) cannot exceed a concentration of 240 mg/L, when adding together the values for the 5-day biochemical oxygen demand (BOD5) and the total suspended solids (TSS). Typically, this corresponds to an influent strength of 300 mg/L BOD5 and 350 mg/L TSS prior to the septic tank. Designing a system that will treat higher strength wastes requires additional Presby pipe. In these situations, consult our Technical Advisors at (800) 473-5298 for recommendations.

11.8 Filters, Alarms & Baffles

a) Effluent Filters are **not** recommended for use with Presby Systems.
b) If used, effluent filters must be maintained on at least an annual basis. Follow manufacturer's instructions regarding required inspections, cleaning and maintenance of the effluent filter. Please consult PEI for the most compatible filter recommendations.
c) Effluent Filters must allow the free passage of air to ensure the proper functioning of the system. A blocked filter in any on-site septic system could interfere with venting, causing the system to convert to an anaerobic state and result in a shortened life.
d) All pump systems to have a high-water alarm float or sensor installed inside the pump chamber.
e) All septic tanks must be equipped with baffles to prevent excess solids from entering the Presby System.
f) Charcoal filters in vent stacks (for odor control) are not recommended by PEI. They can block air flow and potentially shorten system life. Contact PEI for recommendations to correct odor problems.

11.9 Flow Equalizers Required

All distribution boxes used to divide effluent flow require flow equalizers in their outlets. Flow equalizers are limited to a maximum of 15 GPM per equalizer.

11.10 Garbage Disposals (a.k.a. Garbage Grinders)

No additional Presby Pipe is required when using a garbage disposal (grinder). If a garbage disposal is utilized, follow the State's requirements regarding septic tank sizing. Multiple compartment septic tanks or multiple tanks are preferred and should be pumped as needed.

11.11 Presby Pipe Requirement (Single & Multi-Level™)

See Section 11.1, on page 11 for additional Advanced Enviro-Septic® requirements. Presby Pipe requirements are as follows and require a 1.5 ft minimum row spacing:
a) Residential systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
b) Commercial systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
c) Contact Presby Environmental, Inc. when treating high strength effluent.

11.12 Presby Environmental Standards and Technical Support

All Presby Systems must be designed and installed in compliance with the procedures and specifications described in this Manual and in the product's State approval. This Manual is to be used in conjunction with the State Department of Safety and Professional Services Administrative Rules. In the event of contradictions between this Manual and State regulations, Presby Environmental, Inc. should be contacted for technical assistance at (800) 473-5298. Exceptions to any State rules other than those specifically discussed in this Manual require a State waiver.

11.13 Pressure Distribution

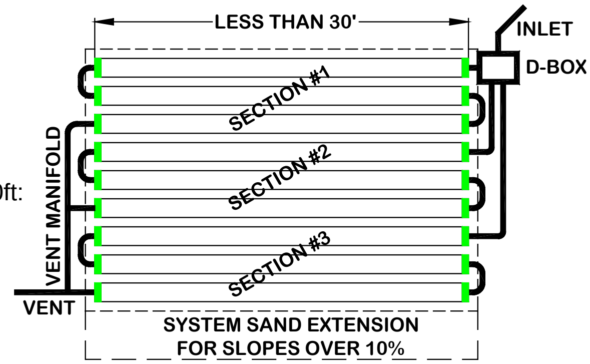
The use of pressure distribution lines in Presby Systems is **prohibited**. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the Presby Field.

11.14 Row Requirements

a) All beds must have at least 2 rows.
b) Maximum row length for any system is 100 ft.
c) Recommended minimum row length is 30 ft.
d) A combination (or D-Box) distribution system must be used if any row length is less than 30 ft. The D-Box must feed at least 30 ft of Presby Pipe, a minimum of two D-Box outlets must be used and the field must be vented.

e) Row Center-to-Center Spacing is 1.5 ft min. for all systems. Row spacing may be increased to accommodate greater basal area spacing requirements if desired.
f) For level beds: the Presby Rows are centered in the middle of the System Sand bed area and any System Sand extensions divided evenly on both sides.
g) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing. All rows to be grouped at the high side of the System Sand bed area with any System Sand extensions placed entirely on the downslope side.
h) All rows must be laid level to within +/- ½ in. (total of 1 in.) of the specified elevation and preferably should be parallel to the contour of the site.
i) It is easier if row lengths are designed in exact 10 ft increments since Presby Pipe comes in 10 ft sections. However, if necessary, the pipe is easily cut to any length to meet site constraints.

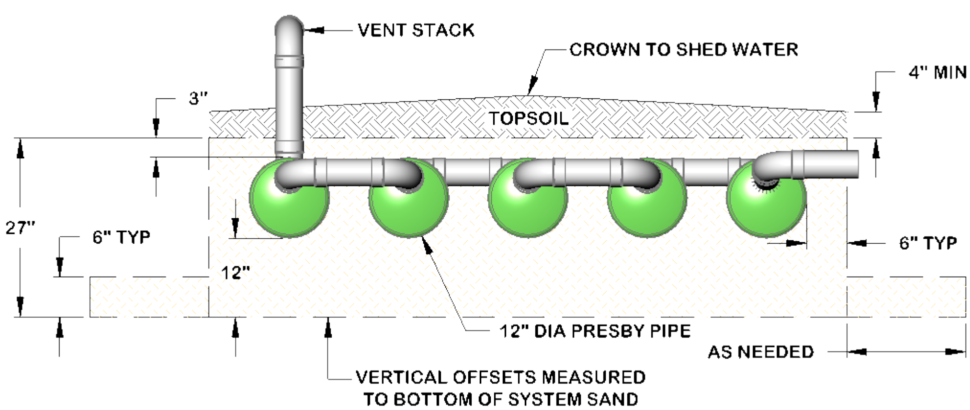
Illustration of row lengths less than 30ft:



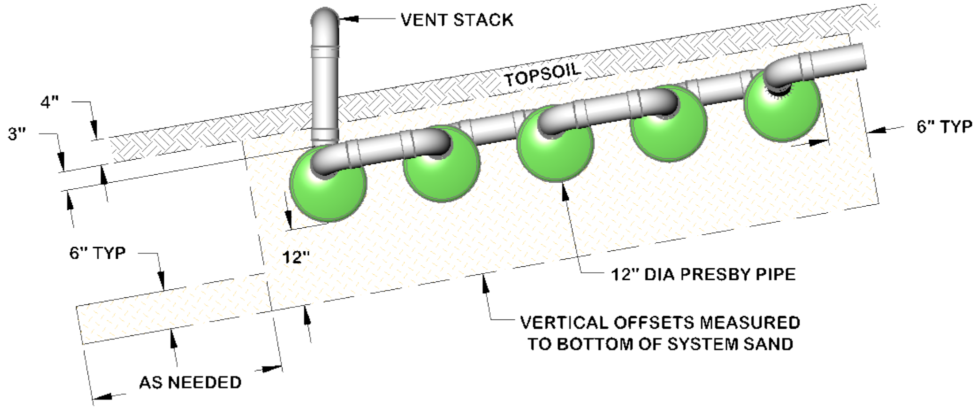
11.15 Separation Distances (Horizontal and Vertical)
Separation distances to the seasonal high water table (SHWT) or other restrictive features are measured from the outermost edge of the System Sand.

11.16 Sloping Sites and Sloping Systems
a) The percentage of slope in all system drawings refers to the slope of the Presby System, not the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
b) The system slope and the site slope do not have to be the same (see illustration in para. 18.218.1 , page 19).
c) Maximum site slope is 33% and maximum system slope is 25% (without a State waiver).

11.17 System Sand Bed Height Dimensions
The height of a Presby Sand Bed measures 27 in. minimum (not including cover material):
a) 12 in. minimum of System Sand below the Presby Pipe;
b) 12 in. diameter of the pipe; and
c) 3 inches minimum of System Sand above the Presby Pipe; also
d) When System Sand Extensions are required, they must be a minimum of 6 inches thick.

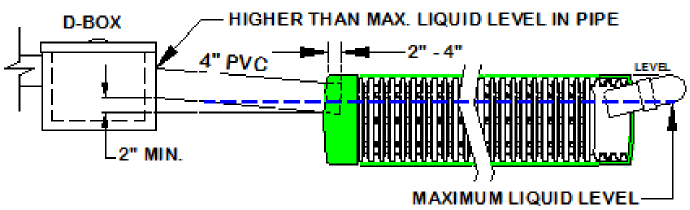


e) Sloping systems require any System Sand extension to be placed on the down slope side of the field. If the system slope is over 10% the sand extension must be at least 2.5 ft.



11.18 Two Inch Rule

The outlet of a septic tank or distribution box (if used) must be set at least 2 inches above the highest inlet of the Presby Row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.) See illustration of 2 in. rule below:



11.19 Topographic Position Requirement

The system location must be located in an area that does not concentrate water, both surface and subsurface. If allowed by State and local authorities, altering the terrain upslope of a system may alleviate this requirement if the waters are sufficiently altered to redirect flows away from the field.

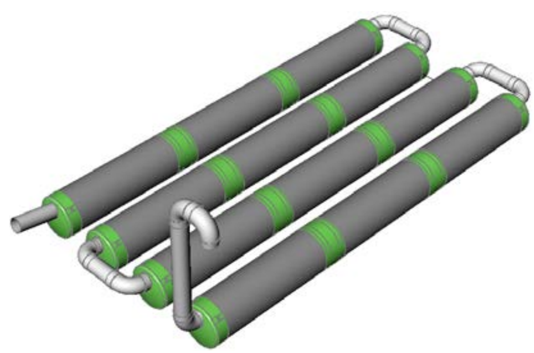
11.20 Water Purification Systems

a) Water purification systems and water softeners should **not** discharge into any Presby System. This "backwash" does not require treatment and the additional flow may overload the system.
b) If there is no alternative means of disposing of this backwash other than in the Presby System, then the system will need to be "oversized." Calculate the total amount of backwash in GPD, multiply by 3, and add this amount to the daily design flow when determining the field and septic tank sizing.
c) Water purification systems and water softeners require regular routine maintenance; consult and follow the manufacturer's maintenance recommendations.

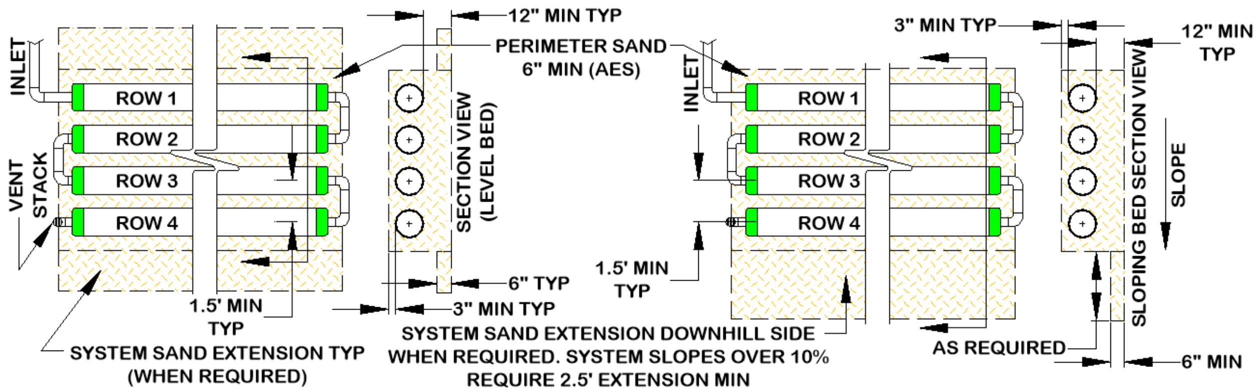
12.0 Basic Serial Distribution (Single Level)

AES rows are connected in series at the ends with raised connections, using offset adapters. Basic Serial distribution systems are quick to develop a strong biomat in the first row, provide a longer flow route, improved effluent treatment and ensure air will pass through all the Presby Rows. Other criteria:

a) May be used for single beds of 750 GPD or less.
b) Incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Flow Equalizers are not required for Basic Serial systems.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
h) Illustrations of Basic Serial Systems:



Level Beds Sloping Beds

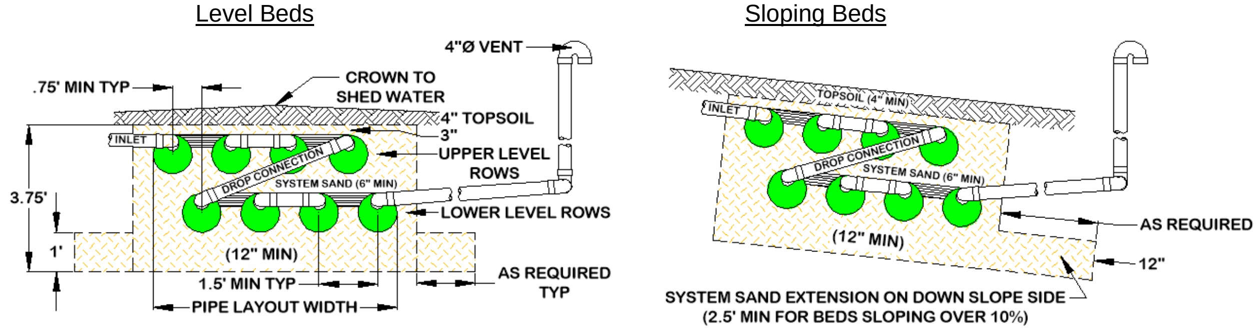


13.0 Basic Serial Distribution (Multi-Level™)

Basic Serial Multi-Level™ systems must conform to the requirements for single level basic serial systems except:

a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) When a System Sand Extension is required, it must be 12 inches thick.
d) A minimum of 6 inches of System Sand separates the Upper and Lower Level Rows.
e) Effluent is delivered first to the Upper Rows, which then connects to the Lower Level Rows by way of a Drop Connection.
f) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
g) Multi-Level™ systems are not allowed in H-20 applications.
h) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
i) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
j) System Sand extensions for Multi-Level™ systems must be 12 inches thick.
k) Illustrations of Multi-Level™ Basic Serial Systems:

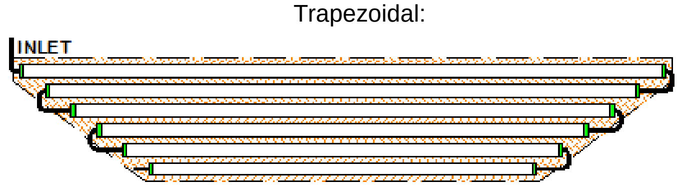
Level Beds Sloping Beds



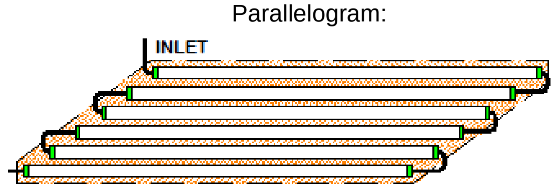
13.1 Basic Serial Configuration with Unusual Shapes:

Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

Trapezoidal:

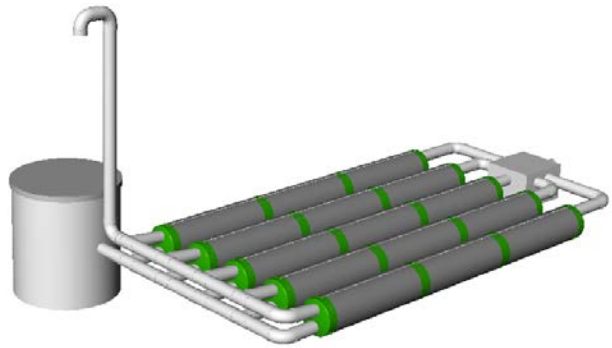


Parallelogram:



14.0 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-box Distribution or Combination Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation. There must be 18 inches from the bottom of the sump to the bottom of the drain. The sump should be brought above the final grade and have a locking or mechanically fastened cover.



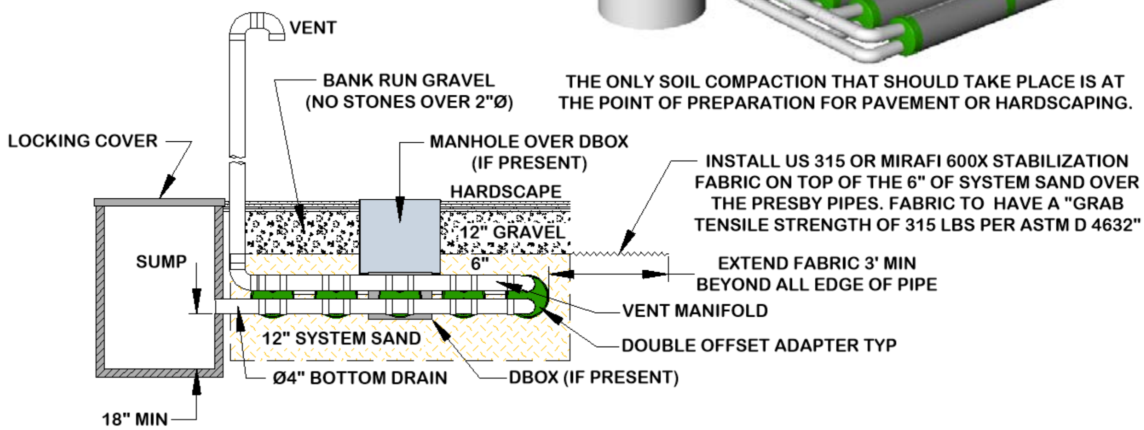
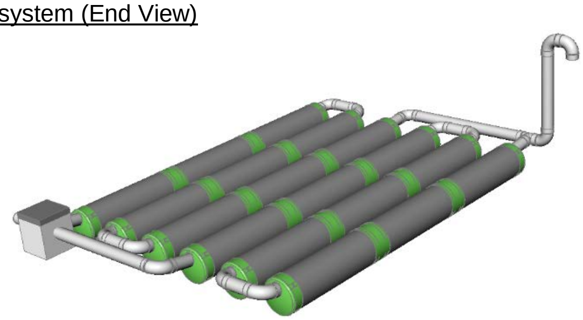


Illustration of a bottom drain used for H-20 system (End View)

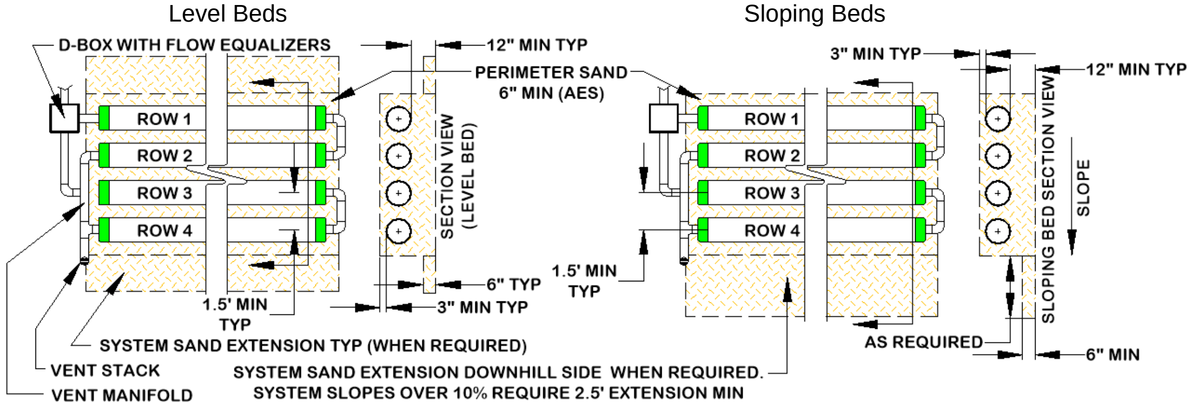
15.0 Combination Serial Distribution (Single Level)

Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 GPD. Combination Serial distribution is quick to develop a strong biomat in the first row of each section, providing improved effluent treatment. Each Combination Serial section is limited to a maximum loading of 750 gallons/day.



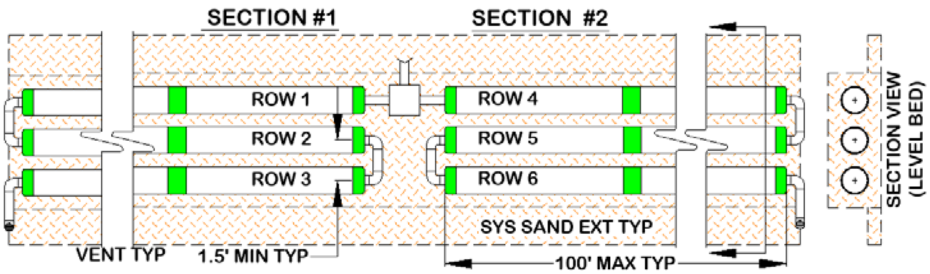
a) Combination Serial distribution consists of two or more serial sections installed in a single bed.
b) Each section in a Combination Serial system consists of a series of Presby Rows connected at the ends with raised connections, using offset adapters and PVC sewer and drain pipe.
c) Maximum length of any row is 100 ft.
d) There is no limit on the number of Combination Serial Sections within a bed.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) When the vent manifold is on the same side as the serial section inlets, the manifold runs over the top of these inlets (as shown below).
h) Combination systems require the use of an adequately sized D-Box.
i) Illustrations of Single Level Combination Serial Systems:

Level Beds | Sloping Beds



15.1 Butterfly Configuration

a) A "butterfly configuration," is considered a single bed system with two or more sections (can also be D-Box or Combination configurations).
b) Maximum length of any row is 100 ft.
c) Serial Section loading limit is 750 GPD.
d) Beds can contain any number of serial sections.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Illustration of a level bed Butterfly configuration (plan view):



15.2 Section Loading

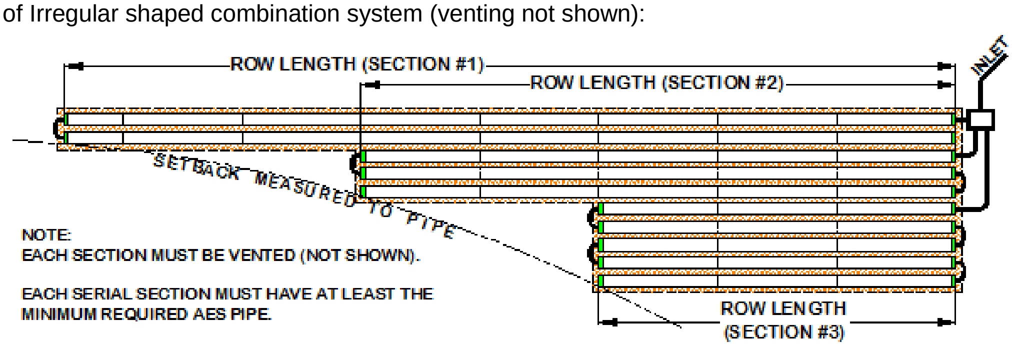
Each section in a Combination Serial system has a maximum daily design flow of 750 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 1,000 GPD requires (1,000 ÷ 750) = 1.4, use 2 sections minimum. Combination systems are only required if the daily design flow exceeds 750 GPD.

15.3 Section Length Requirement

a) Each section must have the same minimum linear feet of pipe.
b) The minimum linear feet of pipe per section is determined by dividing the total linear feet required in the Presby System by the number of sections required.
c) A section may exceed the minimum linear feet required.
d) Rows within a section may vary in length to accommodate site constraints.

15.4 Irregular Shaped Combination Serial Configuration

Illustration of Irregular shaped combination system (venting not shown):



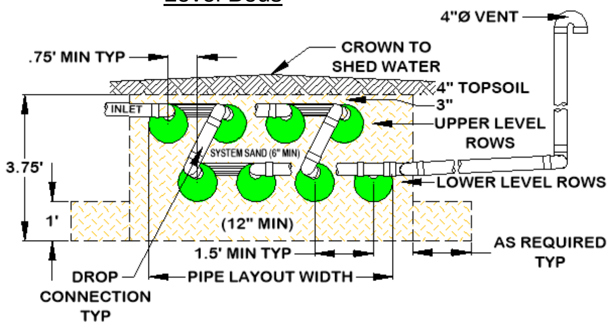
16.0 Combination Serial Distribution (Multi-Level™)

Combination Multi-Level™ systems must conform to the requirements for single level combination systems except:

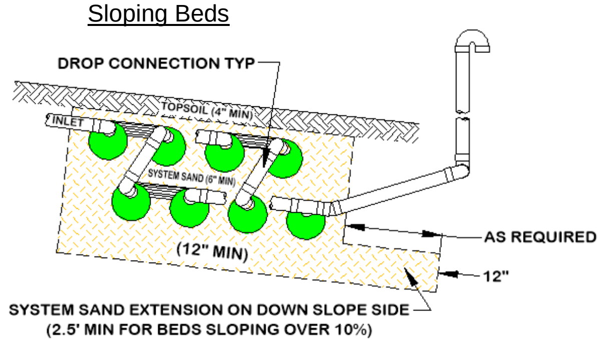
a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) If a System Sand Extension is required, it must be 12 in. thick
d) Effluent must be delivered to the Upper Level Rows from the D-Box. A Drop Connection delivers effluent from the Upper Level rows to the Lower Level rows.
e) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
f) Multi-Level™ systems are not allowed in H-20 applications.
g) The ends of all serial sections on the Lower Level are manifolded and taken to a vent stack. Each serial section may be vented separately.
h) A minimum of 6 in. of System Sand separates the Upper Level Rows from the Lower Level Rows.
i) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
j) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
k) System Sand extensions for Multi-Level™ systems must be 12 inches thick.

l) Illustrations of Multi-Level™ Combination Serial Systems:

Level Beds

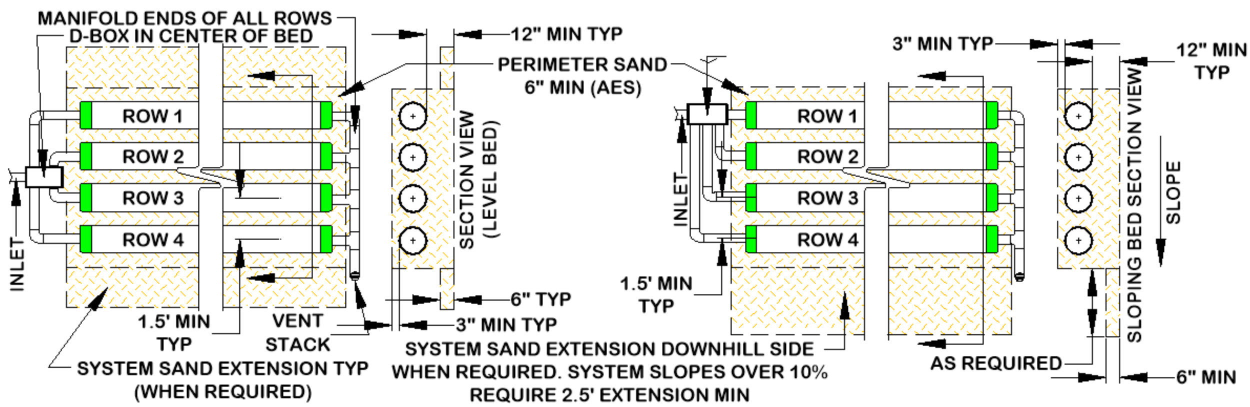


Sloping Beds



17.0 D-Box Distribution (Single Level)

a) All rows in this configuration must be the same length.
b) Flow equalizers must be used in the D-Box.
c) Use a Manifold to connect the ends of all rows. Manifold to be sloped toward Presby Pipes.
d) Maximum row length is 100 ft.
e) Place the D-Box on level, firmly compacted soil.
f) All rows must be laid level end-to-end.
g) A 2-inch minimum drop is required between the D-box outlets and the Presby Pipe inlets.
i) D-Box systems are not recommended for use in Multi-Level™ beds.
j) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
k) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
h) Illustrations for D-Box (Parallel) Distribution:



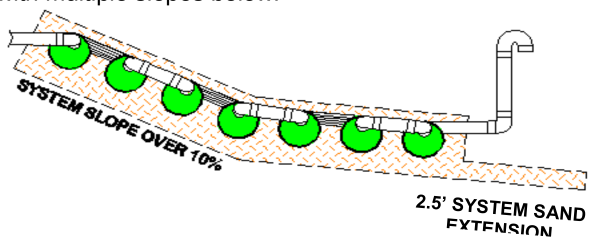
18.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds (Single Level or Multi-Level™), each bed with Basic Serial, Combination Serial, or D-Box distribution, and each receiving an equal amount of effluent from a D-Box. Multiple beds may be oriented along the contour of the site or along the slope of the site.

a) Each bed must have the same minimum linear feet of pipe. The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the Presby System by the number of beds.
b) Rows within a bed may vary in length to accommodate site constraints, except with D-Box configuration which requires all rows to be the same length.
c) End-to-End configurations are preferred to Side-to-Side configurations.
d) In Side-to-Side configuration, one bed is placed beside another or one bed is placed down slope of another. Bed separation distance is measured from pipe-to-pipe and is dependent on soil hydrology and State requirements.
e) Multi-Level™ may be used in multiple bed systems.

18.1 System Sand Extension

In systems where SSBA is greater the PLW + 1' (see para. 8.0, page 6, step #9). In systems sloping more than 10%, a 2.5 ft minimum System Sand extension is required. The System Sand extension area is placed on the down slope side of all sloping systems. For level systems, the System Sand Extension is divided equally and placed on both sides. The System Sand extension area is a minimum of 6 inches deep (12 inches for Multi-Level™ beds). For beds with multiple slopes, if any portion of the bed has a system slope greater than 10% a system sand extension is required. Illustration of bed with multiple slopes below.



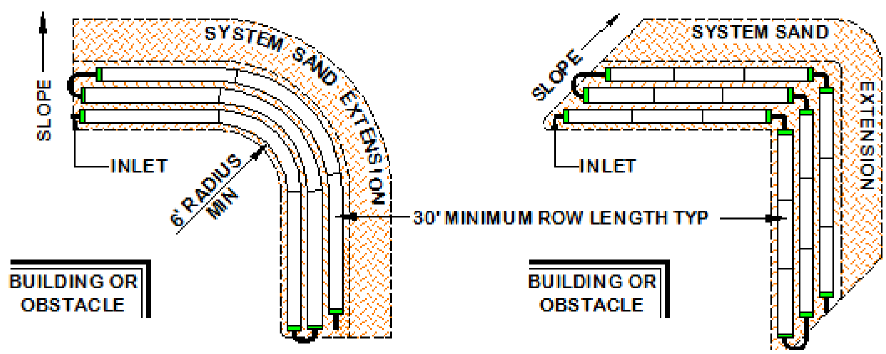
18.2 Total Linear Feet Requirement

a) Maximum row length is 100 ft.
b) Each section or bed must have at least the minimum linear feet of pipe (total feet of pipe required divided by number of sections equals the minimum number of feet required for each section or bed).
c) A section or bed may exceed the minimum linear length.
d) Rows within a section or bed may vary in length (except D-Box configurations) to accommodate site constraints.

19.0 Angled and Curving Beds

Angled configurations are used to avoid obstacles.

a) Rows should follow the contour of the site as much as possible
b) Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters
c) Row lengths are required to be a minimum of 30 ft
d) Multi-Level™ systems may take advantage of angled bed configurations.
e) Illustrations of Angled Beds:

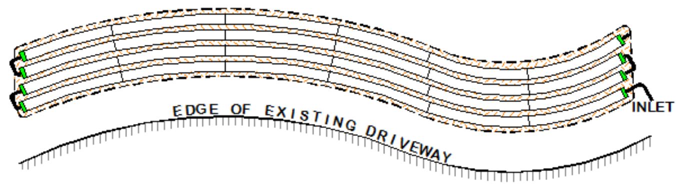


19.1 Trench Systems

Presby pipe may be installed in trench configurations on level or sloping terrain and may utilize serial, combination or parallel distribution. Trench systems may incorporate one or two rows of Presby pipe. A minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above of System Sand are required for all Presby pipes. Consult regulatory rules for required trench separation.

20.0 Curved Beds

Curved configurations work well around structures, setbacks, and slopes. Multiple curves can be used within a system to accommodate various contours of the site.



21.0 Non-Conventional System Configurations

Non-conventional system configurations may have irregular shapes to accommodate site constraints. A site-specific waiver from the state may be required for non-conventional configurations.

22.0 H-20 Loading

If a system is to be installed below an area that will be subjected to vehicular traffic, it must be designed and constructed as depicted below in order to protect the system from compaction and/or damage. Note that a layer of stabilization fabric is added between the System Sand and the cover material. All H-20 systems require venting. See para. 14.0 on page 16 for illustration of H-20 loading requirements.

23.0 Pumped System Requirements
Pumped systems supply effluent to the Presby System using a pump and distribution box when site conditions do not allow for a gravity system. Dosing siphons are also an acceptable means of delivering effluent to the system.

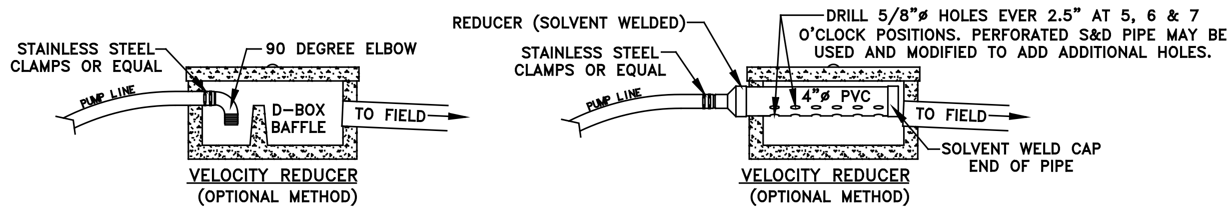
23.1 Alarm
States require all pump systems to have a high-water alarm float or sensor installed inside the pump chamber.

23.2 Differential Venting
All pump systems must use differential venting (see illustration, para. 25.2, page 21).

23.3 Distribution Box
All pump systems require a distribution box with some means of velocity reduction for the effluent entering the D-Box.

23.4 Velocity Reduction
The rate at which effluent enters the Presby Pipe must be controlled. Excessive effluent velocity can disrupt solids that settle in the pipes.

a) Effluent must never be pumped directly into Presby Pipe.
b) A distribution box or tank must be installed between the pumping chamber and the Presby Pipe to reduce effluent velocity.
c) Force mains must discharge into a distribution box (or equivalent) with velocity reducer and a baffle, 90° bend, tee or equivalent (see illustrations on next page).
   Two methods of velocity reduction:



CONCRETE DISTRIBUTION BOX SET ON FIRMLY COMPACTED SOIL & LAID LEVEL. USE OVERSIZED BOX FOR STABILITY. INSTALL EQUALIZERS ON ALL D–BOX OUTLETS

23.5 Dose Volume
a) Pump volume per dose must be no greater than 1 gallon times the total linear feet of Presby Pipe.
b) Pump dosing should be designed for a minimum of 6 cycles per day.
c) If possible, the dosing cycle should provide one hour of drying time between doses.

23.6 Basic Serial Distribution Limit
Pumped systems with Basic Serial distribution are limited to a maximum dose rate of 40 gallons per minute and do not require the use of a flow equalizer on the D-Box outlet. Never pump directly into Presby Pipe.

23.7 Combination and Multiple-Bed Distribution Limit
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. Each Bed or section of Combination Serial distribution is limited to a maximum of 15 gallons per minute, due to the flow constraints of the equalizers. Example: pumping to a combination system with 3 sections (using 3 D-Box outlets). The maximum delivery rate is (3 x 15) = 45 GPM. Always provide a means of velocity reduction.

24.0 System Sand and Sand Fill Requirements for All Beds
It is critical to the proper functioning of Presby Systems that the proper amount and type of System Sand be installed.

24.1 Quantity of System Sand
System Sand is placed a minimum of 12 in. below, 3 in. above and 6 in. between the Presby Rows and a minimum of 6 in. horizontally around the perimeter of the Advanced Enviro-Septic® rows.

24.2 Sand Fill
Sand fill meeting state and local requirements is used to raise the elevation of the system in order to meet the required separation distance from the SHWT or other restrictive feature. No organic material or stones larger than 6 in. are allowed in the Sand Fill. System Sand may be used in place of sand fill; however, this may increase material costs.

25.0 Venting Requirements
An adequate air supply is essential to the proper functioning of Presby Systems. Venting is always required. Including the following requirements:

a) Pump systems must utilize Differential Venting.

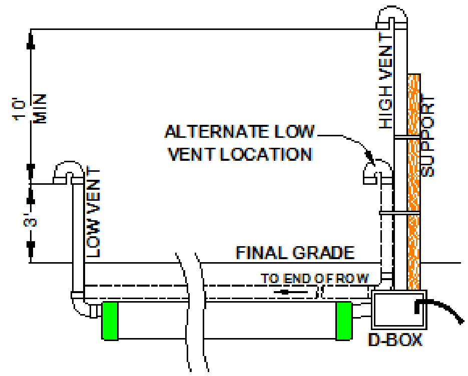
b) Vents for Multi-Level™ beds must connect to the lower level rows.

25.1 General Rules

a) Vent openings must be located to ensure the unobstructed flow of air through the entire Presby System.
b) The low vent inlet must be a minimum of 1 ft above final grade or anticipated snow level.
c) One 4 in. vent is required for every 1,000 ft of Presby Pipe.
d) A single 6 in. vent may be installed in place of up to three 4 in. vents.
e) If a vent manifold is used, it must be at least the same diameter as the vent(s).
f) When venting multiple beds, it is preferred that each bed be vented separately rather than manifolding bed vents together.
g) Sch. 40 PVC or equivalent should be used for all vent stacks.
h) Remote Venting may be utilized to minimize the visibility of vent stacks.

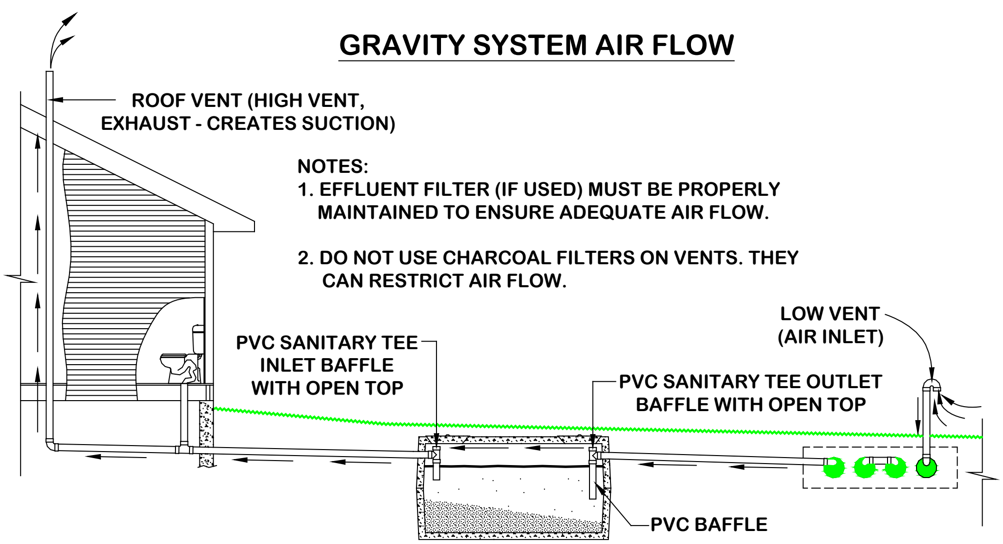
25.2 Differential Venting

a) Differential venting is the use of high and low vents in a system.
b) In a gravity system, the roof stack acts as the high vent.
c) High and low vent openings must be separated by a minimum of 10 vertical feet.
d) If possible, the high and low vents should be of the same capacity.



25.3 Vent Locations for Gravity Systems

a) A low vent is installed at the end of the last row of each section or the end of the last row in a Basic Serial bed, or at the end of each row in a D-Box Distribution Configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
b) The house (roof) vent functions as the high vent as long as there are no restrictions or other vents between the low vent and the house (roof) vent.
c) When the house (roof) vent functions as the high vent, there must be a minimum of a 10 ft vertical differential between the low and high (roof) vent openings.
d) Illustration of gravity system air flow:



VENTING IS ESTABLISHED THROUGH SUCTION (CHIMNEY EFFECT) CREATED BY THE DRAW OF AIR FROM THE HIGH VENT, WHICH DRAWS AIR INTO THE LOW VENT AT THE LEACH FIELD THEN THROUGH THE SEPTIC TANK AND EXHAUSTED THROUGH THE (HIGH) ROOF VENT.

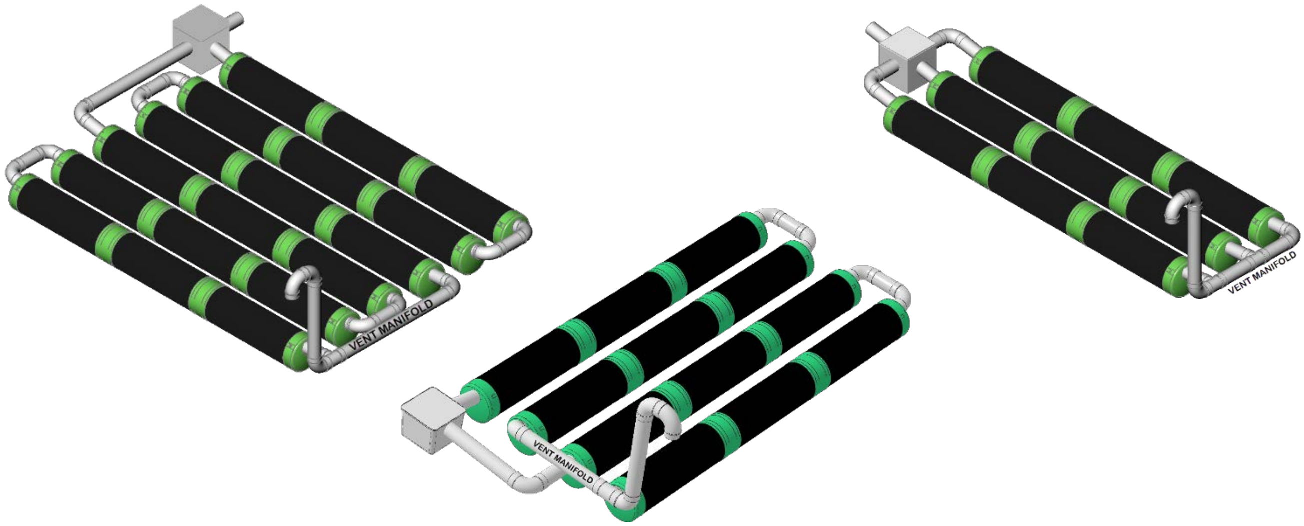
25.4 Pump System Vent Locations

a) A low vent is installed through an offset adapter at the end of each section, Basic Serial bed or attached to a vent manifold.
b) A high vent is attached to an unused distribution box outlet.
c) A 10 ft minimum vertical differential is required between high and low vent openings.
d) When venting multiple beds, it is preferred that each bed be vented separately (have their own high and low vents) rather than manifolding bed vents together.

e) The Low and High vents may be swapped proved the distribution box is insulated against freezing in cold climates.
f) See Remote Venting (para. 25.7, page 22) and Bypass Venting (para. 25.8, page 23) for options to relocate or eliminate the High Vent.

25.5 Vent Manifolds

A vent manifold may be incorporated to connect the ends of a number of sections or rows of Presby Pipe to a single vent opening. Slope the lines connecting the manifold to the Presby pipes to drain condensation. See diagrams below:



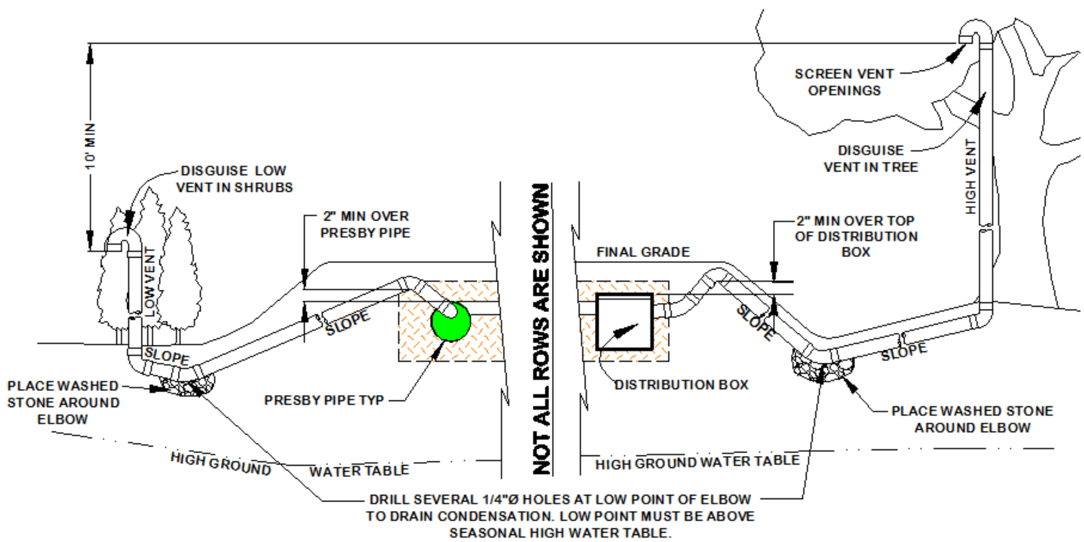
25.6 Vent Piping Slope

Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.

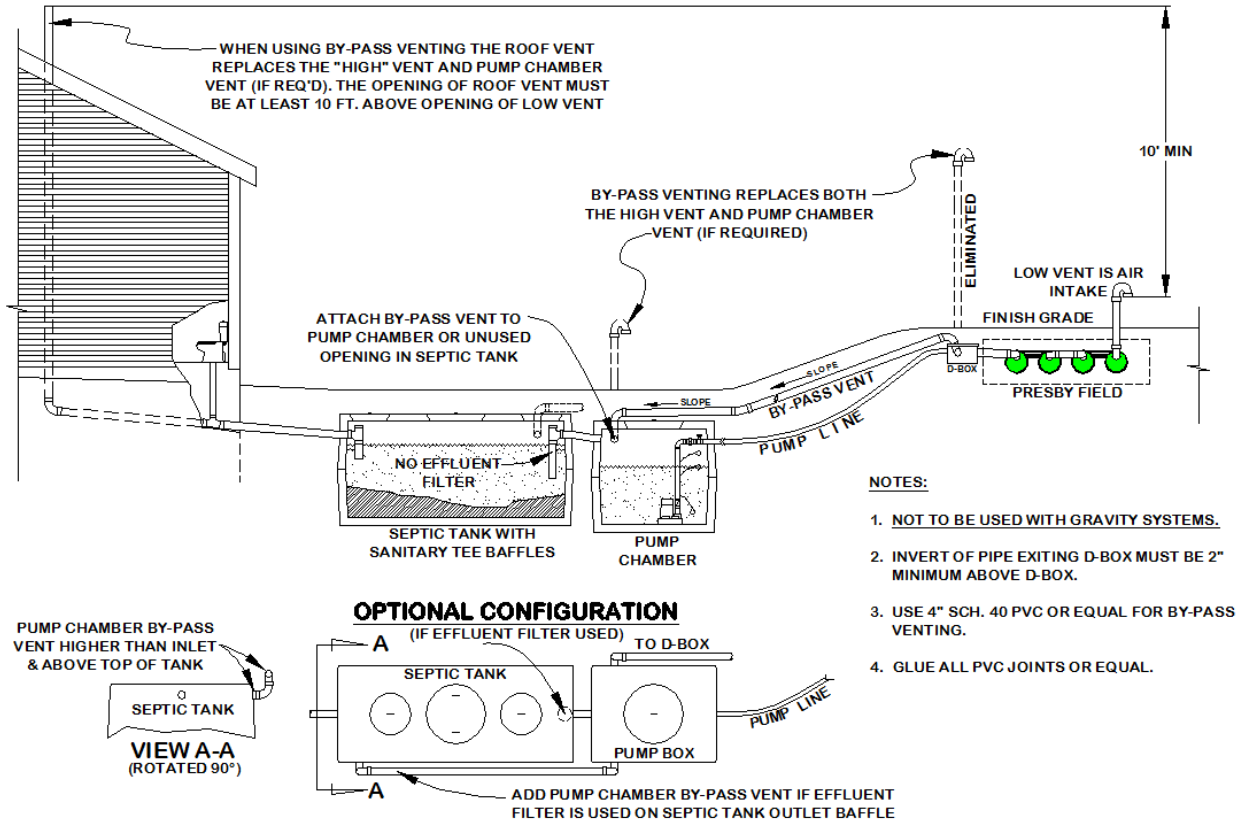
25.7 Remote Venting

If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in. holes to allow drainage of condensation. This procedure may only be used if the vent pipe connecting to the system has:

a) A **high point** that is above the highest point of all Presby Pipes or the Distribution Box; and,
b) A **low point** opened for drainage which is above the SHWT. (See diagram below.)



25.8 By-Pass Venting



26.0 Site Selection

26.1 Determining Site Suitability
Refer to State or local rules regarding site suitability requirements.

26.2 Topography
Locate systems on convex, hill, slope or level locations that do not concentrate surface flows. Avoid swales, low areas, or toe-of-slope areas that may not provide sufficient drainage away from the system.

26.3 Surface Water Diversions
Surface water runoff must be diverted away from the system. Diversions must be provided up-slope of the system and designed to avoid ponding. Systems must not be located in areas where surface or groundwater flows are concentrated.

26.4 Containment
Systems should not be located where structures such as curbs, walls or foundations might adversely restrict the soil's ability to transport water away from the system.

26.5 Hydraulic loading
Systems should not be located where lawn irrigation, roof drains, or natural flows increase water loading to the soils around the system.

26.6 Access
Systems should be located to allow access for septic tank maintenance and to at least one end of all Presby Rows. Planning for future access will facilitate rejuvenation in the unlikely event the system malfunctions.

26.7 Rocky or Wooded Areas
Avoid locating systems in rocky or wooded areas that require additional site work, since this may alter the soil's ability to accept water. No trees or shrubs should be located within 10 ft of the system to prevent root infiltration.

26.8 Replacement System
In the event of system malfunction, contact PEI for technical assistance prior to attempting Rejuvenation procedures. In the unlikely event that a Presby System needs to be replaced …

a) It can be reinstalled in the same location, eliminating the need for a replacement field reserve area.

b) All unsuitable material must be removed prior to replacement system construction.
c) Disposal of hazardous materials to be in accordance with State and local requirements.
d) Permits may be required for system replacement; contact the appropriate local or state agency.

27.0 Installation Requirements, Component Handling and Site Preparation

27.1 Component Handling

a) Keep mud, grease, oil, etc. away from all components.
b) Avoid dragging pipe through wet or muddy areas.
c) Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
d) The outer fabric of the Presby Pipe is ultra-violet stabilized; however, this protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp if stored outdoors.

27.2 Critical Reminder to Prevent Soil Compaction

It is critical to keep excavators, backhoes, and other equipment off the excavated or tilled surface of a bed. Before installing the System Sand, excavation equipment should be operated around the bed perimeter; not on the bed itself.

27.3 Site Preparation Prior to Excavation

a) Locate and stake out the System Sand bed, extension areas and soil material cover extensions on the site according to the approved plan.
b) Install sediment/erosion control barriers prior to beginning excavation to protect the system from surface water flows during construction.
c) Do not travel across or locate excavation equipment within the portion of the site receiving System Sand.
d) Do not stockpile materials or equipment within the portion of the site receiving System Sand.
e) It is especially important to avoid using construction equipment down slope of the system to prevent soil compaction.

27.4 When to Excavate

a) Do not work wet or frozen soils. If a fragment of soil from about 9 inches below the surface can easily be rolled into a wire, the soil moisture content is too high for construction.
b) Do not excavate the system area immediately after, during or before precipitation.

27.5 Tree Stumps

Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical “thumb” or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance.

a) Do not locate equipment within the limits of the System Sand bed.
b) Avoid soil disturbance, relocation, or compaction.
c) Avoid mechanical leveling or tamping of dislodged soil.
d) Fill all voids created by stump or root removal with System Sand.

27.6 Organic Material Removal

Before tilling, remove all grass, leaves, sticks, brush and other organic matter or debris from the excavated system site. It is not necessary for the soil of the system site to be smooth when the site is prepared.

27.7 Raking and Tilling Procedures

All areas receiving System Sand, sand fill and fill extensions **must** be raked or tilled. If a backhoe/excavator is used to till the site, fit it with chisel teeth and till the site. The backhoe/excavator must remain outside of the proposed System Sand area and extensions. For elevated bed systems remove the “A” horizon (topsoil), then use an excavator or backhoe to rake furrows 2 inches – 6 inches deep into the receiving area.

27.8 Install System Sand and/or Sand Fill Immediately After Excavation

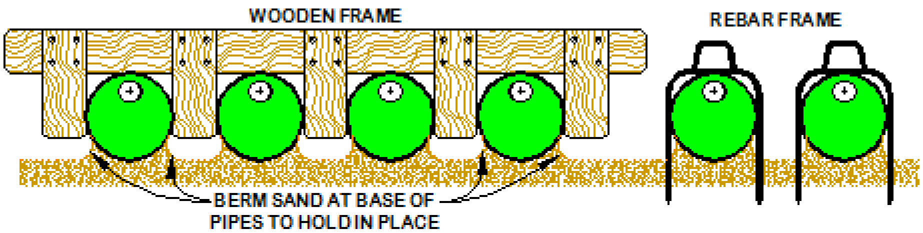
a) To protect the tilled area (System Sand bed area and System Sand extension area) from damage by precipitation, System Sand should be installed immediately after tilling.
b) Work off either end or the uphill side of the system to avoid compacting soil.
c) Keep at least 6 in. of sand between the vehicle tracks and the tilled soil of the site if equipment must work on receiving soil.
d) Track construction equipment should not travel over the installed system area until at least 12 inches of cover material is placed over the Presby Pipes.
e) Heavy equipment with tires must never enter the receiving area due to likely wheel compaction of underlying soil structures.

27.9 Distribution Box Installation
To prevent movement, be sure D-boxes are placed level on compacted soil, sand, pea gravel base, or concrete pad.

27.10 Level Row Tolerances
Use a laser level or transit to install rows level. Variations beyond 1 in. (±1/2") may affect system performance and are not acceptable.

27.11 Correct Alignment of Advanced Enviro-Septic® Bio-Accelerator® Fabric
The Bio-Accelerator® (white geo-textile fabric) is to be positioned centered along the bottom of the pipe rows (sewn seam up).

27.12 Row Spacers
System Sand may be used to keep pipe in place while covering, but simple tools may also be constructed for this purpose. Two examples are shown. One is made from rebar, the other from wood. Center-to-center row spacing may be larger than specified by this manual. Caution: Remove all tools used as row spacers before final covering.



27.13 Connect Rows Using Raised Connections
Raised connections consist of offset adapters, 4 in. PVC sewer and drain pipe, and 90° elbows. They enable greater liquid storage capacity and increase the bacterial surfaces being developed. Use raised connections to connect the rows of the Presby System (see para. 3.7 page 4). Glue or mechanically fasten all pipe connections.

27.14 Backfilling Rows

a) Spread System Sand between the rows.
b) Confirm pipe rows are positioned with Bio-Accelerator® along the bottom (sewn seam up).
c) Straddle each row of pipe and walk heel-to-toe its entire length, ensuring that System Sand fills all void spaces beneath the Presby Pipe.
d) Finish spreading System Sand to the top of the rows and leave them exposed for inspection purposes.

27.15 Backfilling and Final Grading
Spread System Sand to a minimum of 3 inches over the pipe and a minimum of 6 inches beyond Presby Pipes on all four sides beyond the Presby Pipes. Spread soil material free of organics, stones over 4 inches and building debris, having a texture similar to the soil at the site, without causing compaction. Construction equipment should not travel over the installed system area until at least 12 inches of cover material is placed over the Presby Pipes (H-10 Loading). 18 inches of cover material over the Presby System is required for H-20 loading (see para. 22.0, page 19).

27.16 System Soil Cover Material
A minimum of 4 inches of suitable earth cover (topsoil or loam), with a texture similar to the soil at the site and capable of sustaining plant growth, must be placed above the installed system.

27.17 Erosion Control
To prevent erosion, soil cover above the system shall be planted with native, shallow-rooted vegetation such as grass, wildflowers and certain perennials or ground covers.

27.18 Trees and Shrubs
It is recommended that no trees or shrubs be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

28.0 System Bacteria Rejuvenation and Expansion
This section covers procedures for bacteria rejuvenation and explains how to expand existing systems.
Note: Presby Environmental, Inc. must be contacted for technical assistance prior to attempting rejuvenation procedures.

28.1 Why would System Bacteria Rejuvenation be needed?
Bacteria rejuvenation is the return of bacteria to an aerobic state. Flooding, improper venting, alteration or improper depth of soil material cover, use of incorrect sand, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to converting bacteria in any system from an aerobic to an anaerobic

state. This conversion severely limits the bacteria's ability to effectively treat effluent, as well as limiting liquids from passing through. A unique feature of the Presby System is its ability to be rejuvenated in place.

28.2 How to Rejuvenate System Bacteria

System bacteria are "rejuvenated" when they return to an aerobic state. By using the following procedure, this can be accomplished in most Presby Systems without costly removal and replacement.

1. Contact Presby Environmental before attempting Rejuvenation for technical assistance.
2. Determine and rectify the problem(s) causing the bacteria conversion.
3. Drain the system by excavating one end of all the rows and removing the offset adapters.
4. If foreign matter has entered the system, flush the pipes.
5. Safeguard the open excavation.
6. Guarantee a passage of air through the system.
7. Allow all rows to dry for 72 hours minimum. The System Sand should return to its natural color.
8. Re-assemble the system to its original design configuration. As long as there is no physical damage to the Presby components, the original components may be reused.

29.0 System Expansion

Presby Systems are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections. All system expansions must comply with State and local regulations. Permits may be required prior to system expansion.

29.1 Reusable Components

Presby Pipe and components are not biodegradable and may be reused. In cases of improper installation, it may be possible to excavate, clean, and reinstall all system components.

30.0 Operation & Maintenance

30.1 Proper Use

Presby Systems require minimal maintenance, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will guarantee system longevity. We encourage all system owners and service providers to obtain and review a copy of our Owner's Manual, available from our website www.PresbyEnvironmental.com or via mail upon request to (800) 473-5298 or info@presbyeco.com.

30.2 System Abuse Conditions

The following conditions constitute system abuse:

a) Liquid in high volume (excessive number of occupants and use of water in a short period of time, leaking fixtures, whirlpool tubs, hot tubs, water softening equipment or additional water discharging fixtures if not specified in system design).
b) Solids in high volume (excessive number of occupants, paper products, personal hygiene products, garbage disposals or water softening equipment if not specified in system design)
c) Antibiotics and medicines in high concentrations
d) Cleaning products in high concentrations
e) Fertilizers or other caustic chemicals in any amount
f) Petroleum products in any amount
g) Latex and oil paints
h) System suffocation (compacted soils, barrier materials, etc.) without proper venting

<u>Note</u>: PEI and most regulatory agencies do not recommend the use of septic system additives.

30.3 System Maintenance/Pumping of the Septic Tank

a) Inspect the septic tank at least once every two years under normal usage.
b) Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
c) If a garbage disposal is used, the septic tank will likely require more frequent pumping.
d) After pumping, inspect the septic tank for integrity to ensure that no groundwater is entering it. Also, check the integrity of the tank inlet and outlet baffles and repair if needed.
e) Inspect the system to ensure that vents are in place and free of obstructions.
f) Effluent filters require ongoing maintenance due to their tendency to clog and cut off oxygen to the System. Follow filter manufacturer's maintenance instructions and inspect filters frequently.

30.4 Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation, including the entire System Sand bed area, and areas impacted by side slope tapering and perimeter drains (if used). Roots can infiltrate and cause damage or clogging of system components. If a perimeter drain is used, it is important to make sure that the outfall pipes are screened to prevent animal activity. Also, check outfall pipes regularly to ensure that they are not obstructed in any way.

31.0 Glossary

This Manual contains terminology which is common to the industry and terms that are unique to Presby Systems. While alternative definitions may exist, this section defines how these terms are used in this Manual.

31.1 Advanced Enviro-Septic® (AES) Pipe

A single unit comprised of corrugated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. Each unit is 10 ft in length, with an outside diameter of 12 in. and a storage capacity of approximately 58 gallons. Each foot of Advanced Enviro-Septic® provides over 40 sq ft of total surface area for bacterial activity. The sewn seam is always oriented up (12 o'clock position) within the bed. A white tag is sewn into the seam indicating the product is Advanced Enviro-Septic® pipe. Pipes are joined together with couplings to form rows. Advanced Enviro-Septic® is a combined wastewater treatment and dispersal system.

31.2 Basic Serial Distribution

Basic Serial distribution incorporates Presby Rows in serial distribution in a single bed (see Basic Serial Distribution in para. 12.0, page 14).

31.3 Bio-Accelerator®

Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable. Bio-Accelerator® is only available with Advanced Enviro-Septic®.

31.4 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-Box Distribution Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation (see illustration in para. 14.0, page 16).

31.5 Butterfly Configuration

A variation of a standard, single bed system with the D-box located in the center, with rows oriented symmetrically on either side, and with each side or section receiving an equal volume of flow from the D-Box. See Butterfly Configuration (see para. 15.1, page 17).

31.6 Center-to-Center Row Spacing

The distance from the center of one Presby Row to the center of the adjacent row.

31.7 Coarse Randomized Fiber

A mat of coarse, randomly-oriented fibers which separates more suspended solids from the effluent protecting the bacterial surface in the geo-textile fabric (see illustration in para. 2.0, page 2).

31.8 Combination Serial Distribution

Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 750 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 750 GPD or less. See Combination Serial Distribution, para. 15.0, on page 16.

31.9 Cooling Ridges

Pipe ridges that allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling (see illustration in para. 2.0, page 2).

31.10 Coupling

A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.3.3, page 3).

31.11 Daily Design Flow

The peak daily flow of wastewater to a system, expressed in gallons per day (GPD); systems are typically sized based on the daily design flow. Design flow calculations are set forth in the State Rules. In general, actual daily use is expected to be one-half to two-thirds less than "daily design flow."

31.12 Differential Venting

A method of venting a Presby System utilizing high and low vents (see para. 25.2, page 21).

31.13 Distribution Box or "D-Box"
A device designed to divide and distribute effluent from the septic tank equally to each of the outlet pipes that carry effluent into the Presby System. D-Boxes are also used for velocity reduction, see Velocity Reduction, para. 23.4, page 20.

31.14 Drop Connection (Multi-Level™ Systems)
A drop connection is a PVC Sewer & Drain pipe configuration which is used to connect upper level rows to lower level rows in a Multi-Level™ bed. Drop connections extend 2 in. to 4 in. into the pipe and are installed with at least 2 in. of drop from the upper level row to the lower level row. All PVC joints should be glued or mechanically fastened.

31.15 D-Box Distribution Configuration
A design in which each Presby Row receives effluent from a distribution box outlet. Such a system is also called a "parallel system" or a "finger system." See D-Box (Parallel) Distribution, para. 17.0, page 18.

31.16 End-to-End Configuration
Consists of two or more beds constructed in a line (i.e., aligned along the width of the beds).

31.17 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet.

31.18 GPD and GPM
An acronym for <u>G</u>allons <u>p</u>er <u>D</u>ay and <u>G</u>allons <u>p</u>er <u>M</u>inute respectively.

31.19 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 25.0, page 20.

31.20 High Strength Effluent
High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (BOD5) and total suspended solids (TSS) in excess of two-hundred and forty (240) mg/L.

31.21 Manifolded Splitter Box
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 3.6, on page 3.

31.22 Multi-Level™
A Multi-Level™ System is a patented process using Presby Pipe; it consists of essentially two Presby Systems installed in the same bed with one system on top of another with 6 in. of System Sand between the two levels. Multi-Level Systems are limited to soils with a Soil Application rate of 0.6 GDP/ft^2 and greater.

31.23 Multiple Bed Distribution
Incorporates two or more beds, each bed with Basic Serial, Combination Serial, or D-Box distribution and receiving effluent from a distribution box (see para. 18.0, page 18).

31.24 Non-Conventional Configurations
Have irregular shapes or row lengths shorter than 30 ft to accommodate site constraints (see para. 13.1, page 15).

31.25 Offset Adapter
A plastic fitting with a 4-inch hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 3.2, page 3).

31.26 Pressure Distribution
A pressurized, small-diameter pipe system used to deliver effluent to an absorption field. Pressure Distribution is not permitted to be used with the Presby System. Presby Systems are designed to promote even distribution without the need for pressure distribution.

31.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 23.0, page 20).

31.28 Raised Connection
A U-shaped, 4" diameter, PVC pipe configuration which is used to connect rows oriented in a serial configuration and to maintain the proper liquid level inside each row. See drawing in para. 3.8, page 4.

31.29 Raking and Tilling
Refers to methods of preparing the native soil that will be covered with System Sand or Sand Fill, creating a transitional layer between the sand and the soil. See Installation Requirements para. 27.7, page 24.

31.30 Row
Consists of a number of Presby Pipe sections connected by couplings with an Offset Adapter on the inlet end and an Offset Adapter or End Cap on the opposite end. Rows are typically between 30 ft and 100 ft long (see Row Requirements in para. 11.14, page 12).

31.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 24.2, page 20. Sand fill is used to raise the elevation of the system to meet required separation distance or in side slope tapers. System Sand may be used in place of Sand Fill.

31.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 750 GPD daily design flow maximum.

31.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in sections 12.0 on page 14. Combination Serial distribution is described in detail in paragraphs 15.0 and 16.0, pages 16 and 17.

31.34 Skimmer Tabs
Projections into the AES pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

31.35 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another.

31.36 Slope (3:1)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. Example: A slope with a grade of (3:1) is the difference in horizontal distance of two (3) horizontal feet (run) over an elevation difference of one (1) ft (rise).

31.37 Slope (%)
Expressed as a **percent**, is the difference in elevation divided by the difference in horizontal distance between two points on the surface of a landform. Example: A site slope of one (1) percent is the difference in elevation of one (1) foot (rise) over a horizontal distance of one hundred (100) feet (run).

31.38 Smearing
The mechanical sealing of soil air spaces along an excavated, tilled or compressed surface. This is also referred to as "compacting." In all installations, it is critical to avoid smearing or compacting the soils under and around the field.

31.39 Surface Diversion
A natural or manmade barrier that changes the course of water flow around an onsite system's soil absorption field.

31.40 System Sand Bed
System Sand area required/used in Presby Systems. The System Sand bed extends a minimum of 12-inches below, 3-inches above and 6-inches horizontally from the outside edges of the Presby Pipes.

31.41 System Sand
System Sand must be clean, granular sand free of organic matter and must adhere to the Presby System Sand Specification with no more than 3% passing the #200 sieve (see complete details in para. 3.10 on page 4).

31.42 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep for Single Level systems and 12 in. deep for Multi-Level systems. The System Sand extension is placed on the down slope side of sloping systems. System sloping more than 10% require a 2.5 ft minimum extension. The System Sand extension is measured from the tall portion of the System Sand bed (see illustration in para. 18.1, page 19).

31.43 Topsoil (a.k.a. Loam or Soil Cover Material)
Topsoil, also known as Loam, is soil material cover capable of sustaining plant growth which forms the topmost layer of cover material above the system.

31.44 Velocity Reducer
Velocity reducer refers to any of the various components whose purpose is to reduce the velocity of effluent flow into the Presby Pipes. A distribution box with a baffle or inlet tee is sufficient for velocity reduction in most systems (see illustration in para. 23.4, page 20).

WASTEWATER TECHNOLOGY

NSF/ANSI Standard 40 - *Residential Wastewater Treatment Systems*

Final Report:

Presby Environmental Inc.
Simple Septic SS-SPD-450
13/09/055/0030

NSF International
789 N. Dixboro Road
PO Box 130140
Ann Arbor, Michigan 48113-0140 USA

Evaluation Report:
Presby Environmental Inc. SS-SPD-450
Wastewater Treatment System

Under the provisions of NSF/ANSI Standard 40
Residential Wastewater Treatment Systems

October 2015

EXECUTIVE SUMMARY

Testing of the Presby Environmental Simple Septic SS-SPD-450 was conducted under the provisions of NSF/ANSI Standard 40 for Residential Wastewater Treatment Systems (April 2013 revision). NSF/ANSI Standard 40 was developed by the NSF Joint Committee on Wastewater Technology.

The performance evaluation was conducted at the Massachusetts Alternative Septic System Test Center (MASSTC) located at Otis Air National Guard Base in Bourne, Massachusetts. Sanitary sewage from the base residential housing was used for the testing. The evaluation consisted of sixteen weeks of dosing at design flow, seven and one half weeks of stress testing and an additional two and one half weeks of dosing at design flow. Dosing was initiated on July 28, 2013 and the test was officially started on July 28, 2013. Sampling started in the summer and continued through the fall and winter, covering a range of operating temperatures.

Over the course of the evaluation, the average effluent $CBOD_5$ was 11 mg/L, ranging between 2 and 50 mg/L, and the average effluent total suspended solids was 7 mg/L, ranging between 2 mg/L and 18 mg/L.

The Simple Septic SS-SPD-450 produced an effluent that successfully met the performance requirements established by NSF/ANSI Standard 40 for Class I effluent:

> The maximum 7-day arithmetic mean was 28 mg/L for $CBOD_5$ and 13 mg/L for total suspended solids, both below the allowed maximums of 40 and 45 mg/L, respectively. The maximum 30-day arithmetic mean was 17 mg/L for $CBOD_5$ and 10 mg/L for total suspended solids, both below the allowed maximums of 25 mg/L and 30 mg/L, respectively.

The effluent pH during the evaluation ranged between 6.0 and 7.4, within the required range of 6.0 to 9.0. The Simple Septic SS-SPD-450 met the requirements for noise levels (less than 60 dbA at a distance of 20 feet), color, threshold odor, oily film and foam.

PREFACE

Performance evaluation of residential wastewater treatment systems is achieved within the provisions of NSF/ANSI Standard 40: *Residential Wastewater Treatment Systems* (revised April 2013), prepared by the NSF Joint Committee on Wastewater Technology and adopted by the NSF Board of Trustees.

Conformance with the Standard is recognized by issuance of the NSF Mark. This is not to be construed as an approval of the equipment, but a certification of the data provided by the test and an indication of compliance with the requirements expressed in the Standard.

Plants conforming to Standard 40 are classified as Class I or Class II plants according to the quality of effluent produced by the plant during the performance evaluation. Class I plants must meet the requirements of EPA Secondary Treatment Guidelines[1] for five day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS) and pH. Class I plants must also demonstrate performance consistent with the effluent color, odor, oily film and foam requirements of the Standard. Class II plant effluent must have no more than 1% of samples exceeding 60 mg/L $CBOD_5$ and 100 mg/L TSS.

Permission to use the NSF Mark is granted only after the equipment has been tested and found to perform satisfactorily, and all other requirements of the Standard have been satisfied. Continued use of the Mark is dependent upon evidence of compliance with the Standard and NSF General and Program Specific Policies, as determined by periodic reinspection of the equipment at the factory, distributors and reports from the field.

NSF Standard 40 requires the testing laboratory to provide the manufacturer of a residential wastewater treatment system a report including significant data and appropriate commentary relative to the performance evaluation of the plant. NSF policy specifies provision of performance evaluation reports to appropriate state regulatory agencies at publication. Subsequent direct distribution of the report by NSF is made only at the specific request of or by permission of the manufacturer.

The following report contains results of the entire testing program, a description of the plant, its operation and key process control equipment, and a narrative summary of the test program, including test location, procedures and significant occurrences. The plant represented herein reflects the equipment authorized to bear the NSF Mark.

CERTIFICATION

NSF International has determined by performance evaluation under the provisions of NSF/ANSI Standard 40 (revised April 2013) that the Simple Septic SS-SPD-450 manufactured by Presby Environmental Inc. has fulfilled the requirements of NSF/ANSI Standard 40. The Simple Septic SS-SPD-450 has therefore been authorized to bear the NSF Mark so long as Presby Environmental Continues to meet the requirements of Standard 40 and NSF General and Program Specific Policies.

General performance evaluation and stress tests were performed at the Wastewater Technology Site located at the Massachusetts Alternative Septic System Test Center located at Otis Air National Guard Base in Bourne, Massachusetts. The raw wastewater used in the test was sanitary sewage from the base residential housing. The characteristics of the wastewater during the test are included in the tabulated data of this report.

The observations and analyses included in this report are certified to be correct and true copies of the data secured during the performance tests conducted by NSF on the wastewater treatment system described herein. The manufacturer has agreed to present the data in this certification in its entirety whenever it is used in advertising, prospectuses, bids or similar uses.

Thomas J. Bruursema
General Manager
Wastewater Treatment Unit Certification

Thomas Stevens
Technical Manager
Federal Programs

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1.0 PROCESS DESCRIPTION

The Simple-Septic® Treatment System is designed to treat residential effluent that has received primary treatment in a septic tank. The system consists of a high-density plastic pipe which is ridged and perforated with skimmer tabs extending inwardly from each perforation. A layer of geo-textile fabric surrounds the circumference and is stitched in place. The finished product is 12 in. in diameter. By utilizing simple yet effective natural processes, the Presby Treatment System treats septic tank effluent in a manner that prevents suspended solids from sealing the underlying soil, increases system aeration, and provides a greater bacterial treatment area ("biomat") than traditional systems. The Presby Treatment System retains solids in its pipe and provides multiple bacterial surfaces to treat effluent prior to its contact with the soil. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. The patented Simple-Septic® pipe cools the liquid, separating and retaining the solids and grease inside the pipes. Perforations allow the liquid to pass through the pipes, while skimmer tabs retain solids within the pipe. Next the wastewater passes through the outer layer of geo-textile fabric. The Simple-Septic® pipes are surrounded by a bed of specified System Sand, which facilitates the process by wicking the treated liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria. The treated wastewater percolates through the System Sand and is then released into the underlying soil (CTD "combined treatment and dispersal" [bottomless] Model). Simple-Septic® pipe is a single layer geo-textile fabric distribution system after primary treatment by a septic tank.

2.0 PERFORMANCE EVALUATION

2.1 Description of Plant Evaluated

The Presby Environmental, Inc. Simple-Septic® 450 model was evaluated at 450 gallons per day. The model includes a 1,000 gallon single compartment plastic septic tank, 4" diameter PVC, Sched. 35 or Sch. 40 PVC pipe, single offset adapters, couplings, Simple-Septic® leach field which included the design area, System Sand, and Simple-Septic® conduit.

The wastewater exits the septic tank and flows into the Simple-Septic® system by gravity through a 4" PVC pipe and moves into the first row of Simple-Septic® pipe. The wastewater moves through the series of rows using serial distribution, thus the effluent from the first row passes into the second row and so on by a raised connection made of Sch. 35 or Sch. 40 PVC pipe that is inserted into the offset adapter on each end of the Simple-Septic rows. The wastewater is distributed through the five (5) rows by way of the successive raised connection between each row of Simple-Septic pipe.

The Simple-Septic® 450 leach field area included 50 linear feet of Simple-Septic® pipe per 150 gallons per day of flow, 6" of System Sand below all of the Simple-Septic pipe rows, 6" of System Sand between each Simple-Septic® pipe (or 18" center-to-center), and 12" of System Sand around the entire perimeter of the Simple-Septic® System sand bed. The Simple-Septic® leach field consisted of 150 linear feet of Simple-Septic® pipe; this 150 feet was divided into five (5) rows, at 30' per row.

2.2 Test Protocol

Section 8 of NSF/ANSI Standard 40 protocol, “Performance Testing and Evaluation”, is included in Appendix B. Start up of the plant was accomplished by filling the plant with 2/3 water and 1/3 raw sewage. The plant was then dosed at the design loading rate of 450 gpd as follows:

6 a.m. to 9 a.m. - 35 percent of daily rated capacity (160 gallons)
11 a.m. to 2 p.m. - 25 percent of daily rated capacity (110 gallons)
5 p.m. to 8 p.m. - 40 percent of daily rated capacity (180 gallons)

Dosing was accomplished by opening an electrically actuated valve to feed wastewater to the test plant. Five gallon doses were spread uniformly over each dosing period to comprise the total dose volume for the period.

After a start up period (up to three weeks at the manufacturer’s discretion), the plant is subjected to the following loading sequence:

Design loading	-	16 weeks
Stress loading	-	7.5 weeks
Design loading	-	2.5 weeks

During the design loading periods, flow proportioned 24-hour composite influent and effluent samples are collected five days per week. The influent samples are analyzed for five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) concentrations. The effluent samples are analyzed for five-day carbonaceous biochemical oxygen demand ($CBOD_5$), and total suspended solids (TSS) concentrations. On-site determinations of the effluent temperature and pH are made five days per week.

Stress testing is designed to evaluate how the plant performs under non-ideal conditions, including varied hydraulic loadings and electrical or system failure. The test sequence includes (1) Wash Day stress, (2) Working Parent stress, (3) Power/Equipment Failure stress, and (4) Vacation stress. Detailed descriptions of the stress sequences are shown in Appendix B.

During the stress test sequences, 24-hour composite samples are collected before and after each stress dosing pattern. The analyses and on-site determinations completed on the samples are the same as described for the design load testing. Each stress is followed by seven consecutive days of dosing at design rated capacity before beginning the next stress test. Sample collection is initiated twenty-four hours after completion of Wash Day, Working Parent, and Vacation stresses, and beginning 48 hours after completion of the Power/Equipment Failure stress.

In order for the plant to achieve Class I effluent it is required to produce an effluent, which meets the EPA guidelines for secondary effluent discharge[1]:

(1) $CBOD_5$: The 30-day average of effluent samples shall not exceed 25 mg/L and each 7-day average of effluent samples shall not exceed 40 mg/L.

(2) TSS: Each 30-day average of effluent samples shall not exceed 30 mg/L and each 7-day average of effluent samples shall not exceed 45 mg/L.

(3) pH: Individual effluent values remain between 6.0 and 9.0.

Requirements are also specified for effluent color, odor, oily film and foam, as well as maximum noise levels allowed from the plant.

2.3 Test Chronology

The Presby system was installed under the direction of the manufacturer on July 15th, 2013. The infiltration/exfiltration test, during which the entire system was tested for leaks, was completed on July 17th, 2013. The unit was filled with 2/3 fresh water and 1/3 raw sewage and dosing was initiated at the rate of 450 gallons per day beginning July 26th, 2013. The test was officially started on July 28th, 2013. The stress test sequence was started on November 18th, 2013 and ended on December 31st, 2013. Testing was completed on January 24th, 2014.

3.0 ANALYTICAL RESULTS

3.1 Summary

Chemical analyses of samples collected during the evaluation were completed using the procedures in *Standard Methods for the Examination of Water and Wastewater 22nd edition*. Copies of the data generated during the evaluation are included in Appendix C. Results of the chemical analyses and on-site observations and measurements made during the evaluation are summarized in Table I.

TABLE I. SUMMARY OF ANALYTICAL RESULTS

	Average	Std. Dev.	Minimum	Maximum	Median	Interquartile Range
Biochemical Oxygen Demand (mg/L)						
Influent (BOD_5)	180	52	100	430	160	140 - 200
Effluent ($CBOD_5$)	11	9	2	50	8	6- 14
Total Suspended Solids (mg/L)						
Influent	210	71	45	650	190	170- 230
Effluent	7	3	2	18	6	5 -9
pH						
Influent	-	-	6.0	7.5	6.9	6.8 – 7.2
Effluent	-	-	6.0	7.4	6.5	6.3 – 6.7
Temperature (°C)						
Influent	17	5	8	23	19	13 – 21
Effluent	16	7	2	32	18	10 - 23
Dissolved Oxygen (mg/L)						
Influent	*0.4*	0.4	0.1	2.5	0.2	0.1 – 0.5
Effluent	3.5	1.7	1.0	8.5	3.4	2.0 –4.4

Notes: The median is the point where half of the values are greater and half are less.
The interquartile range is the range of values about the median between the upper and lower 25 percent of all values.

Criteria for evaluating the analytical results from the testing are described in Section 8.5 of NSF/ANSI Standard 40. In completing the pass/fail determination for the data, an allowance is made for effluent TSS and $CBOD_5$ during the first month of testing. The 30- and 7-day averages during this time may not equal or exceed 1.4 times the effluent limits required for the rest of the test. This provision recognizes that an immature culture of microorganisms within the system may require additional time to achieve adequate treatment efficiency. Effluent $CBOD_5$ and TSS concentrations from the SS-SPD-450 during the first calendar month of testing were within the normal limits and did not need to use this provision.

Section 8.5.1.1 of the Standard provides guidance addressing the impact of unusual testing conditions, including sampling, dosing, or influent characteristics, on operation of a system under test. Specific data points may be excluded from 7- and 30-day average calculations where determined to have an adverse impact on performance of the system, with rationale for the exclusion to be documented in the final report.

Sections 3.6 and 8.2.1 of the Standard define influent wastewater characteristics as they apply to testing under the Standard. Typical domestic wastewater is defined as having a 30-day average BOD_5 concentration between 100 and 300 mg/L and a 30-day average TSS concentration between 100 and 350 mg/L. The 30-

day average influent remained inside this specified range for the duration of the test.

3.2 Biochemical Oxygen Demand

The five-day biochemical oxygen demand (BOD_5) and five-day carbonaceous biochemical oxygen demand ($CBOD_5$) analyses were completed using *Standard Methods for the Examination of Water and Wastewater* 22nd *edition*. The results of both analyses are shown in Figure 1.

Influent BOD_5:

Individual influent BOD_5 concentrations ranged from 100 to 430 mg/L during the evaluation, with average concentration of 180 mg/L and a median concentration of 160 mg/L. Thirty day average concentrations ranged from 160 to 200 mg/L.

Effluent $CBOD_5$:

Effluent $CBOD_5$ concentrations ranged from 2 to 50 mg/L over the course of the evaluation, with an average concentration of 11 mg/L and a median effluent $CBOD_5$ concentration of 8 mg/L.

The Standard requires that the effluent $CBOD_5$ not exceed 40 mg/L on a 7-day average or 25 mg/L on a 30-day average. As presented in Table II, over the course of the test the 7-day average effluent $CBOD_5$ ranged from 3 to 28 mg/L and the 30-day average ranged from 7 to 17 mg/L. The Simple Septic SS-SPD-450 met the requirements of Standard 40 for effluent $CBOD_5$.

BOD_5 Loading:

Over the course of the evaluation the influent BOD_5 loading averaged 0.66 lb/day. The Simple Septic SS-SPD-450 achieved an average reduction of 0.62 lbs/day.

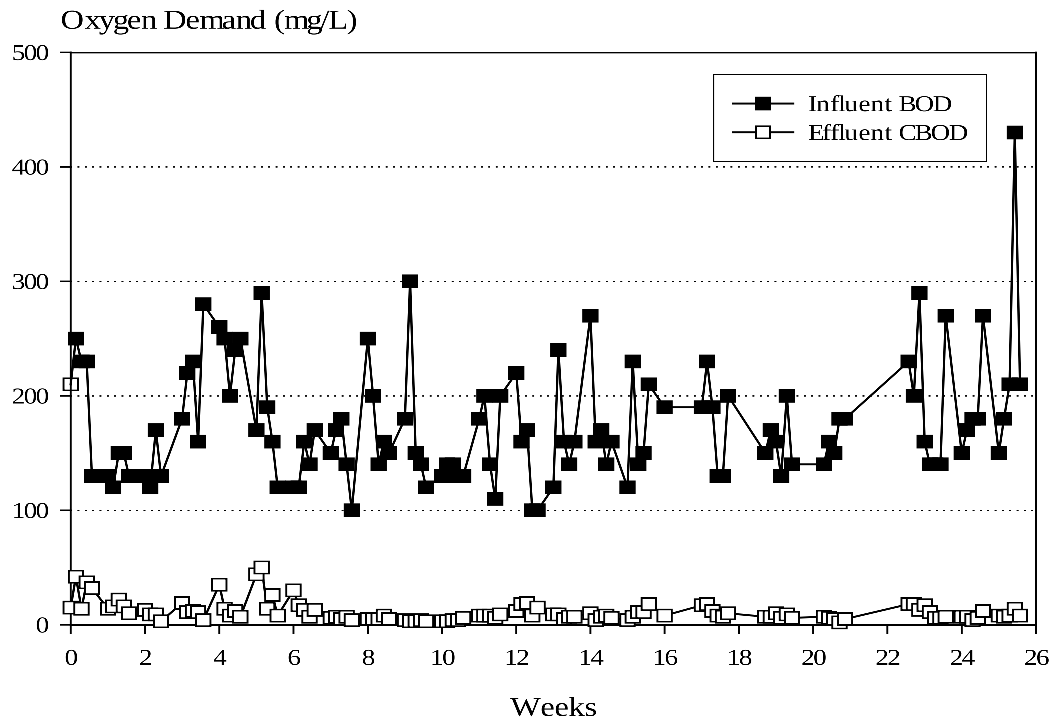

Figure 1. Biochemical Oxygen Demand

3.3 Total Suspended Solids

TSS analyses were completed using *Standard Methods for the Examination of Water and Wastewater* 22nd *edition*. The TSS results over the entire evaluation are shown in Figure 2. Data from the TSS analyses are summarized in Table I.

Influent TSS:

The influent TSS ranged from 45 to 650 mg/L during the evaluation, with an average concentration of 210 mg/L and a median concentration of 190 mg/L. The 30-day average concentrations during the test ranged from 190 to 220 mg/L.

Effluent TSS:

The effluent TSS concentration ranged from 2 to 18 mg/L during the evaluation, with an average concentration of 7 mg/L and a median concentration of 6 mg/L.

Over the course of the evaluation, NSF/ANSI Standard 40 requires that the effluent TSS not exceed 45 mg/L on a 7-day average or 30 mg/L on a 30-day average. Table III shows the 7- and 30-day total suspended solids averages. The 7-day average effluent TSS ranged from 4 to 13 mg/L and the 30-day average ranged from 5 to 10 mg/L during the test. The Simple Septic SS-SPD-450 met the requirements of NSF/ANSI Standard 40 for effluent TSS.

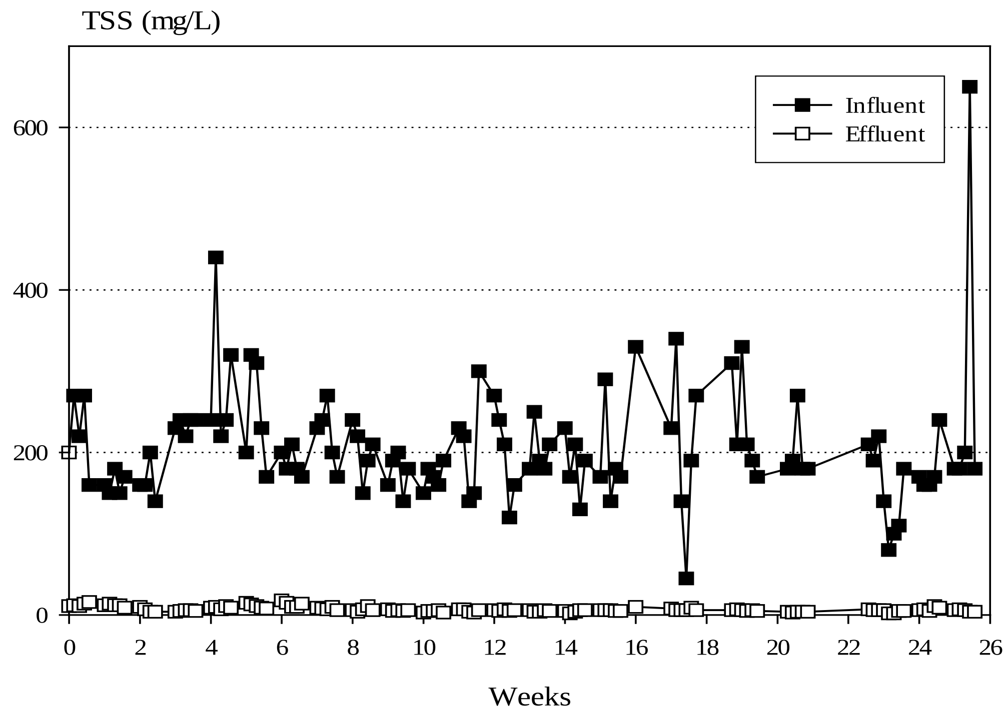

Figure 2. Total Suspended Solids

Table II. 7- and 30-day Average Effluent $CBOD_5$ and 30-day Average Influent BOD_5

Month	Week	7-day Average Effluent $CBOD_5$ (mg/L)	30-day Average Effluent $CBOD_5$ (mg/L)	30-day Average Influent BOD_5 (mg/L)
1	1	28	17	180
	2	16		
	3	8		
	4	11		
2	5	15	14	170
	6	28		
	7	16		
	8	6		
	9	6		
3	10	3	7	160
	11	4		
	12	8		
	13	14		
4	14	7	9	170
	15	7		
	16	7		
	17	12		
5	18	14	8	160
	19	8		
	20	8		
	21	6		
	22	4		
6	23	16	10	200
	24	9		
	25	7		
	26	9		

Table III. 7- and 30-day Total Suspended Solids

Month	Week	7-day Average Effluent TSS (mg/L)	30-day Average Effluent TSS (mg/L)	30-day Average Influent TSS (mg/L)
1	1	13	9	210
	2	12		
	3	6		
	4	5		
2	5	9	10	220
	6	11		
	7	13		
	8	8		
	9	7		
3	10	6	5	190
	11	4		
	12	5		
	13	6		
4	14	5	5	200
	15	5		
	16	6		
	17	7		
5	18	6	5	210
	19	7		
	20	6		
	21	4		
	22	4		
6	23	6	6	200
	24	4		
	25	8		
	26	5		

3.4 pH

Over the entire evaluation period, the influent pH ranged from 6.0 to 7.5 (median of 6.9). The effluent pH ranged from 6.0 to 7.4 during the evaluation (median of 6.5); within the 6 to 9 range required by NSF/ANSI Standard 40. The pH data for the evaluation are shown in Appendix C.

3.5 Temperature

Influent temperatures over the evaluation period ranged from 8 to 23 °C (median of 19 °C). The temperature data are shown in Appendix C.

3.6 Dissolved Oxygen

Dissolved Oxygen (DO) was measured in the influent and effluent during the evaluation. The influent DO ranged between 0.1 and 2.5 mg/L (median of 0.2 mg/L), while the effluent DO ranged between 1.0 and 8.5 mg/L (median of 3.4 mg/L). All dissolved oxygen data are shown in Appendix C.

3.7 Color, Threshold Odor, Oily Film, Foam

Three samples of the effluent were analyzed for color, odor, oily film and foam as prescribed in NSF Standard 40. The effluent was acceptable according to the requirements in NSF Standard 40, with color less than 15 units, non-offensive threshold odor, no visible evidence of oily film and no foam.

3.8 Noise

A reading of the noise level at a distance of 20 feet from the plant was taken while the plant was in operation, using a hand-held decibel meter. The reading was below the 60 dbA required by ANSI/NSF Standard 40.

3.9 Alkalinity

Over the entire evaluation period, the influent alkalinity ranged from 150 to 610 (average of 250). ; within the average greater than 175 mg/L as $CaCO_3$ required by NSF/ANSI Standard 40

4.0 REFERENCES

1. American Public Health Association (APHA), American Water Works Association (AWWA) & Water Environment Federation (WEF): *Standard Methods for the Examination of Water and Wastewater,* 21st Edition, 2005 (hereinafter referred to as *Standard Methods*.

2. ANSI/AWS D.1.1/D1.1M:2010, *Structural Welding Code – Steel* and ANSI/AWS D1.3/D1.3M:2008, *Structural Welding Code – Sheet Steel,* 5th Edition, with Errata

3. NFPA 70®: *National Electrical Code*® (NEC®), 2011*5*

4. US EPA, *Code of Federal Regulations (CFR), Title 40: Protection of Environment, 2012*.

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APPENDIX A

PLANT SPECIFICATIONS

PLANT SPECIFICATIONS

Presby Environmental, Inc. Simple-Septic® 450

Plant Capacity

Design Flow	450 gpd

System Hydraulic Capacity

Pretreatment Chamber	1,000 gallons
Total Hydraulic Capacity	1,000 gallons

Hydraulic Retention Time (at Design Flow)

Pretreatment Chamber	60 hours
Total Hydraulic Retention	60 hours

Filter Media

Manufacture	Presby Environmental, Inc.
Model #	Simple-Septic® conduit
Shape	Circular
Size	Nominal 12" Outside Diameter X" to X"
Material	High density polyethylene pipe, geotextile fabric

Alarm Panel

Manufacture	Polylok, Inc.
Model #	Filter Alarm System

APPENDIX B

NSF STANDARD 40 PERFORMANCE EVALUATION METHOD AND REQUIREMENTS

8 Performance testing and evaluation

This section describes the methods used to evaluate the performance of residential wastewater treatment systems. Systems shall be designated as Class I or Class II. The performance classification shall be based upon the evaluation of effluent samples collected from the system over a six-month period.

8.1 Preparations for testing and evaluation

8.1.1 The system shall be assembled, installed, and filled in accordance with the manufacturer's instructions.

8.1.2 The manufacturer shall inspect the system for proper installation. If no defects are detected and the system is judged to be structurally sound, it shall be placed into operation in accordance with the manufacturer's start-up procedures. If the manufacturer does not provide a filling procedure, ⅔ of the system's capacity shall be filled with water and the remaining ⅓ shall be filled with residential wastewater.

8.1.3 The system shall undergo design loading (see 8.2.2.1) until testing and evaluations are initiated. Sample collection and analysis shall be initiated within 3 wk of filling the system and, except as specified in 8.5.1.2, shall continue without interruption until the end of the evaluation period.

8.1.4 If conditions at the testing site preclude installation of the system at its normally prescribed depth, the manufacturer shall be permitted to cover the system with soil to achieve normal installation depth.

8.1.5 Performance testing and evaluation of systems shall not be restricted to specific seasons.

8.1.6 When possible, electrical or mechanical defects shall be repaired to prevent evaluation delays. All repairs made during the performance testing and evaluation shall be documented in the final report.

8.1.7 The system shall be operated in accordance with the manufacturer’s instructions. However, routine service and maintenance of the system shall not be permitted during the performance testing and evaluation period.

> NOTE – The manufacturer may recommend or offer more frequent service and maintenance of the system but for the purpose of performance testing and evaluation, service and maintenance shall not be performed beyond what is specified in this Standard.

8.2 Testing and evaluation conditions, hydraulic loading, and schedules

8.2.1 Influent wastewater characteristics

The 30-d average BOD5 concentration of the wastewater delivered to the system shall be between 100 mg/L and 300 mg/L.

The 30-d average TSS concentration of the wastewater delivered to the system shall be between 100 mg/L and 350 mg/L.

The average wastewater alkalinity of the wastewater delivered to the system over the course of the testing shall be greater than 175 mg/L as $CaCO_3$ (alkalinity may be adjusted if inadequate). Unless requested by the manufacturer, the raw influent shall be supplemented with sodium bicarbonate if the wastewater is found to be deficient in alkalinity.

8.2.2 Hydraulic loading and schedules

The performance of the system shall be evaluated for 26 consecutive wk. During the testing and evaluation period, the system shall be subjected to 16 wk of design loading, followed by 7.5 wk (52 days) of stress loading, and then an additional 2.5 wk (18 days) of design loading.

8.2.2.1 Design loading

The system shall be dosed 7 days a week with a wastewater volume equivalent to the daily hydraulic capacity of the system. The following schedule shall be adhered to for dosing:

Time Frame	Approximate % rated daily hydraulic capacity
6 a. m. – 9 a. m.	35
11 a. m. – 2 p. m.	25
5 p. m. – 8 p. m.	40

NOTE – The individual dosage shall be no more than 10 gallons per dose, unless the dosage system is based on a continuous flow, and be uniformly applied over the dosing periods.

8.2.2.2 Stress loading

Stress loading is designed to evaluate a system's performance under four non-ideal conditions. Systems shall be subjected to each stress condition once during the 6-month testing and evaluation period, and each of the four stress conditions shall be separated by 7 days of design loading (see 8.2.2.1).

8.2.2.2.1 Wash-day stress

The wash day stress shall consist of 3 wash days in a 5-day period. Each wash day shall be separated by a 24-h period. During a wash-day, the system shall be loaded at times and capacities similar to those delivered during design loading (see 8.2.2.1), however during the first two dosing periods per day, the design loading shall include 3 wash loads (3 wash cycles and 6 rinse cycles).

8.2.2.2.2 Working-parent stress

For 5 consecutive days, the system shall be subjected to a working-parent stress. During this stress, the system shall be dosed with 40% of its daily hydraulic capacity between 6:00 a.m. and 9:00 a.m. Between 5:00 p.m. and 8:00 p.m., the system shall be dosed with the remaining 60% of its daily hydraulic capacity, which shall include 1 wash load (1 wash cycle and 2 rinse cycles).

8.2.2.2.3 Power/equipment failure stress

The system shall be dosed with 40% of its daily hydraulic capacity between 5:00 p.m. and 8:00 p.m. on the day the power/equipment failure stress is initiated. Power to the system shall then be turned off at 9:00 p.m. and dosing shall be discontinued for 48 h. After 48 h, power shall be restored and the system shall be dosed over a 3- h period with 60% of its daily hydraulic capacity, which shall include 1 wash load (1 wash cycle and 2 rinse cycles).

8.2.2.2.4 Vacation stress
On the day that the vacation stress is initiated, the system shall be dosed at 35% of its daily hydraulic capacity between 6:00 a.m. and 9:00 a.m. and at 25% between 11:00 a.m. and 2:00 p.m. Dosing shall then be discontinued for 8 consecutive days (power shall continue to be supplied to the system). Between 5:00 p.m. and 8:00 p.m. of the ninth day, the system shall be dosed with 60% of its daily hydraulic capacity, which shall include 3 wash loads (3 wash cycles and 6 rinse cycles).

8.2.3 Dosing volumes
The 30-d average volume of the wastewater delivered to the system shall be within 100% ± 10% of the system's rated hydraulic capacity.

> NOTE – All dosing days, except those with dosing requirements less than the daily hydraulic capacity, shall be included in the 30-d average calculation.

8.2.4 Color, odor, foam, and oily film assessments
During the 6-month testing and evaluation, a total of three effluent samples shall be assessed for color, odor, foam, and oily film. The assessments shall be conducted on effluent composite samples selected randomly during the first phase of design loading (weeks 1 – 16), the period of stress loading (weeks 17 – 23.5), and the second phase of design loading (weeks 23.5 – 26).

8.3 Sample collection

8.3.1 General

8.3.1.1 A minimum of 96 data days shall be required during system performance testing and evaluation. The maximum length of the test to obtain the 96 data days shall be no more than 34 wk. No routine service or maintenance shall be performed on the system whether the time period to achieve the 96 data days falls within or exceeds 26 wk.

> NOTE – In the event that a catastrophic site problem occurs, as described in 8.5.1.2, the maximum length of the test shall be no more than 37 wk.

8.3.1.2 All sample collection methods shall be in accordance with *Standard Methods* unless otherwise specified.

8.3.1.3 Influent wastewater samples shall be flow-proportional, 24-h composites obtained during periods of system dosing. Effluent samples shall be flow-proportional, 24-h composites obtained during periods of system discharge. Effluent samples shall be representative of all treated effluent discharged from the system, as sampled from a central point of collection of all treated effluent.

8.3.2 Design loading
During periods of design loading, daily composite effluent samples shall be collected and analyzed 5 days a week.

8.3.3 Stress loading

During stress loading, influent and effluent 24-h composite samples shall be collected on the day each stress condition is initiated. Twenty-four h after the completion of washday, working-parent, and vacation stresses, influent and effluent 24-h composite samples shall be collected for 6 consecutive days. Forty-eight h after the completion of the power/equipment failure stress, influent and effluent 24-h composite samples shall be collected for 5 consecutive days.

8.4 Analytical descriptions

8.4.1 pH, TSS, BOD5, and CBOD5

The pH, TSS, and BOD5 of the collected influent and the pH, TSS and CBOD5 of the collected effluent 24-h composite samples shall be determined with the appropriate methods in *Standard Methods* for each listed parameter. Grab samples shall be collected during the morning dosing period for gravity flow systems and during a time of discharge for systems that are pump discharged.

> NOTE – Standards Methods requires pH and temperature to be sampled as grab samples.

8.4.2 Color, odor, oily film, and foam

8.4.2.1 General

The effluent composite samples shall be diluted 1:1000 with distilled water. Three composite effluent samples shall be tested during the 6-month evaluation period.

8.4.2.2 Color

The apparent color of the diluted effluent samples shall be determined with the visual comparison method described in *Standard Methods.*

8.4.2.3 Odor

A panel consisting of at least 5 evaluators shall qualitatively rate 200 mL aliquots of the diluted effluent samples as offensive or non-offensive when compared to odor-free water prepared in accordance with *Standard Methods*.

8.4.2.4 Oily film and foam

Diluted effluent sample aliquots shall be visually evaluated for the presence of an oily film or foaming.

8.5 Criteria

8.5.1 General

8.5.1.1 If conditions during the testing and evaluation period result in system upset, improper sampling, improper dosing, or influent characteristics outside of the ranges specified in 8.2.1, an assessment shall be conducted to determine the extent to which these conditions adversely affected the performance of the system. Based on this assessment, specific data points may be excluded from the 7-d and 30-d averages of effluent measurements. Rationale for all data exclusions shall be documented in the final report.

8.5.1.2 In the event that a catastrophic site problem not described in this Standard including, but not limited to, influent characteristics, malfunctions of test apparatus, and acts of God, jeopardizes the validity of the performance testing and evaluation, manufacturers shall be given the choice to:

> 1) Perform maintenance on the system, reinitiate system start-up procedures, and restart the performance testing and evaluation; or
>
> 2) With no routine maintenance performed, have the system brought back to pre-existing conditions and resume testing within 3 wk after the site problem has been identified and corrected. Data collected during the system recovery period shall be excluded from 7-d and 30-d averages of effluent measurements.
>
> NOTE – Pre-existing conditions shall be defined as the point when the results of 3 consecutive data days are within 15% of the previous 30-d average(s)

8.5.1.3 A 7-d average discharge value shall consist of a minimum of 3 data days. If a calendar week contains less than 3 data days, sufficient data days may be transferred from the preceding calendar week to constitute a 7-d average discharge value. If there are not sufficient data days available in the preceding calendar week, the transfer of data days may take place from the following calendar week to constitute a 7-d average discharge value. No data day shall be included in more than one 7-d average discharge value.

8.5.1.4 A 30-d average discharge value shall consist of a minimum of 50% of the regularly scheduled sampling days per month. If a calendar month contains less than the required number of data days, sufficient data days may be transferred from the preceding calendar month to constitute a 30-d average discharge value. If there are not sufficient data days available in the preceding calendar month, the transfer of data days may take place from the following calendar month to constitute a 30-d average discharge value. No data day shall be included in more than one 30-d average discharge value.

8.5.1.5 During the stress loading sequence, consisting of wash-day, working-parent, power/equipment failure, and vacation stress loading periods, data shall be collected from a minimum of ⅔ of the total scheduled sampling days and from at least 2 of the scheduled sampling days during any single stress recovery.

8.5.2 Class I systems

The following criteria shall be met in order for a system to be classified as a Class I residential wastewater treatment system.

All requirements for each parameter shall be achieved except as provided for in 8.5.2.2.

> NOTE – 8.5.1.3, 8.5.1.4, and 8.5.1.5 are testing minimums. These minimums shall be attained to be considered a valid test.

8.5.2.1 EPA secondary treatment guideline parameters

8.5.2.1.1 CBOD5

The 30-d average of CBOD5 concentrations of effluent samples shall not exceed 25 mg/L.

The 7-d average of CBOD5 concentrations of effluent samples shall not exceed 40 mg/L.

8.5.2.1.2 TSS

The 30-d average of TSS concentrations of effluent samples shall not exceed 30 mg/L.

The 7-d average of TSS concentrations of effluent samples shall not exceed 45 mg/L.

8.5.2.1.3 pH

The pH of individual effluent samples shall be between 6.0 and 9.0.

8.5.2.2 Effluent concentration excursions

System performance shall not be considered outside the limits established for Class I systems if, during the first calendar month of performance testing and evaluation, 7-d average and 30-d average effluent CBOD5 and TSS concentrations do not equal or exceed 1.4 times the effluent limits specified in 8.5.2.1.

> NOTE – The technology utilized in many residential wastewater treatment systems is biologically based. The allowance of excursions from the effluent limits established in this Standard during the first calendar month of performance testing and evaluation reflects the fact that an immature culture of microorganisms within the system may require additional time to achieve adequate treatment efficiency

The value of 1.4 is based on the USEPA Technical Review Criteria for Group I Pollutants[6], including CBOD5 and TSS.

8.5.2.3 Color, odor, oily film, and foam

8.5.2.3.1 Color

The color rating of each of the three diluted composite effluent samples shall be reported. There are no criteria that these values shall meet.

8.5.2.3.2 Odor

The overall rating of each of the three diluted composite effluent samples shall be nonoffensive.

8.5.2.3.3 Oily film and foam

Oily films and foaming shall not be visually detected in any of the diluted composite effluent samples.

8.5.3 Class II systems

The following criteria shall be met in order for a system to be classified as a Class II residential wastewater treatment system.

8.5.3.1 CBOD5

Not more than 10% of the effluent CBOD5 values shall exceed 60 mg/L.

8.5.3.2 TSS

Not more than 10% of the effluent TSS values shall exceed 100 mg/L.

APPENDIX C

ANALYTICAL RESULTS

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 28-Jul-13 Plant Code: Presby Simple Septic

Weeks Into Test: 1

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.10	0.20	0.30	0.20	0.30
	effluent	1.40	1.50	1.40	1.00	1.50
Temperature (C)	influent	21	21	21	22	22
	aeration chamber					
	effluent	23	24	24	24	23
pH	influent	7.4	7.0	7.1	7.2	7.1
	aeration chamber					
	effluent	7.3	7.4	7.4	6.9	7.0
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	210	250	230	230	130
	effluent ($CBOD_5$)	15	42	14	37	32
Suspended Solids (mg/L)	influent	200	270	220	270	160
	aeration chamber					
	effluent	11	12	11	14	16

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes:

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 4-Aug-13 Plant Code: Presby Simple Septic

Weeks Into Test: 2

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.30	0.70	0.10	0.20	0.10
	effluent	1.90	1.50	1.70	1.40	2.20
Temperature (C)	influent	22	22	21	21	21
	aeration chamber					
	effluent	24	24	24	25	24
pH	influent	6.6	6.5	7.0	7.1	6.8
	aeration chamber					
	effluent	6.4	6.3	7.3	6.8	7.2
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	130	120	150	150	130
	effluent ($CBOD_5$)	14	16	22	16	10
Suspended Solids (mg/L)	influent	160	150	180	150	170
	aeration chamber					
	effluent	12	14	12	12	9

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes:

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 11-Aug-13 Plant Code: Presby Simple Septic

Weeks Into Test: 3

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.14	0.10	0.19	0.28	a
	effluent	2.10	1.96	2.61	2.14	a
Temperature (C)	influent	22	22	21	22	a
	aeration chamber					
	effluent	23	23	23	23	a
pH	influent	7.3	7.2	6.5	6.8	a
	aeration chamber					
	effluent	6.9	6.9	6.4	6.5	a
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	130	120	170	130	a
	effluent ($CBOD_5$)	13	9	9	3	a
Suspended Solids (mg/L)	influent	160	160	200	140	a
	aeration chamber					
	effluent	10	7	4	4	a

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: No samples 8/16 due to a problem with the sampler.

8/14/13 ALK 170mg/l

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 18-Aug-13 Plant Code: Presby Simple Septic

Weeks Into Test: 4

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.30	0.10	0.10	0.30	0.30
	effluent	2.80	2.50	3.60	1.30	1.40
Temperature (C)	influent	21	22	21	22	22
	aeration chamber					
	effluent	23	23	23	22	23
pH	influent	7.3	7.2	7.2	6.5	7.4
	aeration chamber					
	effluent	6.9	6.2	6.6	7.1	6.4
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	180	220	230	160	280
	effluent ($CBOD_5$)	19	11	12	11	4
Suspended Solids (mg/L)	influent	230	240	220	238	240
	aeration chamber					
	effluent	4	5	6	6	5

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 8/20/13 Alklinity 240 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 25-Aug-13 Plant Code: Presby Simple Septic

Weeks Into Test: 5

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.10	0.10	0.20	0.30
	effluent	1.70	4.10	2.00	3.40	1.80
Temperature (C)	influent	22	22	23	22	21
	aeration chamber					
	effluent	23	23	23	23	23
pH	influent	7.3	6.6	7.2	6.9	7.3
	aeration chamber					
	effluent	6.7	6.8	6.7	6.4	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	260	250	200	240	250
	effluent ($CBOD_5$)	35	14	8	12	7
Suspended Solids (mg/L)	influent	240	440	220	240	320
	aeration chamber					
	effluent	9	10	7	11	9

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 8/30/13 Alklinity 610 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 1-Sep-13 Plant Code: Presby Simple Septic

Weeks Into Test: 6

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.10	0.10	0.20	0.30
	effluent	1.70	4.10	2.00	3.40	1.80
Temperature (C)	influent	22	22	23	22	21
	aeration chamber					
	effluent	23	23	23	23	32
pH	influent	6.4	6.8	7.3	7.2	6.9
	aeration chamber					
	effluent	6.3	7.0	6.8	6.4	6.4
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	170	290	190	160	120
	effluent ($CBOD_5$)	44	50	14	26	8
Suspended Solids (mg/L)	influent	200	320	310	230	170
	aeration chamber					
	effluent	15	13	11	9	8

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 9/4/13 Alklinity 150 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 8-Sep-13 Plant Code: Presby Simple Septic

Weeks Into Test: 7

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.10	0.10	0.10	0.20
	effluent	1.90	1.20	1.10	3.60	2.80
Temperature (C)	influent	21	21	22	22	21
	aeration chamber					
	effluent	21	21	21	21	22
pH	influent	7.1	7.1	7.3	7.5	7.2
	aeration chamber					
	effluent	6.4	6.4	7.3	7.0	6.7
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	120	120	160	140	170
	effluent ($CBOD_5$)	30	17	13	7	13
Suspended Solids (mg/L)	influent	200	180	210	180	170
	aeration chamber					
	effluent	18	15	10	10	14

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 9/10/13 Alklinity 440 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 15-Sep-13 Plant Code: Presby Simple Septic

Weeks Into Test: 8

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.10	0.10	0.10	0.10	0.20
	effluent	2.80	3.50	2.20	1.50	2.30
Temperature (C)	influent	21	20	20	21	21
	aeration chamber					
	effluent	21	21	21	20	20
pH	influent	7.0	7.1	7.2	7.1	7.3
	aeration chamber					
	effluent	6.7	6.4	6.4	6.3	6.3
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	150	170	180	140	100
	effluent ($CBOD_5$)	6	7	5	7	4
Suspended Solids (mg/L)	influent	230	240	270	200	170
	aeration chamber					
	effluent	9	8	7	10	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 9/17/13 Alklinity 200 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 22-Sep-13 Plant Code: Presby Simple Septic

Weeks Into Test: 9

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.10	1.50	0.10	0.40	0.40
	effluent	3.40	2.40	1.90	2.20	2.40
Temperature (C)	influent	20	19	20	20	20
	aeration chamber					
	effluent	20	20	20	20	20
pH	influent	7.0	7.2	7.4	6.9	7.4
	aeration chamber					
	effluent	7.0	6.9	6.8	6.6	6.8
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	250	200	140	160	150
	effluent ($CBOD_5$)	5	5	5	8	5
Suspended Solids (mg/L)	influent	240	220	150	190	210
	aeration chamber					
	effluent	6	4	7	11	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 9/24/13 Alklinity 180 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 29-Sep-13 Plant Code: Presby Simple Septic

Weeks Into Test: 10

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.20	0.10	0.20	0.10
	effluent	2.40	2.20	1.60	1.70	2.00
Temperature (C)	influent	19	19	19	19	19
	aeration chamber					
	effluent	19	19	19	19	19
pH	influent	6.7	6.6	7.3	6.5	6.4
	aeration chamber					
	effluent	6.3	6.2	6.5	6.1	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	180	300	150	140	120
	effluent ($CBOD_5$)	4	<3	3	4	3
Suspended Solids (mg/L)	influent	160	190	200	140	180
	aeration chamber					
	effluent	7	5	6	5	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 10/1/13 Alklinity 240 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 6-Oct-13 Plant Code: Presby Simple Septic

Weeks Into Test: 11

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.10	0.10	0.10	0.40	0.10
	effluent	3.40	2.90	2.00	2.00	2.50
Temperature (C)	influent	20	20	19	20	20
	aeration chamber					
	effluent	19	20	20	19	19
pH	influent	6.9	6.4	7.3	6.8	6.7
	aeration chamber					
	effluent	6.3	6.7	6.1	6.2	6.3
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	130	140	140	130	130
	effluent ($CBOD_5$)	<3	3	4	4	6
Suspended Solids (mg/L)	influent	150	180	170	160	190
	aeration chamber					
	effluent	3	5	5	6	3

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 10/8/13 Alklinity 300 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 13-Oct-13 Plant Code: Presby Simple Septic

Weeks Into Test: 12

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	1.60	0.50	0.60	0.40
	effluent	3.60	3.60	3.80	4.40	4.10
Temperature (C)	influent	19	18	19	19	20
	aeration chamber					
	effluent	18	18	18	18	18
pH	influent	6.7	7.1	6.9	7.0	7.1
	aeration chamber					
	effluent	6.3	6.7	6.7	6.6	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	180	200	140	110	200
	effluent ($CBOD_5$)	8	8	8	6	9
Suspended Solids (mg/L)	influent	230	220	140	150	300
	aeration chamber					
	effluent	7	7	4	3	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 10/16/13 Alklinity 180 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 20-Oct-13 Plant Code: Presby Simple Septic

Weeks Into Test: 13

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.70	0.50	0.60	0.20	0.40
	effluent	2.20	2.40	2.90	2.90	2.40
Temperature (C)	influent	19	19	18	19	19
	aeration chamber					
	effluent	18	18	17	18	17
pH	influent	6.5	7.5	6.0	6.8	7.0
	aeration chamber					
	effluent	6.2	6.7	6.1	6.6	6.3
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	220	160	170	98	100
	effluent ($CBOD_5$)	12	18	19	8	15
Suspended Solids (mg/L)	influent	270	240	210	120	160
	aeration chamber					
	effluent	6	5	7	5	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 10/22/13 Alklinity 160 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 27-Oct-13 Plant Code: Presby Simple Septic

Weeks Into Test: 14

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.60	0.30	0.80	0.40
	effluent	4.15	5.34	4.47	3.70	3.60
Temperature (C)	influent	18	19	18	15	18
	aeration chamber					
	effluent	16	16	16	15	16
pH	influent	6.8	6.7	7.3	6.8	6.5
	aeration chamber					
	effluent	6.4	6.4	6.1	6.2	6.7
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	120	240	160	140	160
	effluent ($CBOD_5$)	9	9	5	7	7
Suspended Solids (mg/L)	influent	180	250	190	180	210
	aeration chamber					
	effluent	6	4	4	6	5

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 10/29/13 Alklinity 240 mg/L

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 3-Nov-13 Plant Code: Presby Simple Septic

Weeks Into Test: 15

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.13	0.13	0.26	1.25	1.02
	effluent	4.40	5.80	3.40	a	3.00
Temperature (C)	influent	17	17	17	17	16
	aeration chamber					
	effluent	15	14	15	a	15
pH	influent	7.1	7.3	6.8	6.8	6.9
	aeration chamber					
	effluent	6.7	6.5	6.2	6.6	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	270	160	170	140	160
	effluent ($CBOD_5$)	10	4	7	8	6
Suspended Solids (mg/L)	influent	230	170	210	130	190
	aeration chamber					
	effluent	5	2	4	6	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 11/05/13 Alklinity 270 mg/L
Effluent temperature and DO not measured on 11/7 due to lab error.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 10-Nov-13 Plant Code: Presby Simple Septic

Weeks Into Test: 16

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.30	0.30	0.30	0.20	0.40
	effluent	3.10	2.20	3.30	4.00	3.40
Temperature (C)	influent	16	17	16	16	15
	aeration chamber					
	effluent	14	13	13	12	12
pH	influent	7.1	6.8	6.9	6.9	7.3
	aeration chamber					
	effluent	6.2	6.4	6.2	6.6	6.5
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	120	230	140	150	210
	effluent ($CBOD_5$)	4	7	11	11	18
Suspended Solids (mg/L)	influent	170	290	140	180	170
	aeration chamber					
	effluent	6	6	6	5	5

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes:

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 17-Nov-13 Plant Code: Presby Simple Septic

Weeks Into Test: 17

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Dosed Volume (gallons)		450	450	450	450	450	450	450
Dissolved Oxygen (mg/L)	influent		0.20					
	effluent		3.40					
Temperature (C)	influent		16					
	aeration chamber							
	effluent		12					
pH	influent		6.8					
	aeration chamber							
	effluent		6.4					
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)		190					
	effluent ($CBOD_5$)		8					
Suspended Solids (mg/L)	influent		330					
	aeration chamber							
	effluent		10					

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Wash Day Stress 11/18 through 11/22.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 24-Nov-13 Plant Code: Presby Simple Septic

Weeks Into Test: 18

		Sunday	Monday	Tuesday	Wednesday	Thursday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent		0.60	0.20	0.20	0.20
	effluent		7.40	4.50	4.22	4.17
Temperature (C)	influent		13	14	14	14
	aeration chamber					
	effluent		9	10	10	10
pH	influent		7.2	7.1	7.2	7.2
	aeration chamber					
	effluent		7.0	6.7	6.5	6.5
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)		190	230	190	130
	effluent ($CBOD_5$)		17	18	12	8
Suspended Solids (mg/L)	influent		230	340	140	45
	aeration chamber					
	effluent		8	6	6	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Working Parent Stress started on 11/30.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 1-Dec-13 Plant Code: Presby Simple Septic

Weeks Into Test: 19

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Dosed Volume (gallons)		450	450	450	450	450	450	450
Dissolved Oxygen (mg/L)	influent							0.35
	effluent							3.01
Temperature (C)	influent							13
	aeration chamber							
	effluent							10
pH	influent							6.7
	aeration chamber							
	effluent							6.5
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)							150
	effluent ($CBOD_5$)							7
Suspended Solids (mg/L)	influent							310
	aeration chamber							
	effluent							6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Working Parent Stress completed on 12/4.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 8-Dec-13 Plant Code: Presby Simple Septic

Weeks Into Test: 20

		Sunday	Monday	Tuesday	Wednesday	Thursday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	0.20	0.20	1.40	0.30	0.50
	effluent	3.70	5.30	3.80	3.60	3.76
Temperature (C)	influent	13	12	13	13	12
	aeration chamber					
	effluent	10	9	9	8	8
pH	influent	6.6	6.5	6.8	6.7	7.1
	aeration chamber					
	effluent	6.6	6.4	6.2	6.4	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	170	160	130	200	140
	effluent ($CBOD_5$)	7	10	6	9	6
Suspended Solids (mg/L)	influent	210	330	210	190	170
	aeration chamber					
	effluent	7	6	5	6	5

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Power/Equipment Failure Stress from 12/12 through 12/14.
12/10/13 Color, odor, foam, oily film all ND
12/10/13 Alkalainty 180 mg/l

NSF International

Standard 40 - Residential Wastewater Treatment Systems

Plant Effluent

Week Beginning: 15-Dec-13 Plant Code: Presby Simple Septic

Weeks Into Test: 21

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Dosed Volume (gallons)		450	450	450	450	450	450	450
Dissolved Oxygen (mg/L)	influent				0.32	0.28	0.21	1.66
	effluent				4.67	6.50	4.36	8.04
Temperature (C)	influent				11	11	11	11
	aeration chamber							
	effluent				6	6	6	6
pH	influent				7.0	6.9	6.8	7.2
	aeration chamber							
	effluent				6.6	6.4	6.3	6.2
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)				140	160	150	180
	effluent ($CBOD_5$)				7	6	5	2
Suspended Solids (mg/L)	influent				180	190	270	180
	aeration chamber							
	effluent				4	3	4	4

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 12/17/13 Alkalainty 180 mg/l

NSF International

Standard 40 - Residential Wastewater Treatment Systems

Plant Effluent

Week Beginning: 22-Dec-13 Plant Code: Presby Simple Septic

Weeks Into Test: 22

		Sunday	Monday	Tuesday	Wednesday	Thursday
Dosed Volume (gallons)		270	0	0	0	0
Dissolved Oxygen (mg/L)	influent	0.20				
	effluent	5.19				
Temperature (C)	influent	11				
	aeration chamber					
	effluent	7				
pH	influent	7.0				
	aeration chamber					
	effluent	6.7				
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	180				
	effluent ($CBOD_5$)	5				
Suspended Solids (mg/L)	influent	180				
	aeration chamber					
	effluent	4				

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Vacation Stress started on 12/22.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 29-Dec-13 Plant Code: Presby Simple Septic

Weeks Into Test: 23

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Dosed Volume (gallons)		0	0	270	450	450	450	450
Dissolved Oxygen (mg/L)	influent						c	1.64
	effluent						c	7.88
Temperature (C)	influent						c	11
	aeration chamber							
	effluent						c	2
pH	influent						6.8	6.8
	aeration chamber							
	effluent						6.2	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)						230	200
	effluent ($CBOD_5$)						18	18
Suspended Solids (mg/L)	influent						210	190
	aeration chamber							
	effluent						7	6

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Vacation Stress completed on 12/31.
Field measurments were not completed on 1/3 due to blizzard conditions at the test site.

NSF International
Standard 40 - Residential Wastewater Treatment Systems
Plant Effluent

Week Beginning: 5-Jan-14 Plant Code: Presby Simple Septic

Weeks Into Test: 24

		Sunday	Monday	Tuesday	Wednesday	Thursday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	1.30	1.40	1.40	0.90	0.80
	effluent	5.60	5.90	5.90	7.00	6.80
Temperature (C)	influent	10	9	9	9	9
	aeration chamber					
	effluent	5	5	5	4	4
pH	influent	6.9	6.8	6.8	6.7	6.9
	aeration chamber					
	effluent	6.2	7.0	6.5	6.4	6.6
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	290	160	140	140	140
	effluent ($CBOD_5$)	13	17	11	6	6
Suspended Solids (mg/L)	influent	220	140	80	97	110
	aeration chamber					
	effluent	6	6	2	2	5

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes:

NSF International

Standard 40 - Residential Wastewater Treatment Systems

Plant Effluent

Week Beginning: 12-Jan-14 Plant Code: Presby Simple Septic

Weeks Into Test: 25

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	1.40	0.80	0.80	0.50	1.30
	effluent	5.40	4.50	7.70	5.20	5.40
Temperature (C)	influent	9	9	9	9	9
	aeration chamber					
	effluent	5	6	5	6	6
pH	influent	7.1	6.2	6.3	6.9	6.4
	aeration chamber					
	effluent	6.9	6.0	6.6	6.7	6.4
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	150	170	180	180	270
	effluent ($CBOD_5$)	7	7	4	6	12
Suspended Solids (mg/L)	influent	170	160	160	170	240
	aeration chamber					
	effluent	6	7	5	11	9

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: 1/14/2014 Color,Odor,Foam,Oily film ND

NSF International

Standard 40 - Residential Wastewater Treatment Systems

Plant Effluent

Week Beginning: 19-Jan-14 Plant Code: Presby Simple Septic

Weeks Into Test: 26

Weekend Dosing: Sunday 450 gallons Saturday 450 gallons

		Monday	Tuesday	Wednesday	Thursday	Friday
Dosed Volume (gallons)		450	450	450	450	450
Dissolved Oxygen (mg/L)	influent	2.50	0.60	c	0.30	0.50
	effluent	8.50	5.00	c	6.40	6.20
Temperature (C)	influent	10	10	c	9	9
	aeration chamber					
	effluent	6	6	c	5	5
pH	influent	7.1	6.8	6.8	6.9	6.8
	aeration chamber					
	effluent	6.5	6.1	6.6	6.6	6.5
Biochemical Oxygen Demand (mg/L)	influent (BOD_5)	150	180	210	430	210
	effluent ($CBOD_5$)	8	7	8	14	8
Suspended Solids (mg/L)	influent	180	180	200	650	180
	aeration chamber					
	effluent	6	7	6	4	4

(a) Site problem
(b) Malfunction of system under test
(c) Weather problem
(d) Other

Notes: Field measurments were not completed on 1/22 due to blizzard conditions at the test site.
1/22/2014 Color,Odor,Foam,Oily film ND

APPENDIX D

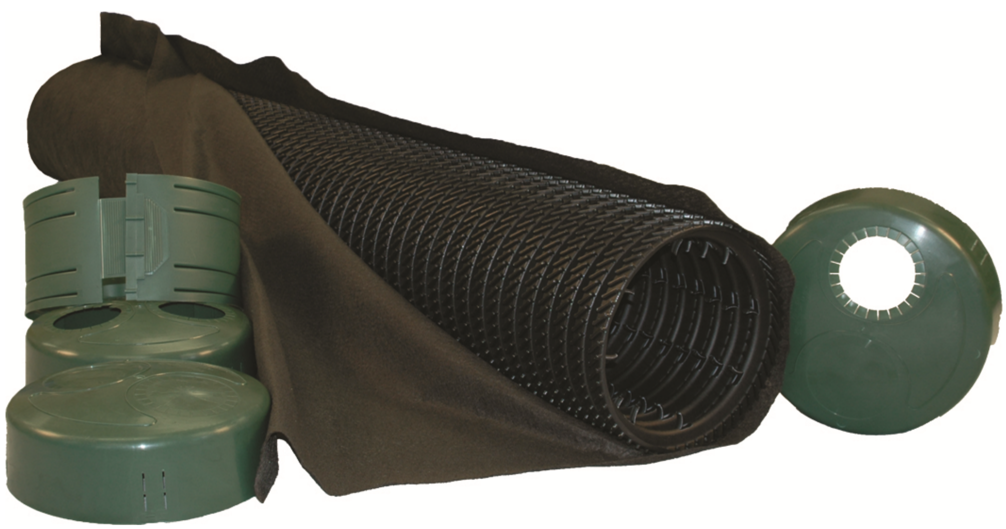
OWNER'S MANUAL

The Presby Simple-Septic®
Wastewater Treatment System

Owner's Manual

Including Instructions for Operation & Maintenance

NSF/ANSI Standard 40 Class I Certified
Combined Treatment and Dispersal



Minimizes the Expense **Protects the Environment** **Preserves the Site**

Presby Environmental, Inc.

The Next Generation of Wastewater Treatment Technology

143 Airport Rd., Whitefield, NH 03598
Tel: 800-473-5298 Fax: 603-837-9864
info@presbyeco.com
www.PresbyEnvironmental.com

Dear System Owner:

Congratulations! You made a wise investment and an environmentally-responsible decision by selecting a state-of-the-art Simple-Septic® Treatment System.   This system requires virtually no maintenance on the part of the homeowner; however, a basic understanding of how the system functions and what is needed to keep it in good working order will help ensure the reliable, trouble-free operation of your system, protecting your investment, your health and your environment.

This manual will familiarize you with simple steps to maximize the functioning of your system and prevent problems, as well as providing instructions for routine maintenance, inspection, troubleshooting and repair. Having accurate records will greatly assist your service provider in maintaining and evaluating your system. We encourage you to utilize the System Information and Maintenance Record section (found in the back of this manual) to record important information about your system and its maintenance history for ease of future reference.

If you ever have questions or need technical assistance of any kind, please contact us by phone at (800) 473-5298 or via email to info@presbyeco.com, or visit our website at www.presbyenvironmental.com.

Sincerely,

President, Presby Environmental, Inc.
Inventor of Simple-Septic®

The information in this manual is subject to change without notice. We make a continual effort to improve our Manuals in order to ensure they are as complete, accurate and helpful as possible. Please confirm that this is the most recent and up-to-date version of this Manual by contacting us at (800) 473-5298 or visiting our website, www.presbyenvironmental.com

IMPORTANT NOTICE: This Manual is intended ONLY for owners of Presby Environmental's Simple-Septic® NSF Treatment System. The use of this Manual with any other product is prohibited. The processes and design criteria contained herein are based solely on our experience with and testing of Simple-Septic®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects and will void NSF Certification.

Presby Environmental, Inc. United States and Canadian Patents:
Coupling system: US Patent No 6,899,359; Canada 2,359,255
End Cap: US Patent No 6,792,977; Canada 2,365,453
Enviro-Septic US Patent No 6,461,078; Canada 2,300,535
Fluid Conduit (AES): US Patent No 8,342,212; Canada 2,609,409
Multi-Layer Fabric (AES): US Patent No 5,954,451; Canada 2,185,087
Multi-Level Leaching System: US Patent No 6,290,429; Canada 2,286,995
Pipe Making Method: US Patent No 5,606,786; Canada 2,817,126
Skimmer Tab Former: US Patent No 7,270,532; Canada 2,415,194
US Patent Nos. 7,713,414, 6,461,078; Canada 2,300,535
With other patents pending in the United States, Canada and other jurisdictions.

Simple-Septic® is a registered trademark of Presby Environmental Inc.

Combined Treatment & Dispersal (bottomless) Model Numbers:
450-SSCTD, 600-SSCTD, 750-SSCTD, 900-SSCTD, 1050-SSCTD, 1200-SSCTD, 1350-SSCTD, 1500-SSCTD.

TABLE OF CONTENTS

Data Plate/Service Label as shown below can be found on the Electrical Control Box and near the High Water Alarm. Authorized Representative to complete the form below for ease of future reference.

Contact the Manufacturer's Authorized Representative identified on the Data Plate/Service Label or Presby Environmental, Inc. for service, inspection, parts or repairs:

Simple-Septic® Treatment System Service Dataplate

NSF Standard 40 Class I Certified

Manufacturer: **Presby Environmental, Inc.**
143 Airport Road, Whitefield NH 03598
800-473-5298
info@presbyeco.com
www.PresbyEnvironmental.com

Certified to NSF/ ANSI Standard 40

Simple-Septic® Treatment System Model Number: ___________________________

Date of Installation: ____________ Rated Hydraulic Capacity (*Gallons per Day*): __________

Manufacturer's Authorized Representative:

Assigned Serial Number:___________________ *(State abbreviation/Rep. I.D./system number)*

Name: ____

Address: ____

Telephone(s): ____

To Obtain Service or Parts: Contact the Manufacturer's Representative above or Presby Environmental, Inc.

1.0 Introduction

1.1 Simple-Septic® Treatment System, Tested and Listed Under NSF/ANSI Standard 40, Class I

The Simple-Septic® Treatment System has been vigorously tested in compliance with NSF International's Standard-40 protocols and achieved treatment results that exceed NSF's Class I requirements. Simple-Septic® is distributed in the United States exclusively by Presby Environmental, Inc. ("PEI") and its Authorized Representatives.

1.2 Design Basis Data

The Simple-Septic® Treatment System is designed to treat residential effluent that has received primary treatment in a septic tank. Expected characteristics of the effluent leaving the septic tank and entering the system are: 30 day average BOD_5 between 100 and 300 mg/L. and 30-day average TSS between 100 and 350 mg/L. In compliance with NSF Standard 40 Class I criteria, the expected quality of the effluent after treatment by Simple-Septic® is:

a) $CBOD_5$ 30 day average less than 25 mg/L., 7 day average less than 40 mg/L.
b) Total Suspended Solids (TSS) 30 day average less than 30 mg/L., 7 day average less than 45 mg/L.
c) pH range 6.0 to 9.0
d) Wastewater is expected to be colorless, and no offensive odor, oily film, or foam should be detectable in a representative sample of treated effluent.

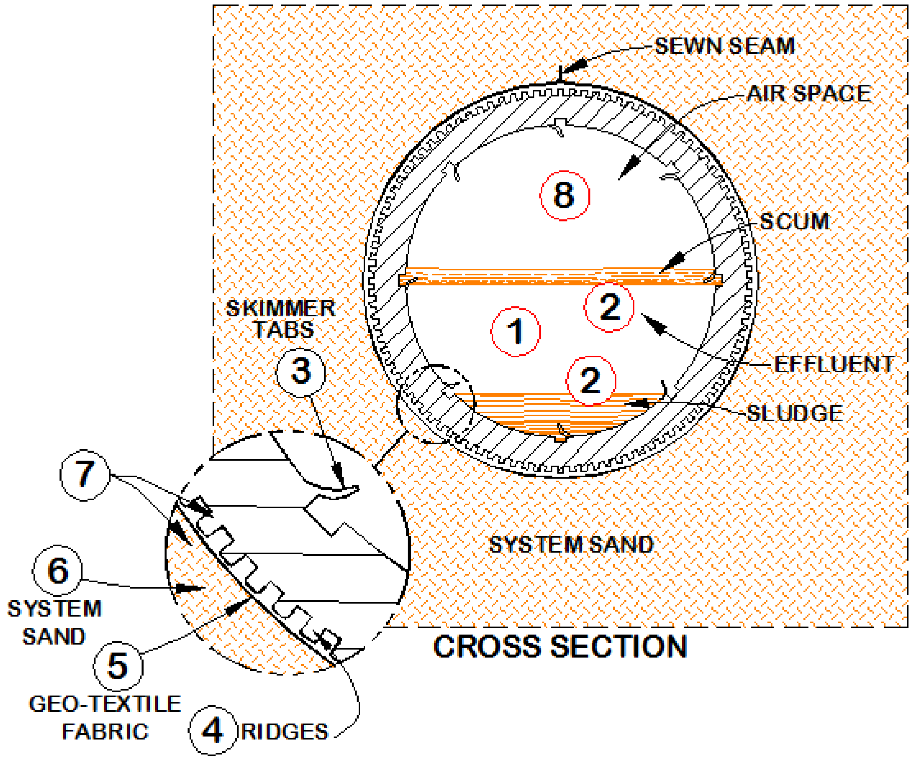
The amount of Simple-Septic® pipe used for each model is determined based on a loading rate of 3.0 gallons per linear foot of pipe. This loading rate provides for exceptional treatment and long-term system effectiveness. There is no need to ever remove accumulated solids from within the system; this small amount of organic matter is continually processed by bacterial activity inside the pipes due to sustained aerobic conditions. A minimal accumulation of non-biodegradable solids within the pipe is to be expected and does not adversely affect the system's performance. There is no media, filter, etc. to replace in the Simple-Septic® Treatment System; components are made from extremely durable, non-biodegradable plastic. The septic tank will require periodic removal of accumulated solids (see Sec. 3.0 for recommended septic tank maintenance) and the electrical/mechanical devices included in the constructed system will also require periodic inspection and/or adjustment.

1.3 How does Simple-Septic® Work?

The system consists of a high-density plastic pipe which is ridged and perforated with skimmer tabs extending inwardly from each perforation. A layer of geo-textile fabric surrounds the circumference and is stitched in place. The finished product is 12 in. in diameter. By utilizing simple yet effective natural processes, the Presby Treatment System treats septic tank effluent in a manner that prevents suspended solids from sealing the underlying soil, increases system aeration, and provides a greater bacterial treatment area ("biomat") than traditional systems. The Presby Treatment System retains solids in its pipe and provides multiple bacterial surfaces to treat effluent prior to its contact with the soil. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. This all combines to create a unique eco-system that no other passive wastewater treatment system is designed to offer. The result is a system that excels by being more efficient, lasting longer, and has a minimal environmental impact.

The patented Simple-Septic® pipe cools the liquid, separating and retaining the solids and grease inside the pipes. Perforations allow the liquid to pass through the pipes, while skimmer tabs retain solids within the pipe. Next the wastewater passes through the outer layer of geo-textile fabric. The Simple-Septic® pipes are surrounded by a bed of specified System Sand, which facilitates the process by wicking the treated liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria. The treated wastewater percolates through the System Sand and is then released into the underlying soil (CTD "combined treatment and dispersal" [bottomless] Model). Simple-Septic® pipe is a single layer geo-textile fabric distribution system after primary treatment by a septic tank. Simple-Septic® is similar to other single-layer fabric, large diameter, gravelless pipe (LDGP) systems on the market today, yet provides the added benefit of Presby's patented skimmer tabs and cooling ridges to protect the bacterial surface area of the fabric.

1.4 Eight Stages of Wastewater Treatment



Stage 1: Warm effluent enters the pipe and is cooled to ground temperature.

Stage 2: Suspended solids separate from the cooled liquid effluent.

Stage 3: Skimmers further capture grease and suspended solids from the existing effluent.

Stage 4: Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.

Stage 5: Effluent passes into the geo-textile fabrics and grows a protected bacterial surface.

Stage 6: Sand wicks liquid from the geo-textile fabrics and enables air to transfer to the bacterial surface.

Stage 7: The pipe and fabric provide a large bacterial surface to break down solids.

Stage 8: An ample air supply and fluctuating liquid levels increase bacterial efficiency.

2.0 System Components

2.1 Presby Simple-Septic® Pipe

a) Plastic pipe made with a significant percentage of recycled material
b) 10 ft sections (can be cut to any length)
c) Ridged and perforated, with skimmer tabs on interior
d) Wrapped in a non-woven geo-textile fabric stitched in place
e) Exterior diameter of 12 in.
f) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
g) A 10 ft length of Simple-Septic® pipe is flexible enough to bend up to 90°
h) 50 ft minimum per bedroom (150 GPD) required
i) Number of rows may vary to suit site requirements
j) Row lengths limited may vary between 30 ft to 100 ft

2.2 Presby Offset Adapter

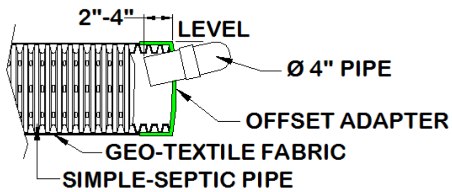
An offset adapter is a plastic fitting 12 in. in diameter with an inlet hole designed to accept a 4 inch sewer line, raised connection or vent pipe. The hole is to be installed in the 12 o'clock position. The distance from the bottom of the Offset Adapter to the bottom of its inlet hole is 7 in. When assembling pipes into rows, note that the geo-textile fabrics are placed over the edges of the Offset Adapter and Couplings.

2.3 Presby Coupling

A coupling is a plastic fitting used to create a connection between two pieces of Presby Pipe. Note that the couplings are wide enough to cover 1 or 2 pipe corrugations on each of the two pipe ends being joined. The couplings feature a snap-lock feature that requires no tools. When assembling pipes into rows, note that the geo-textile fabric does not go under couplings. Pull fabric back, install coupling, and then pull fabric over coupling. Also note, during installation in cold weather, couplings are easier to work with if stored in a heated location (such as a truck cab) before use.

2.4 Raised Connection

A raised connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows. Raised connections extend 2 in. to 4 in. into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened.



2.5 Septic Tank

The Simple-Septic® System is designed to treat effluent that has received "primary treatment" in a standard septic tank meeting the following requirements:

a) Meets the standards set forth in BNQ Standard NQ-3680-905 or ASTM C1227. NSF requires supporting documentation of structural integrity.
b) Fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Simple-Septic® System.
c) The access ports required to have a secure locking mechanism, or require a special tool for access, or the weight of the cover must be more than 65 lbs.
d) Effluent filters are not recommended by Presby Environmental, Inc. due to their tendency to clog, which cuts off the oxygen supply that is essential to the functioning of the Simple-Septic® system.
e) If you are required to use an effluent filter in a gravity fed system due to state or local requirements, the effluent filter selected must allow the free passage of air to ensure the proper functioning of the system.
f) Minimum septic tank sizes are based on hydraulic capacity of the model selected in gallons per day (GPD) per the table below. These sizes are based on providing approximately 2.5 days retention time in the septic tank.
g) In selecting the size of the pretreatment tank, always round up to the closest standard capacity tank. It is acceptable to utilize more than one tank (in serial) provided their combined capacity meets the minimum requirements.

2.6 Table A: Minimum Septic Tank Capacity

Simple-Septic® Model Numbers	Daily Design Flow (GPD)	Minimum Septic Tank Nominal Capacity (US Gallons)
450-SSCTD	450	1,125
600-SSCTD	600	1,500
750-SSCTD	750	1,875
900-SSCTD	900	2,250
1050-SSCTD	1,050	2,625
1200-SSCTD	1,200	3,000
1350-SSCTD	1,350	3,375
1500-SSCTD	1,500	3,750

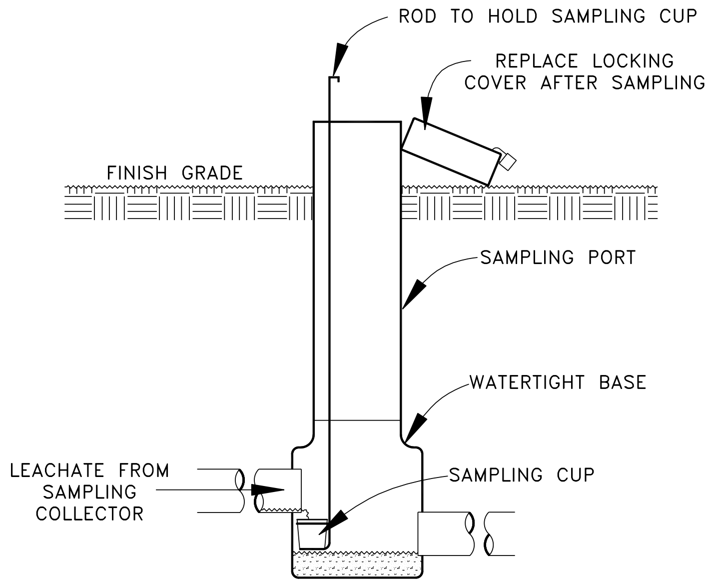
2.7 Polylok High Water Audio/Visual Alarm

A Polylok / SJE-Rhombus Audio/Visual Alarm System (Parts # 3014A and 3014B) is a required and included system component. The alarm will be activated in the event of high water (more than 10 in.) within the pipes. The visual alarm can be seen from 50 ft. and the audible alarm is 82 decibels (can be heard from a distance of 50 ft.). Schematics and wiring instructions for the alarm are attached as Appendix C.

2.8 Sampling Device

A plastic, two-piece sample collection device will be included with each SSCTD Model system. The device is installed under one Simple-Septic® pipe to enable the collection of effluent samples produced by the system for the purposes of analysis and inspection. It is accessed by a locking cap accessible from above-grade.

Illustration of Sampling Device at right:



2.9 System Sand

The System Sand that surrounds the Simple-Septic® pipes is an essential component of the system. System Sand must be coarse to very coarse, clean, granular sand, free of organic matter. It must meet ASTM C-33 specifications for "concrete sand" and contain less than 3% fines (materials passing a #200 sieve). System Sand is placed a minimum of 6 inches below all Simple-Septic® pipes, a minimum of 3 in. above the pipes, a minimum of 6 in. between pipe rows, and a minimum of 1 ft. horizontally around the perimeter of the Simple-Septic® pipes.

The Authorized Representative is required to obtain and retain a copy of a sieve analysis or particle size distribution report for each system confirming that the specified sand was utilized in construction.

2.10 PVC Pipe

PVC plastic pipe is used to connect the septic tank to the Simple-Septic® pipes, for construction of the Raised Connections, the high water alarm pipe and the venting stack. The offset adapters accept 4 inch Schedule 20-40 PVC pipe. The line from the septic tank to the Simple-Septic® pipe must be constructed of the more heavy-duty Schedule 40 or equivalent gauge PVC, sewer and drain pipe (Schedule 20 PVC) can be used for the remaining connections.

2.11 Component, Handling, Offloading & Storage

When handling Simple-Septic® pipes, it is important to be aware of the following:

a) Keep mud, grease, oil. etc. away from all components.
b) Avoid dragging pipe through wet or muddy areas.
c) Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
d) Do not pull or drag pipe by the fabric.
e) The outer fabric of the Simple-Septic® pipe is ultra-violet stabilized; however, this protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp or store under cover.

3.0 Use and Care of Your Simple-Septic® Treatment System

3.1 Start-Up Procedures

The start-up procedure is quite simple—begin using your plumbing system. Simple-Septic® does not require any "starter" bacteria, additives or chemicals. Simply using the home's plumbing system will enable the system to begin to develop its bacteria populations and biomat.

3.2 Importance of Water Conservation

Systems are usually sized based on the quantity of daily flow that will be generated by the structure, which is usually calculated based on the number of bedrooms. Therefore, be aware of situations (additional occupants, addition of fixtures, etc.) which result in increased water usage, since this will require more frequent septic tank pumping. If the amount of wastewater entering is regularly more than the system is designed for, wastewater can back up into the house or the yard, creating a health hazard and a nuisance. Choosing the correct size system considering actual water usage is advisable.

A common sense approach to water conservation will maximize your system's effectiveness. A few suggestions for ways to minimize water consumption:

a) Don't wash all your laundry on the same day, since this could potentially "flood" the system and interfere with the settling of solids. A single load of wash in a typical machine can use up to 62 gallons of water. Instead, distribute the wash loads throughout the week.
b) Run your washing machine and dishwasher only when they have full loads.
c) Careful selection of appliances and fixtures that use less water is another way to minimize the demands placed on your Advanced Enviro-Septic™ system. Look for the terms "Energy Star" or "high-efficiency" in the product's description. For example, an "Energy Star" washing machine uses one-half as much water as a traditional model.
d) When you consider that 25-30% of total household wastewater is attributable to toilet use, it is easy to see that replacing a traditional toilet (5-7 gallons per flush) with a high efficiency toilet (1.6 gallons per flush) can conserve a considerable amount of water.
e) Installing aeration devices on faucets and showerheads greatly reduces the amount of water used. A "low flow" showerhead reduces the water used in a ten minute shower from 50 gallons to 25 gallons. Multiply this by the number of showers per day, and the water conservation is significant.
f) Leaks and drips within the plumbing system can waste a significant amount of water. Leaking fixtures could create a hydraulic overload for your wastewater treatment system and should be repaired immediately.

TIP: *An excellent resource for learning more about water conservation is available from the Environmental Protection Agency at <u>www.epa.gov/owm/water-efficiency/index.htm</u>*

3.3 What Not to Flush

As described above, how often your septic tank needs to be pumped is dependent on the amount of solids that accumulate in the tank; minimizing solids (such as paper products and other waste) will reduce the frequency of septic tank pumping. In general, if an item isn't biodegradable, you should dispose of it in the trash rather than in your wastewater treatment system. Use toilet paper, etc., that states it is "septic safe."

3.4 Garbage Disposals

The use of a garbage disposal (also called a "garbage grinder") creates a **tremendous** increase in the amount of solids in wastewater, resulting in the need for more frequent pumping (one to two years sooner than if no garbage disposal is used). While some of the kitchen waste from a garbage disposal will be broken down by bacterial action, some accumulates over time and will eventually have to be pumped out.

3.5 Hot Tubs

Hot tubs use a tremendous amount of water, and some states require increases in the design flow of systems that include hot tubs. If the hot tub drains into the wastewater treatment system, the sudden influx of water stirs up the solids in the septic tank. In addition, the chemical additives sometimes used to disinfect the water in hot tubs are detrimental to the bacteria that are essential to the treatment process. Consult with your Authorized Representative about an alternate means of dispersal. If a hot tub does discharge into the wastewater treatment system, this additional hydraulic loading must be included when selecting the size model to be installed for a particular residence (add 150 gpd hydraulic capacity, select next model size up).

3.6 Water Softeners and Water Purifiers

Water purification systems and water softeners pump hundreds of gallons of water into the septic tank, causing agitation of solids and excess flow to the system if it is not designed to handle this additional hydraulic loading. Consult with your Authorized Representative to pursue alternative means to disperse the discharges from these appliances if possible. Also consult state regulations, since some states prohibit backwash from these appliances from being discharged into a wastewater treatment system. If a water softener or purifier does discharge into the wastewater treatment system, this discharge must be included when calculating the hydraulic capacity in order to select the appropriate model.

3.7 Other Substances Detrimental to Wastewater Treatment Systems:

A wastewater treatment system is a living collection of bacterial organisms, and the introduction of toxins and chemicals can kill the bacteria that are essential to the treatment process. If it is impossible to avoid the use of any of the following substances, use care to introduce them a little at a time so their concentration is diluted and the system can neutralize them gradually.

3.7.1 Cleaning Products:

The wastewater treatment system's bacteria should recover quickly after small amounts of household cleaning products enter the system, but using excessive amounts of such substances constitutes system abuse. Some cleaning products are less toxic to your system than others. If the product states "Danger" or "Poison" on its label, it is highly hazardous, "Warning" indicates it is moderately hazardous, and "Caution" indicates the product is slightly hazardous. If possible, utilize liquid detergents that have little or no phosphates, that are "low-sudsing" or which are biodegradable. There are many cleaning products on the market today that utilize natural ingredients, such as citrus, instead of caustic chemicals. With all cleaning products, use the minimum amount necessary, which is often less than the amount the manufacturer recommends.

Cleaning products especially harmful to bacteria, *use only in moderation*:

a) bleach
b) chlorine
c) ammonia
d) anti-bacterial soaps
e) disinfectants

3.7.2 Medications
Some people dispose of medications by flushing them down the toilet. Certain medications, particularly antibiotics, can have adverse effects on the wastewater treatment system's bacteria. Dispose of medications in the trash and not in your wastewater treatment system.

3.7.3 Chemicals and Toxic Substances
The following substances are harmful to the bacterial organisms in your wastewater treatment system and introducing them constitutes system abuse. These substances can not only have an adverse effect on your system, they can also result in groundwater contamination. Check with your local sanitation department for proper disposal procedures for:

a) Fertilizers
b) Root killers or other products with copper sulfate
c) Poisons or pesticides
d) Drain cleaners
e) Oven cleaners or other lye-based products
f) Degreasers
g) Photographic processing chemicals
h) Petroleum products of any kind
i) Latex paint, oil paint, stains, thinners and solvents
j) Antifreeze
k) Chlorinated water from swimming pools or hot tubs

3.7.4 Grease and Cooking Oil
Grease may harden in the septic tank's scum layer and result in a blockage of the inlet or outlet. Whenever possible, it is preferable to dispose of waste grease and oil in the trash.

3.8 Care of system during periods of intermittent or non-use
The Simple-Septic® system does not require any special maintenance before, during or after periods of non-use. While the biomat may partially "die off" while not in use, it will quickly "re-grow" once the system is put back into operation. Screens can be installed in vent inlets to prevent animals from nesting in the vent stack.

3.9 Use of Septic "Additives"
The use of additives is not recommended by Presby Environmental, Inc. Products that claim to "boost" bacteria populations or "speed up" digestion of solids are not needed and may even be detrimental to a wastewater treatment system. The system does not require any such additives, chemicals or bacteria.

4.0 Maintenance Procedures and Schedule

4.1 Obtaining Service or Parts
Only a Presby Environmental, Inc. Authorized Representative can install a Simple-Septic® Treatment System and provide included service during the initial 2-year period. If you do not know who installed your system, refer to the Data Plate/Service Label (on the electrical control box and near the high water alarm) which will include the Authorized Representative's name and contact information. Our Authorized Representatives also maintain a supply of replacement parts. For referral to an Authorized Representative in your area, contact us at (800) 473-5298, visit our website, www.presbyenvironmental.com, or send an email to info@presbyeco.com.

4.2 Initial Two-Year Service Policy
Four routine inspections (one every six months) are provided under the Initial Service Policy which is included in the purchase price of a Simple-Septic system (see Sec. 9.0). These inspections and service are provided by our Authorized Representatives only. During these inspections, a visual and olfactory assessment of the treated effluent will be conducted and all components will be inspected, adjusted and serviced (if necessary). The system owner will

be notified in writing of any improper system operations that cannot be remedied at the time of inspection. Please note that an extended service policy is available for purchase; contact Presby Environmental for more details.

4.3 Routine Inspection and Pumping Frequency After Initial Two Years

Since it is difficult to predict with precision how often a particular system's tank will require pumping, Presby Environmental, Inc., recommends that a service professional inspect the system at least once every two years, **even if there are no indications of a problem**, in order to access the need for tank pumping and to confirm that the system's components are in good working order. See details below regarding the procedures included in performing a routine inspection.

4.4 Periodic Pumping of the Septic Tank

The Simple-Septic® Treatment System requires virtually no maintenance other than the need to remove the accumulated solids from the attached septic tank. Solid waste accumulates in the tank over time and eventually needs to be removed. Pumping is required approximately every 2 to 5 years for a typical residence with a properly sized system; however, there are many factors which determine how often a particular system's septic tank needs to be emptied, including:

a) The number of occupants;
b) The amount of wastewater generated;
c) The volume of solids in the waste;
d) The size of the septic tank.

(Refer to Sec. 3.0 for information about how to conserve water and minimize the accumulation of solids in your septic tank.)

As a general rule, the septic tank should be pumped when the surface scum and bottom sludge occupy one-fourth or more of the septic tank's liquid depth. If a plastic septic tank is used, and pumping is being performed at a time of year (typically spring) when the ground water table is high enough to exert hydrostatic pressure against the tank, measures should be taken to prevent the tank from "floating." One method of preventing floating is to fill the septic tank with water immediately after pumping, and the weight of the water will hold the tank in place. Presby Environmental recommends assessing the need for septic tank pumping once every two years.

4.5 Use of Additives

There are a variety of additives on the market which claim to breakdown sludge or boost the bacteria population so that the septic tank will need to be pumped less frequently. These claims are largely unsupported, and therefore Presby Environmental, Inc. does not recommend the use of septic system additives of any kind. The bacteria needed for effective treatment are naturally present in wastewater and there is no need to use any chemicals, enzymes, yeast, cleaners, solvents or other additives with a Simple-Septic® System. Some of these "treatments" can actually have a detrimental effect on the system, and some states have even banned their use.

4.6 Maintenance Procedures and Schedule

To be performed by an Authorized Representative or trained Service Provider:

4.6.1 Initial Two-Year Service Policy

The Initial Two-Year Service Policy (Sec. 9.0) is included in the purchase of a Simple-Septic® Treatment System.

a) This consists of four (4) system inspections by the Authorized Representative, one every 6 months following the date of installation.
b) Electrical, mechanical and other components are inspected, adjusted and serviced if necessary.
c) An effluent sample will be obtained and visually inspected for color, turbidity, oil, foam and scum overflow; an olfactory assessment of odor is also performed.
d) Owner will be notified in writing of any improper system operations that cannot be remedied at the time of inspection, and an estimated date of correction.
e) An extended service policy is available for purchase after the initial two years; contact PEI or your Authorized Representative for more information and pricing.

4.6.2 System Maintenance / Pumping of the Septic Tank

Inspect the septic tank at least once every two years under normal usage and assess the need for pumping.

a) Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
b) If a garbage disposal is used, the septic tank will likely require more frequent pumping.
c) After pumping, inspect the septic tank for integrity to ensure that no groundwater is entering it. Also check for evidence of leaking fixtures (water entering tank when no water is being used in the residence).
d) Check the integrity of the tank inlet and outlet baffles and clean, repair or replace if necessary.

e) Effluent filters are not recommended because of their tendency to clog and cut off oxygen to the system. If a filter is required due to state or local regulations, the filter selected must allow oxygen to flow freely. Follow filter manufacturer's maintenance instructions and inspect and clean filters frequently

4.6.3 Distribution Box (if used)

a) Remove any accumulated solids from the d-box.
b) Check for level and adjust if necessary.
c) Adjust flow equalizers as needed.
d) Re-seal any access covers removed during servicing.

4.6.4 Alarm

a) Test the High Water Alarm at least annually.
b) Lift the float approximately 1 vertical inch to activate alarm.
c) Confirm that both the audible and visual alarms are functioning properly (discernable from a distance of 50 ft.).
d) Return float to original position.

4.6.5 Venting

a) Confirm all vents are in place.
b) Ensure that vent openings are unobstructed by leaves, animal activity, etc.
c) Install screen over vent opening to prevent animal activity.
d) Perform draft test if necessary.

4.6.6 Treatment Field

a) No trees or deep rooted vegetation to be planted within 10 ft.
b) No heavy motorized or foot traffic.
c) No added hydraulic load to treatment field (i.e., no ground or surface water, irrigation systems, gutter systems, floor drains, sump pumps, etc. discharging in area of treatment field).
d) Final grading above system diverts surface water away from treatment field.
e) No gardens for human consumption.
f) Check for any odor or surface ponding.

4.7 Repair or replacement parts

Authorized Representatives are to maintain a supply of replacement parts and to provide emergency service within 48 hours of request. Only Authorized Representatives may service the system during the first two (2) years.

5.0 Inspection & Sampling Procedures

5.1 Routine Inspection of System

Note: These procedures are to be performed by properly trained technicians with appropriate safety equipment. During the first two years of system operation, these services are provided by Authorized Representatives only as part of the included Initial Two-Year Service Policy (see Sec. 8.0).

5.1.1 Evaluate Integrity of the Septic Tank and its Components

This includes evaluation of connecting pipes, inlet and outlet baffles, lids and risers, distribution box, filters, pumps, etc. It is especially important that your service provider confirms the structural integrity of the septic tank and all seals; if the tank is not watertight, water can leak both in and out of it.

5.1.2 Inspect Vents

The service provider should also verify that the vents are in place and free of obstructions, since the flow of air to the Simple-Septic® system is crucial to its functioning. A "draft test" may be conducted to confirm that vents are functioning properly. DO NOT remove the vent, as this will shut off the oxygen to the Simple-Septic® System and could result in system malfunction. Refer to our website, www.presbyenvironmental.com for some ingenious ways to conceal unsightly vents.

5.1.3 Sample and Analyze the Treated Wastewater

Routine maintenance during the initial two-year period includes obtaining a sample of the treated wastewater for visual and olfactory analysis by the inspector. In addition, analysis by a laboratory may be performed to confirm that the liquid being discharged into the ground has been sufficiently purified. State regulations vary and sampling and analysis after the initial two-year period may or may not be required for your system. See Step-by-Step Inspection and Sampling Procedures, in Sec. 4.3, for more detail.

NOTE: Refer to Sec. 7.0 of this Owner's Manual for a System Information and Maintenance section where you can keep a record of your system's routine maintenance, inspections and service.

5.2 General Safety Considerations

a) Septic tanks contain toxic gases including methane; exposure to these fumes can be fatal within minutes and the gases are highly explosive. Only a trained professional with the proper gear and equipment should attempt to service a septic tank.
b) Effluent can contain dangerous viral and bacterial hazards; care should be taken to avoid any contact with effluent. If contact is unavoidable, wash immediately and thoroughly with anti-bacterial soap.
c) Secure excavated areas and exposed tank covers, and do not leave an exposed tank unattended. Falling into a septic tank is likely to be fatal, and extreme care should be taken at all times.

5.3 Step-by-Step Inspection and Sampling Procedures

5.3.1 Safety precautions

a) Perform inspection procedures and collect all samples taking care to prevent contact with effluent.
b) Use proper safety equipment, including gloves and eye protection.
c) Use care and make sure to clean thoroughly any tools or equipment used.

5.3.2 System owner interview

a) Confirm septic tank pumping schedule is being followed
b) Inquire about any unusual or problematic issues experienced (fixtures backing up or sluggish, high water alarm incidents, odor, etc.)
c) Confirm that system owner has been provided with an Operating Manual.
d) Review use and care recommendations with system owner
e) System owner to perform visual inspection of the treatment field (as set forth below) on a monthly basis.

5.3.3 Visually inspect treatment field

To be performed by Owner on a monthly basis.

a) Confirm no ponding/surfacing of effluent on ground surface
b) Confirm no offensive odor detectable in the system area
c) Confirm treatment field is not being subjected to hydraulic loading from surface or ground water flows, irrigation systems, gutter systems, floor drains, etc.
d) Confirm no trees or plants within 10 ft. of treatment field
e) Confirm system vents are in place and unobstructed; repair/replace if needed
f) Observe water level within pipes via the Inspection Port. When the system is operating as expected, the liquid within the pipes will range from 0 to 10 in. of depth and will fluctuate based on water use.

5.3.4 Mechanical inspection

a) Inspect, adjust and/or service the High Water Alarm as needed. Any electrical service required is to be performed by a licensed electrician.
b) Test to confirm proper operation by raising float 1 in. vertically, which will activate alarm.
c) Confirm audible and visual alarms discernable from a distance of 50 ft.
d) Return float to original position (so as to activate if water level within pipes exceeds 10 in.).

5.3.5 Septic tank and d-box inspection

a) Inspect accumulated solids in septic tank, pump tank if necessary.
b) Inspect tank for structural integrity, confirm no infiltration or exfiltration.
c) Inspect baffles and confirm they are in place and unobstructed.
d) Inspect d-box and remove any accumulated solids.
e) Check d-box for level; adjust flow equalizers if needed.
f) Clean and maintain effluent filter (if used).
g) Perform draft test to assess ventilation if necessary.
h) Inspect connecting PVC lines for proper connections.

5.4 Effluent sampling procedure

5.4.1 Step by step instructions

a) Label clean plastic sample bottle with site address, owner's name, time and date of collection.
b) Remove cover from sampling device stack.
c) Do not remove cap from sample bottle until ready to use; do not touch or allow contaminants to contact the rim or mouth of the bottle. If there is any possibility that the sample has been contaminated, discard and obtain a new sample.
d) Place disposable collection cup attached to rod below sampling device's inlet and allow treated effluent to fill the cup. In the case of low or no flow from the inlet pipe of Sampling Device, collect sample from treated effluent collected in the base of the sampling device.

e) Remove collection cup from sampling device and pour collected effluent sample into labeled sample bottle.
f) Immediately re-cap the sample bottle and pack in ice for transport (if applicable).
g) Follow chain of custody procedures (if submitting for laboratory analysis).
h) Carefully wash hands and all tools after obtaining effluent sample.

5.4.2 Visual inspection of effluent sample(s)

a) Visual inspection of effluent sample to be performed on-site immediately after obtaining sample.
b) Assess color – There should be no visible color (refer to APHA's Standard Methods for the Examination of Water and Wastewater.)
c) Assess turbidity – There should be no visible suspended particles or sediment.
d) Assess scum overflow – There should be no oily film or foaming.
e) Make detailed notes documenting visual inspection of sample for the file, including date, time, name and address of person performing assessment.

5.4.3 Olfactory assessment of odor

a) Olfactory assessment for odor to be performed on-site immediately after obtaining sample.
b) The sample should not produce an offensive odor (refer to APHA's Standard Methods for the Examination of Water and Wastewater.)
c) Make detailed notes documenting olfactory assessment for odor for the file, including date, time, name and address of person performing assessment.

5.4.4 Inspection report requirements

a) Copy of report to be provided to system owner, Presby Environmental, and state/local approving authority (if required).
b) Notify system owner in writing of any improper system operations discovered which could not be remedied at the time of inspection, including an estimated date of correction.

5.4.5 Repair or Replacement Parts

a) Contact the Authorized Representative identified on the Data Plate/Service Label for any necessary repairs or replacements parts.
b) Emergency service is available within 48 hours of request.
c) If you have any difficulty reaching the Authorized Rep., please call Presby Environmental, Inc. directly at (800) 473-5298 for assistance.
d) Only Authorized Reps. may service the system during its initial two years in operation. See Initial Two-Year Service Policy, Sec. 9.0.
e) Authorized Representative maintains a supply of replacement parts and can assist you with Warranty claims.

6.0 Causes & Indicators of System Malfunction

6.1 What is "System Malfunction"?

The term "system malfunction" refers to any situation in which the system has stopped operating as expected.

6.2 What can cause System Malfunction?

a) Continuous volume of wastewater in excess of design flow.
b) System flooded with excessive volumes of wastewater which agitates sludge in the septic tank and sends solids into the Advanced Enviro-Septic™ system.
c) System flooded by hydraulic overload from surface or ground water.
d) Lack of oxygen due to vent obstructions, plumbing problems, etc.
e) Failure to periodically pump the septic tank.
f) System components clogged by excessive amounts of grease.
g) Excessive use of chemicals, medications, toxic substances, cleaning products, etc.
h) Excessive volume of solids and/or non-biodegradable materials in the wastewater.
i) Damage to or leaks in any of the system components.

6.3 What are the symptoms of system malfunction?

a) A foul odor in the absorption area.
b) Ponding or surfacing of wastewater at the ground surface.
c) Backing up of wastewater inside the structure (sluggish drains or toilets slow to flush).
d) Activation of the high water alarm.

6.4 In case of system malfunction

Contact your service provider identified on the Data Plate/Service Label attached to the electrical control box and near the high water alarm IMMEDIATELY if you observe symptoms of system malfunction. Emergency Service is available within 48 hours of request.

You may also call Presby Environmental, Inc. directly at 800-473-5298 and we will provide technical assistance and trouble-shooting. No matter what the problem may be, the sooner it is addressed the easier it will be to correct or repair.

SIMPLE-SEPTIC® SYSTEM MALFUNCTION TROUBLESHOOTING GUIDE		
Problem	**Possible Cause(s)**	**Action to take**
High Water Alarm activated	System malfunction, hydraulic overload or mechanical malfunction	Restrict water use as much as possible and contact Authorized Rep.
Wastewater backup into plumbing fixtures (sluggish drains or slow flushing toilets)	Sewage line to septic tank clogged	Contact your service provider. Use a plumbing “snake” to remove the clog. Do not use caustic chemical drain cleaners.
	Sewage line damaged or invaded by roots	Contact service provider to replace sewage line from house to septic tank
	Too many accumulated solids in the septic tank	Contact service provider; have septic tank pumped
	Damaged or missing inlet or outlet baffles	Contact service provider to repair/replace baffle(s)
	D-Box plugged	Contact service provider to clean out D-Box
	D-Box out of level	Contact service provider to adjust flow equalizers
	Connecting pipe from septic tank to Simple-Septic® system damaged or invaded by roots	Contact service provider to replace connecting pipe (reminder: plant no trees or deep rooted vegetation within 10 ft. of the system)
Foul odor detected	System overload or malfunction	Restrict water use as much as possible and contact Authorized Representative
	Ventilation malfunction	
Ponding or pooling of wastewater on ground surface	System overload or malfunction	Restrict water use as much as possible and contact Authorized Representative
No draft through venting system	Vents damaged, missing or plugged; improper plumbing configurations	Contact Authorized Rep. to repair/replace vents as needed
Visual Inspection of Treated Effluent Sample	Color, sediment, suspended solids, foam or oil detected	Contact PEI for technical assistance
Olfactory Analysis of Treated Effluent Sample	Foul or objectionable odor detected	Contact PEI for technical assistance

7.0 System Information and Maintenance Records

Date of Installation	
Model Number (Refer to Data Plate/Service Label)	
Copy of Plan available?	Yes No Note: If "No" sketch plan on next page
Authorized Rep. Name & Company (Refer to Data Plate/Service Label)	
Address & Telephone (Refer to Data Plate/Service Label)	

Site Information:

Owner(s)	
Street Address	
Town / State	
Map/Lot	
Municipal Contact Name & Telephone	
Permit Number	
Water Supply	Public Private
If private, Well Info.	
Proximities to bodies of water, wetlands, etc.	

Diagram System Location:

Indicate location of structure, septic tank & access hatch, absorption area, vents, wells, restrictive features (pavement, swimming pools, foundations, surface water, property lines, etc.)

System Maintenance and Service Record		
DATE:	**PERFORMED BY:**	**DESCRIPTION OF SERVICE:**
		Six-month Inspection
		Twelve-month Inspection
		Eighteen-month Inspection
		Twenty-four month Inspection

8.0 Simple-Septic® Treatment System Limited Warranty

SIMPLE-SEPTIC® TREATMENT SYSTEM
LIMITED WARRANTY

Presby Environmental, Inc. ("manufacturer") warrants the parts in each Simple-Septic® Treatment System to be free from defects in materials and workmanship for a period of two (2) years from the date of installation when used to treat residential wastewater from a single family dwelling only. The manufacturer's sole obligation under this Warranty is to repair or replace any component that shows evidence of defects, provided said component has been paid for and is returned through an Authorized Representative, transportation prepaid. The system owner ("warrantee") is required to give written notice specifying the nature of the claimed defect to the authorized representative indicated on the system Data Plate/Service Label and to the manufacturer at the following address:

Presby Environmental, Inc.
Warranty Department
143 Airport Road
Whitefield, NH 03598

Written notice of claimed defect must be postmarked within two (2) years of the date of initial system installation. This warranty is a Limited Warranty and no claim of any nature shall be made against manufacturer unless and until the owner, or his legal representative, notifies manufacturer in writing of the defect complained of and delivers the product and/or defective parts, freight prepaid, to the manufacturer's Authorized Representative.

No warranty is made as to the adequacy of work performed by third-parties. The warranty does not cover treatment systems that have been damaged due to flooding by external means, or that have been disassembled by unauthorized persons, improperly installed, subjected to external damage or damage due to altered or improper wiring or overload protection, or for any failure to obtain required permits or authorization to build. This Limited Warranty applies only to the components manufactured and/or supplied by Presby Environmental, Inc. and does not include any portion of the household plumbing, drainage system, electrical wiring, septic tank, pump tank or other components or accessories. System components supplied by the manufacturer but manufactured by others are warranted to be free of defects in materials and workmanship for a period of two (2) years from the date of installation. In no event shall manufacturer be responsible for delay or damages of any kind or character resulting from, or caused directly or indirectly by, defective components or materials manufactured by others, and the manufacturer's sole obligation is repair or replacement of defective components.

This Limited Warranty extends to the "owner" of the product and is transferable during the first two (2) years after date of installation. As used herein, "owner" is defined as the purchaser of the system or the subsequent owner during the first two (2) years after the system's initial installation. It is the original owner's obligation to make known to the subsequent owner(s) the terms and conditions of this Limited Warranty, and it is the new owner's obligation to contact the Authorized Representative or Manufacturer in order to provide documentation of change of ownership.

Manufacturer reserves the right to revise, change, or modify the construction and design of its wastewater treatment system, or any component or parts thereof, without incurring any obligation to make such changes or modifications to systems previously sold. Manufacturer also reserves the right, in making replacements of component parts under this warranty, to furnish a component part which, in its judgment, is equivalent to the part replaced.

Under no circumstances will the manufacturer be responsible to the Warrantee for any other incidental or consequential damages, including but not limited to lost profits, lost income, labor changes, delays in production and/or idle production, which damages are caused by a defect in material and/or workmanship in its product or parts. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty is expressly in lieu of any other express or implied warranty, including any warranty of merchantability or fitness for a particular purpose. There is no informal dispute resolution available under this Limited Warranty. This warranty gives you special legal rights and you may have other rights, which vary from state to state.

9.0 Initial Two-Year Service Policy

INITIAL TWO-YEAR SERVICE POLICY

All Simple-Septic® Treatment Systems with NSF Class I Certification include a two-year initial service contract which is included in the system's purchase price.

Only a Presby Environmental, Inc. Authorized Representative may provide system inspection, sampling, service and repair during the first two years after installation.

The Initial Two-Year Service Policy includes:

- Four routine inspections (one every six months)
- A visual analysis of a sample of treated effluent to assess color, turbidity, oil, and foam
- An olfactory assessment of the treated effluent for offensive odor
- All components will be inspected, adjusted and serviced.

The system owner will be notified in writing of any improper system operations that cannot be remedied at the time of inspection.

Emergency service calls are available within 48 hours of system owner's request for assistance.

The Authorized Representative will have a supply of replacement parts available for installation in the event that a component requires off-site repairs.

An extended service policy is available for purchase; contact Presby Environmental for more details.

Refer to the Data Plate / Service Label which contains the name, address and telephone number of the Authorized Representative who installed the system. If a System Owner is unable to reach the Authorized Representative, call Presby Environmental, Inc. at (800) 473-5298 for further assistance.

April 15, 2015

Mr. David Presby
Presby Environmental, Inc.
143 Airport Road
Whitefield, NH 03598

RE: NSF/ANSI Standard 40 Certification of the Enviro-Septic®

Dear Mr. Rashkin,

We have completed the review of the proposed Enviro-Septic® and modifications to the Advanced Enviro-Septic® Wastewater Treatment Unit models. The key elements of the review included:

- Determining whether the requirements of NSF/ANSI Standard 40 (2013) will continue to be met.

- Determining whether the requirements of the NSF Certification Policies for Wastewater Treatment Devices will continue to be met.

Based on this review NSF can authorize the Enviro-Septic® line of products, and modify the Advanced Enviro-Septic® listing to show 3.0 gallons per linear foot and a depth of 6 inches of system sand.

If you have any further comments or questions, please don't hesitate to contact us.

Kind Regards,

Sharon Steiner

Sharon Steiner
Business Unit Manager
Wastewater Treatment Unit Program

734-827-6846 (Voice)
734-827-7790 (Fax)
steiner@nsf.org (E-mail)

corp. corr: 3U460