The Presby Wastewater Treatment System

Alabama

Design & Installation Manual

for

Advanced Enviro-Septic® , Enviro-Septic® and Simple-Septic®

Wastewater Treatment Systems

✔ 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

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

Presby Environmental, Inc.
143 Airport Road
Whitefield, NH 03598
Phone: 1-800-473-5298 Fax: (603) 837-9864
Website: www.PresbyEnvironmental.com

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.

IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® and Simple-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® and Simple-Septic®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

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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 the Presby Pipe 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.

1.6 Enviro-Septic® (ES)

The Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been certified to NSF 40, Class I standards. Enviro-Septic® is comprised of corrugated, perforated plastic pipe which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. The system is designed to simultaneously purify and disperse effluent after primary treatment by a septic tank. Each foot of Enviro-Septic® pipe provides over 25 sq ft of total surface area for bacterial activity.

1.7 Simple-Septic® (SS)

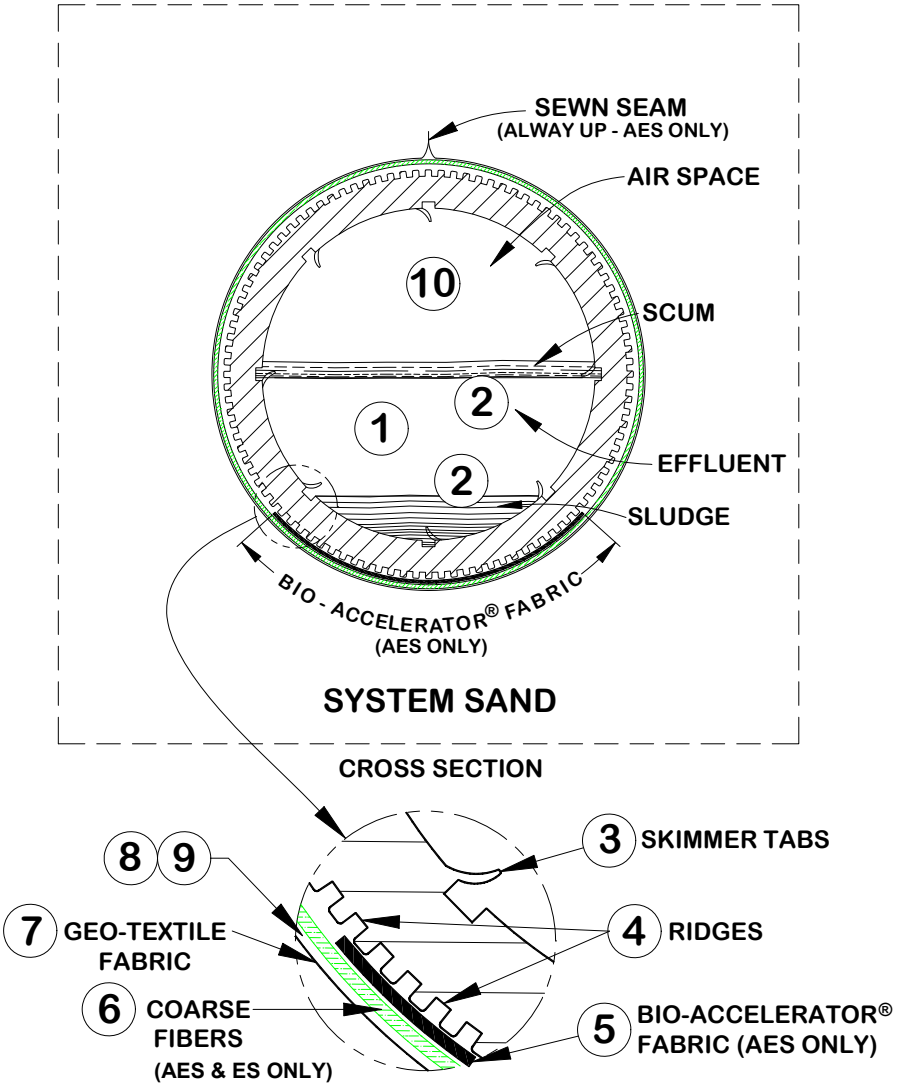
The Simple-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I. Simple-Septic® pipe is a single layer geo-textile fabric distribution system after primary treatment by a septic tank. Simple-Septic® is similar to other 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. Each foot of Simple-Septic® pipe provides over 15 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), Enviro-Septic® and Simple-Septic® (SS)



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. (AES only)

Stage 6: A mat of coarse, randomly-oriented fibers separates more suspended solids from the effluent. (AES & ES only)

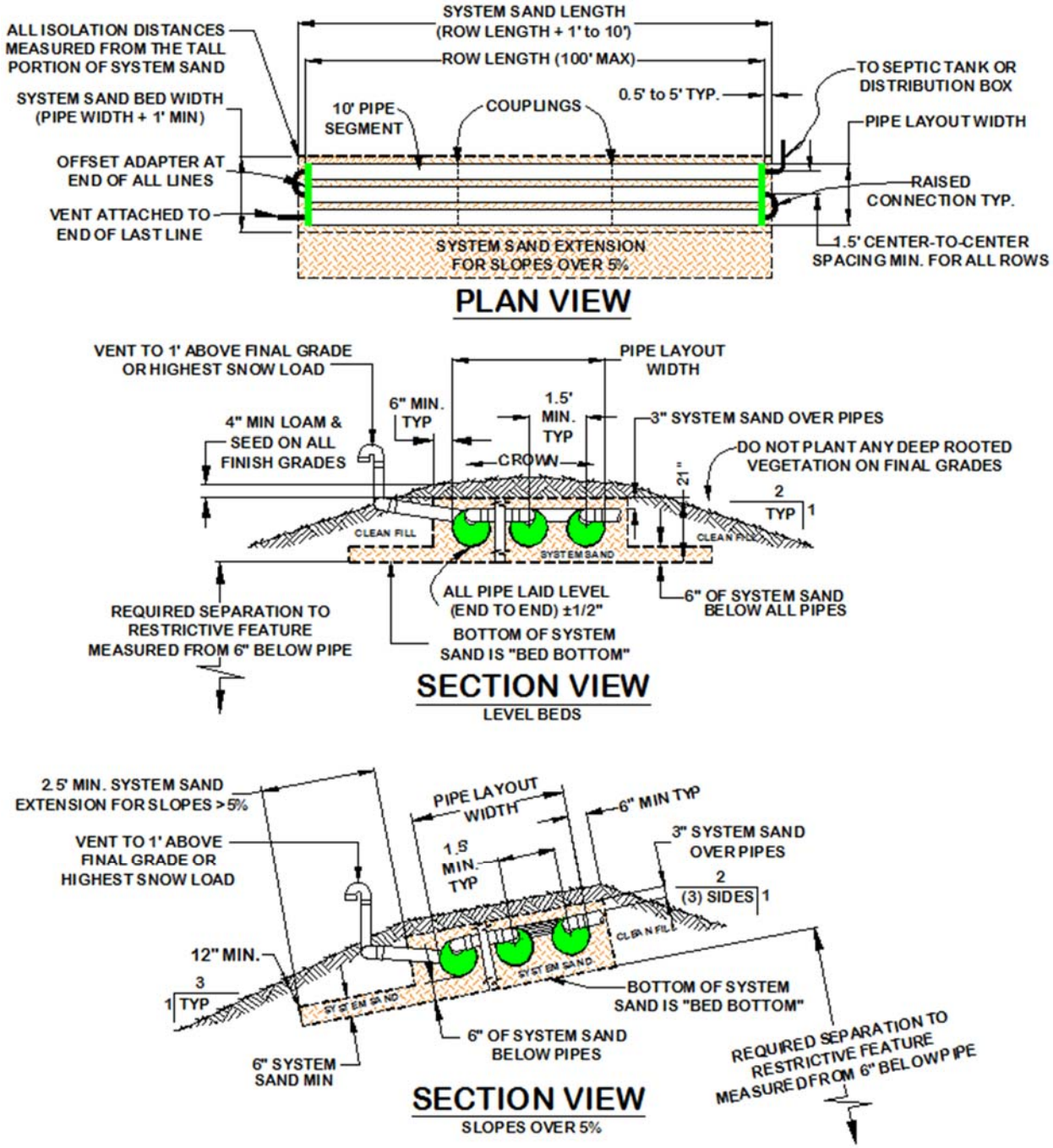
Stage 7: Effluent passes into the geo-textile fabrics and grows a protected bacterial surface.

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 System Diagram:



Notes:

1. All rows 1.5 ft center-to-center row spacing minimum
2. Rows centered in System Sand bed area if system slope is 5% or less
3. Rows grouped to up slope side of System Sand bed if system slope is over 5%
4. Venting is required for bed configurations
5. Differential venting required for all pump systems

4.0 Introduction

The purpose of this Manual is to provide general information regarding the design criteria, installation procedures and use and care instructions for the Presby Treatment System. Presby systems are extremely versatile and, as a result, this Manual cannot possibly set forth every conceivable system configuration. We encourage you to contact our Technical Advisors, who will be happy to address any questions or concerns unique to your project or assist you in designing a system for special applications.

4.1 Presby Environmental Standards

All systems using the Presby pipe must be designed and installed in compliance with the procedures and specifications described in this Manual. Exceptions to any requirements in this Manual require Presby Environmental, Inc. (PEI) approval.

4.2 Conflicts between Alabama Rules and this Manual

In the event of contradictions between this Manual and Alabama and/or local rules, PEI should be contacted for technical assistance.

4.3 Presby Certification required

PEI requires all designers and installers to be certified. Certification is obtained by completing the "Presby Certification Course" presented by PEI or its sanctioned representative. We offer a variety of certification training options, including online webinars and DVDs. Please visit our website, www.PresbyEnvironmental.com. Special note: PEI highly recommends that all individuals involved in the approval, permitting or inspection process also complete a certification course.

4.4 Technical Support

PEI provides technical support free of charge to all individuals using our products or involved in the permitting process. For any questions about our products or the information contained in this Manual, please contact us at (800) 473-5298, send an email to info@presbyeco.com or visit our website, www.PresbyEnvironmental.com.

4.5 Disclaimer

The technical support staff at Presby Environmental, Inc. is committed to providing comprehensive product information and support via telephone, website and email at no cost to our customers. The assistance we are able to provide in this way is based on limited information and therefore should be considered general in nature. Accordingly, Presby Environmental, Inc. disclaims any liability whatsoever in connection with providing technical support.

5.0 Presby System Components

5.1 Component Handling & Storage

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.

5.2 Advanced Enviro-Septic®, Enviro-Septic® and 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) AES only: Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
e) AES & ES only: Surrounded by a mat of randomly-oriented plastic fibers
f) Wrapped in a non-woven geo-textile fabric stitched in place
g) Exterior diameter of 12 in.
h) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
i) A 10 ft length of Presby pipe is flexible enough to bend up to 90°

5.3 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.

5.4 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 in. 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.

5.5 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.

5.6 Distribution Box

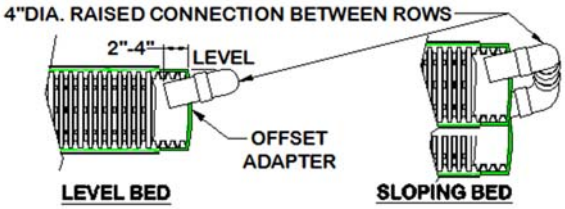
A Distribution Box, also called a "D-box," is a device used to distribute effluent coming from the septic tank in a system that contains more than one section or more than one bed. D-boxes are also sometimes used for velocity reduction. D-boxes come in various sizes and with a varying number of outlets. Concrete D-boxes are preferred, some are made of plastic. Flow equalizers 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.

5.7 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.

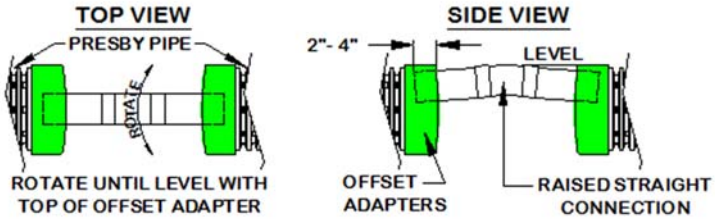
5.8 Raised Connection

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.



5.9 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.



5.10 Septic Tank

The Presby System is designed to treat effluent that has received "primary treatment" in a standard septic tank. Unless specified by State/local regulations, the septic tank capacity should be:

a) If a garbage disposal is utilized, follow the State's requirements regarding septic tank sizing. Commercial Systems in Alabama require septic tanks sized to provide a minimum of 48 hours retention time.
b) Septic tanks used with the Presby pipe 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 System.
c) 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 field.
d) 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.

5.11 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. A minimum of 6 inches of System Sand is placed below, 6 inches between and 3 inches over all the Presby pipes (see illustration in para. 3.0, p 3). The System Sand must extend 6 inches minimum around the perimeter of the Presby pipes. The sand bed may extend up to 5 ft beyond the ends of the Presby rows. System Sand 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)	

5.12 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.

6.0 Presby Pipe Required

a) Residential systems require 50 ft of Advanced Enviro-Septic®, Enviro-Septic® or Simple-Septic® pipe for every bedroom. Minimum system size is two bedrooms (50 ft x 2 = 100 ft of Presby pipe).
b) Commercial systems with normal strength effluent will be calculated at 3 gallons per day per foot of Presby pipe. Simple-Septic® should not be used to treat high strength effluent.

7.0 Table A: System Sand Bed Sizing

Percolation Rate minutes/inch (MPI)	Soil Group & USDA Textures	Bed Loading Rate (GPD/sq ft)
1-5	**Group 1**	1.80
6-10		1.67
11-15		1.52
16-20	**Group 2**	1.40
21-25		1.27
26-30		1.13
31-35	**Group 3**	1.05
36-40		0.96
41-45		0.87
46-50		0.714
51-55		0.714
56-60		0.714
61-65	**Group 4**	0. 536
66-70		0. 507
71-75		0. 481
76-80		0. 457
81-85		0. 436
86-90		0.417
91-240	**Group 4 & 5b**	**Per State Rules Appendix A, Tables 3 & 3a:** Field Sizing for Establishments or Large Flow Systems with Secondary Treated Effluent

8.0 Table B: System & Site Slope Limitations and Allowed Bed Configurations

Percolation Rate Minutes per Inch (MPI)	System Slope Max (%)	Site Slope Max (%)
15 or less	25%	33%
16-30	20%	25%
31-60	15%	20%
61-240	Level	10%

9.0 Table C: Row Length and Pipe Layout Width

		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	190	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	1050
	75	150	225	300	375	450	525	600	675	750	825	900	975	1050	1125
	80	160	240	320	400	480	560	640	720	800	880	960	1040	1120	1200
	85	170	255	340	425	510	595	680	765	850	935	1020	1105	1190	1275
	90	180	270	360	450	540	630	720	810	900	990	1080	1170	1260	1350
	95	190	285	380	475	570	665	760	855	950	1045	1140	1235	1330	1425
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
# of Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Spacing (ft)	1.50	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
	Pipe Layout Width ft														

Ex: 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 to find the pipe layout width for your spacing.

10.0 Design Procedure and Examples

Step #1: Calculate the minimum amount of Presby Pipe needed

a) Residential: multiply the number of bedrooms time 50 ft of Presby pipe per bedroom (two bedrooms minimum).
b) Commercial: systems with normal strength effluent are calculated by dividing the daily design flow by 3 GPD/ft of Presby pipe (contact Technical Support for high strength wastewater). Simple-Septic® should not be used to treat high strength effluent.

Step #2: From Table A: find the Bed loading rate using the percolation rate or soil's texture and calculate the minimum System Sand bed Area (SSBA): divide the daily design flow (GPD) by the Bed loading rate (each bedroom is calculated at 150 GPD).

Step #3: From Table B: choose an allowable system slope and bed configuration using the soils percolation rate.

Step #4: Calculate the minimum number of serial sections required (does not apply to Parallel configuration or systems with a percolation rate over 60 MPI): divide the daily design flow by 600 GPD (round up to nearest whole number).

Step #5: Select a row length suitable for the site

a) Select a row length and then calculate the number of rows required (round up to whole number).
b) The number of rows must be evenly divisible by the number of serial sections required (add rows as necessary).

Step #6: Choose a System Sand bed length that is:

a) At least the row length from Step #5 plus one ft
b) No longer than the row length from Step #5 plus 10 ft

Step #7: Find the Pipe Layout Width (PLW) from Table C using a 1.5 ft minimum center-to-center row spacing (larger spacing allowed, but not required).

Step #8: Calculate the minimum System Sand Bed Width (SSBW) by dividing the System Sand Bed Area from Step #2 by the System Sand bed length Step #6.

Step #9: Verify the minimum SSBW from Step #8 will cover all the rows in the Presby bed:

a) Beds sloping 5% or less: If the minimum SSBW is less than the (PLW + 1 ft), use (PLW + 1 ft) as the new minimum SSBW.

b) Beds sloping > 5%: If the minimum SSBW is less than the (PLW + 3.5 ft), use (PLW + 3.5 ft) as the new minimum SSBW.

Step #10: Calculate System Sand Extension(s):

a) Level Beds: System Sand Extension (SSE) are placed on each side of Presby Pipes = [SSBW – (PLW + 1)] ÷ 2. There will be no SSE's if the SSBW = (PLW +1 ft).

b) Sloping Beds: the SSE is placed entirely on the down slope side of the bed = SSBW – (PLW + 1) and must be at least 2.5 ft (3 ft from the edge of the Presby Pipe) if system slope is > 5%.

10.1 Design Example #1 – Basic Serial System

Single family residence, (4) bedrooms (600 GPD), percolation rate of 12 MPI, level site, serial distribution layout, system entirely below original grade.

Step #1: Presby pipe required = (4) bedrooms x 50 ft / bedroom = 200 ft minimum

Step #2: Bed loading rate from Table A = 1.52 GPD/ft²; SSBA = 600 GPD ÷ 1.52 GPD/ft² = 395 ft² minimum.

Step #3: Table B allows up to 25% system slope for 12 MPI, however our system will be level

Step #4: Serial sections required: not required for daily flows of 600 GPD or less

Step #5: Using a row length of 50 ft requires four rows (200 ft ÷ 50 ft = 4 rows)

Step #6: System Sand bed length (longer beds are preferred to shorter beds):

Minimum = 50 ft row length + 1 ft = 51 ft

Maximum = 50 ft row length + 10 ft = 60 ft

Use 51 ft as the sand bed length.

Step #7: Table C shows a Pipe Layout Width (PLW) of 7 ft when using 50 ft long rows spaced at 2 ft center-to-center.

Step #8: Minimum SSBW = 395 ft² ÷ (50 ft + 1 ft) = 7.75 ft.

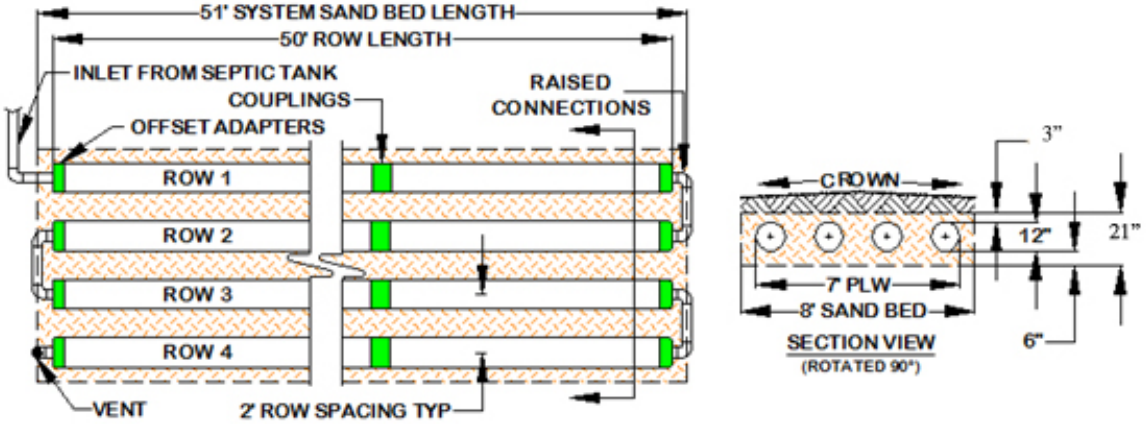
Step #9: a) 8 ft SSBW is greater than 7.75 ft; use 8 ft as the minimum SSBW. Please note that if the minimum 1.5 ft center-to-center row spacing had been use it would have created very small System Sand extensions; increasing the row spacing to 2 ft eliminated the need for System Sand extensions. An alternate method is to increase the System Sand bed length and use a 1.5 ft row spacing.

b) Not required.

Step #10: a) there are no System Sand extensions because the System Sand bed width from Step #9 is greater than 7.75 ft calculated in Step #8.

b) Not required.

Illustration of Design Example #1, Basic Serial Distribution:



Alternate bed configuration: (5) 40 ft rows @ 2 ft spacing; sand bed = 10 ft wide x 41 ft long; 4.1 L/W ratio

10.2 Design Example #2 – Combination System

Commercial system using 1,000 GPD, normal strength effluent, 35 MPI soils, 10% sloping terrain, use sloping bed if possible, system entirely below grade

Step #1: Presby pipe required = 1,000 GPD ÷ 3 GPD/ft = 334 ft minimum

Step #2: Bed loading rate from Table A = 1.05 GPD/ft²; SSBA = 1,000 GPD ÷ 1.05 GPD/ft² = 953 ft² minimum.

Step #3: Table B allows up to 15% system slope for 35 MPI, our system will match site slope of 10%

Step #4: Serial sections required: 1,000 GPD ÷ 600 = 1.7, round up to 2

Step #5: a) Using a row length of 85 ft requires four rows (334 ft ÷ 85 ft = 3.93, round up to 4 rows)

b) 4 rows ÷ 2 serial section = 2 rows per section

Step #6: System Sand bed length (longer beds are preferred to shorter beds):

Minimum = 85 ft row length + 1 ft = 86 ft

Maximum = 85 ft row length + 10 ft = 95 ft

Use 86 ft as the sand bed length.

Step #7: Table C shows a Pipe Layout Width (PLW) of 5.5 ft when using 85 ft long rows spaced at 1.5 ft center-to-center.

Step #8: Minimum SSBW = 953 ft² ÷ (85 ft + 1 ft) = 11.1 ft minimum.

Step #9: a) 11.1 ft SSBW is greater than 6.5 ft (5.5 ft + 1 ft); use 11.1 ft as the minimum SSBW.

b) Bed is sloping over 5% so verify 11.1 ft SSBW is equal to or greater than (PLW + 3.5); 5.5 +3.5 = 9 ft; the System Sand bed width does not need to be increased.

Step #10: a) not applicable (using sloping bed)

b) System Sand extension is placed entirely on down slope side of field and is = 11.1 ft – (5.5 PLW + 1 ft) = 11.1 ft – 6.5 ft = 4.6 ft

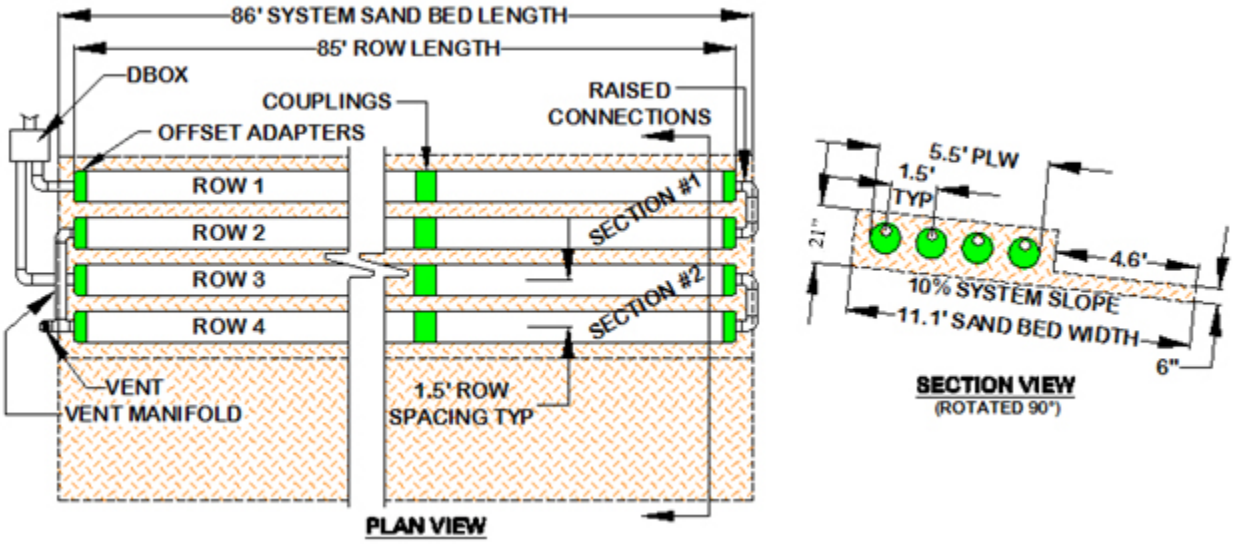


Illustration of Design Example #2, Combination System:

11.0 Design Criteria

11.1 Presby Pipe Requirements

a) For Advanced Enviro-Septic® only: 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) For Enviro-Septic® and Simple-Septic® only: the sewn seam does not have to be placed in the 12 o'clock position, it may be placed in any rotational orientation.

c) Advanced Enviro-Septic® pipe may be substituted for Simple-Septic® or Enviro-Septic® pipe, however, SS or ES may not be substituted for AES without the approval of the designer. The design must be revised to show this change.

d) Venting is always required.

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.

11.3 Bed Bottom

The bed bottom for any Presby field is measured at 6 inches below the Presby pipes. This is also known as the infiltrative surface and interfaces with either the natural subsoils or suitable sand fill (see illustrations in para. 3.0 on page 3).

11.4 Bed Separation Distances
Bed separation distances are measured to the edge of the Presby pipe. Horizontal bed separation distances shall be per state rules.

11.5 Below Grade (In-Ground) Bed Systems
When there are no restrictive features to force the construction of an elevated bed, a Presby system may be placed below grade, however the bed bottom may not be constructed at the original grade. Often times a below grade system may have portions of the bed extending above the original grade. When this happens suitable fill and topsoil must be used to cover the field. See para. 11.17 on page 11 for "Side Slope Taper" requirements when this happens and the illustrations in para. 3.0 on page 3.

11.6 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.

11.7 Daily Design Flow
Residential daily design flow for Presby Systems is calculated in accordance with State rules. Systems servicing more than two residences shall use the Commercial portions of all sizing tables. The minimum daily design flow for any single-family residential system is two bedrooms and 300 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 use for commercial systems, PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of 2 to 3 times.
d) 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.

11.8 Elevated Bed Systems (Mounds)
Elevated bed systems are not allowed by the current onsite rules in Alabama and will be required to comply with 420-3-1-.88 Hardship Variance. Elevated Presby Beds are designed for sites with soil, depth to groundwater or restrictive feature constraints that do not allow for In-Ground Bed Systems. An elevated bed system is a soil absorption field with the bed bottom located at least 6 inches above the original grade. Bed bottom elevations from the original grade to less than 6 inches above the original grade are not allowed. Elevated bed systems require side-slope tapering of the fill and topsoil covering the bed. These must conform to the requirements of para. 11.17 on page 11 (see illustrations in para. 3.0 on page 3).

11.9 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. 19.15.0, page 14).

11.10 Fill Extensions for Elevated (Mound) Systems
If any portion of the bed extends above the original grade, the fill covering the field cannot begin the required side slope taper for a distance of 6 inches minimum from the outmost edge of any Presby Pipe.

11.11 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.

11.12 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.

11.13 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.

11.14 Presby Pipe Requirement

Presby Systems use the same bed sizing tables, pipe and installation requirements noted in this manual with the exception that Advanced Enviro-Septic® must always have the sewn seam placed in the 12 o'clock position. See Section 11.1, on page 9 for additional Advanced Enviro-Septic® requirements. Presby Pipe requirements are as follows and require a 1.5 ft minimum row spacing:

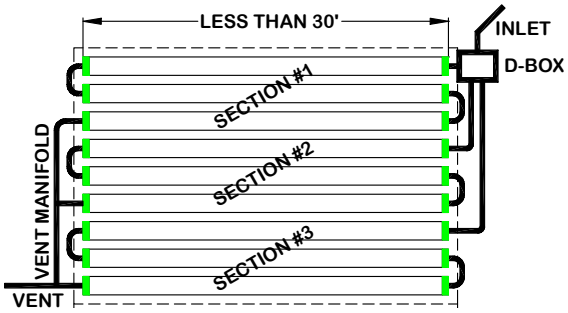
a) Residential systems: 50 ft per bedroom
b) Commercial systems: 3 GPD/ft (normal strength effluent). Simple-Septic® should not be used to treat high strength effluent. Contact PEI for high strength wastewater recommendations (see para. 11.23, page 12).

11.15 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.

11.16 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 Parallel 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.
e) Center-to-Center Spacing is 1.5 ft min. for all systems. Row spacing may be increased to accommodate greater basal area spacing requirements.
f) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing.
g) 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.
h) 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.
i) Illustration of row lengths less than 30 ft:



11.17 System Side Slopes (Side Slope Tapers)

Side slope tapering begins 6 inches from the edge of the Presby Pipe and is to be no steeper than 2:1. If the bed slopes, a 3:1 side slope taper is to be used on the down slope side of the field. Always maintain 12 inches of material cover over the end of any System Sand extension (if present). See paragraph 3.0, page 3 for illustration.

11.18 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.

11.19 Sloping Sites and Sloping Mound Systems

a) The percentage of slope in all system drawings refers to the slope of the Presby System, <u>not</u> 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 para. 16.3, page 15).
c) Maximum site slope is 33% and maximum system slope is 25% (without a State waiver).

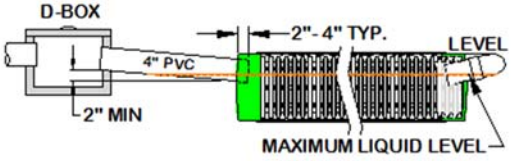
11.20 System Sand Bed Height Dimension

The height of a Presby Sand Bed measures 21 in. minimum (not including cover material):

a) 6 in. minimum of System Sand below the Presby Pipe; and
b) 12 in. diameter of the pipe; and
c) 3 in. minimum of System Sand above the Presby Pipe.
d) When a bed slopes over 5%, a minimum 2.5 ft System Sand Extension area is required and is to be a minimum of 6 in. deep.

11.21 Two Inch Rule

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



11.22 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.

11.23 Wastewater Strength

The Presby pipe requirement for Bed 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). Designing a system that will treat higher strength wastes requires additional Advanced Enviro-Septic® or Enviro-Septic® Presby pipe. Simple-Septic® pipe cannot be used to treat high strength wastewater. In these situations, consult our Technical Advisors at (800) 473-5298 for recommendations.

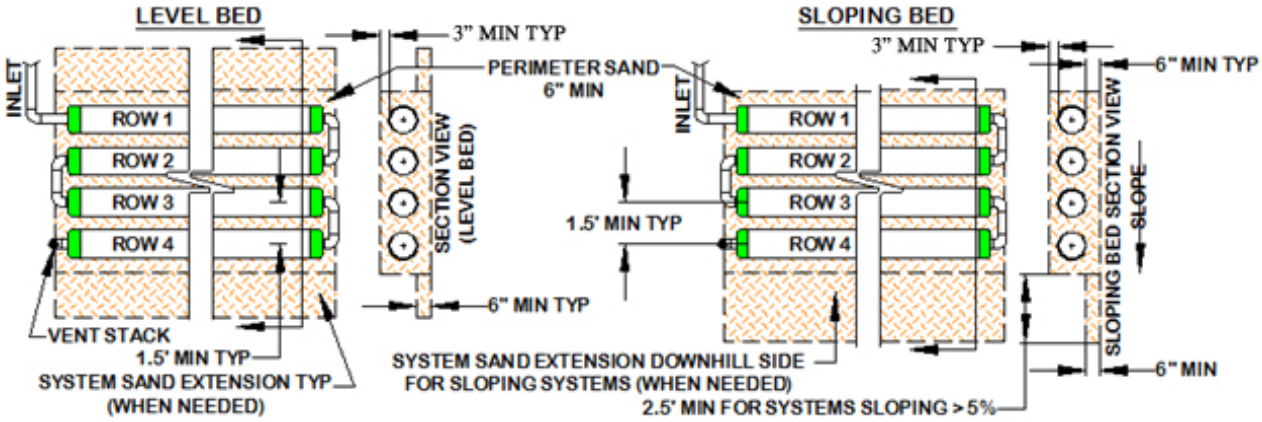
11.24 Water Purification Systems

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

Presby 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:

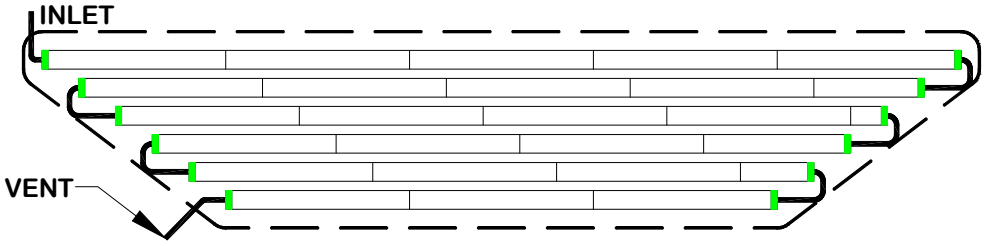
a) May be used for single beds of 600 GPD or less.
b) Basic Serial distribution incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Flow Equalizers are not required for Basic Serial systems because they do not divide flow to the bed.
e) For sloping beds a System Sand Extension (if needed/required) is placed entirely on the downhill side and must be at least 2.5 ft for beds that slope over 5%.
f) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
g) Illustrations of Basic Serial Systems:



Note: Basic Serial distribution is installed with a series of Presby rows connected at the ends with Raised Connections, using Offset Adapters and Schedule 20 to 40 PVC pipe.

12.1 Trapezoidal Basic Serial System – Unique Configuration

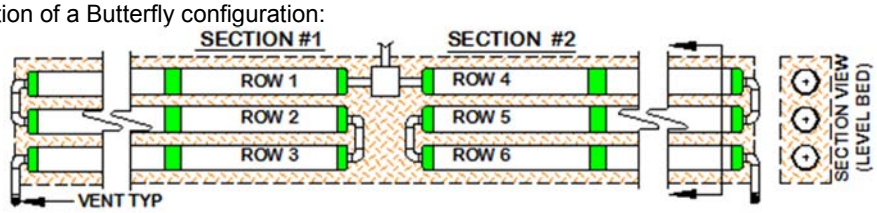
Basic serial systems may have rows of varying length to meet specific site constrains. These configurations are allowed in soils with a percolation rate of 1 – 60 MPI.



12.2 Butterfly Configuration

a) A "butterfly configuration," is considered a single bed system with two or more sections (can also be Parallel D-Box or Combination configurations).
b) Maximum length of any row is 100 ft.

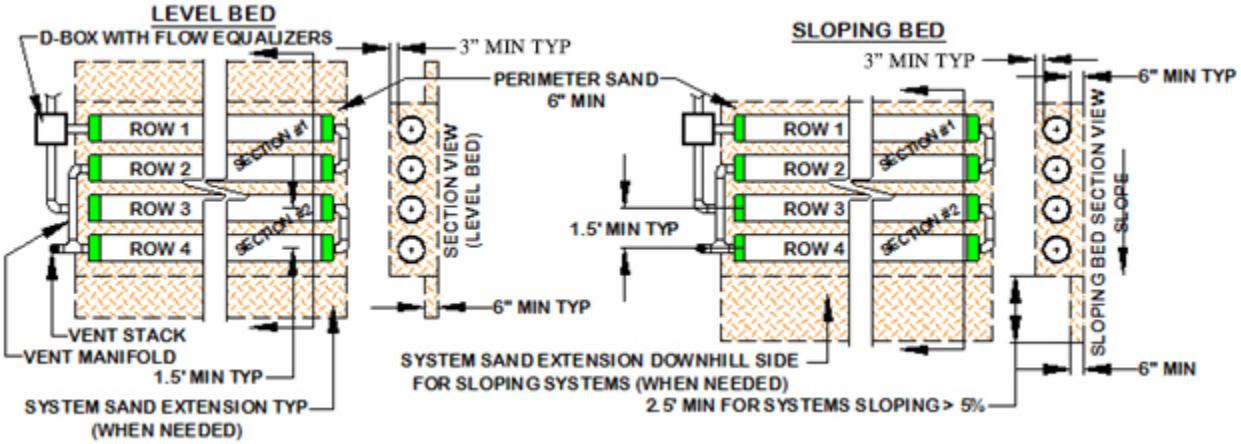
c) Serial Section loading limit is 600 GPD (only applies to serial systems and not Parallel D-Box configuration).
d) Beds can contain any number of serial sections or rows.
e) Level beds: System Sand extensions (if needed) are placed equally on both sides of the Presby pipes. This will place all the rows in the middle of the System Sand bed area.
f) Sloping beds: System Sand extension is placed entirely on downhill side of bed. If bed slopes greater than 5%, the System Sand extension must be at least 2.5 ft.
g) Illustration of a Butterfly configuration:



13.0 Combination Serial Distribution

Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 600 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 600 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) Serial Section loading limit is 600 GPD.
e) There is no limit on the number of Combination Serial Sections within a bed.
f) For sloping systems: the System Sand Extension (if required) is placed entirely on downhill side of bed (as shown in the illustration below).
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 in illustration).
h) Combination systems require the use of an adequately sized D-Box.
i) Illustrations of Combination Serial Systems (two sections shown):



13.1 Section Loading

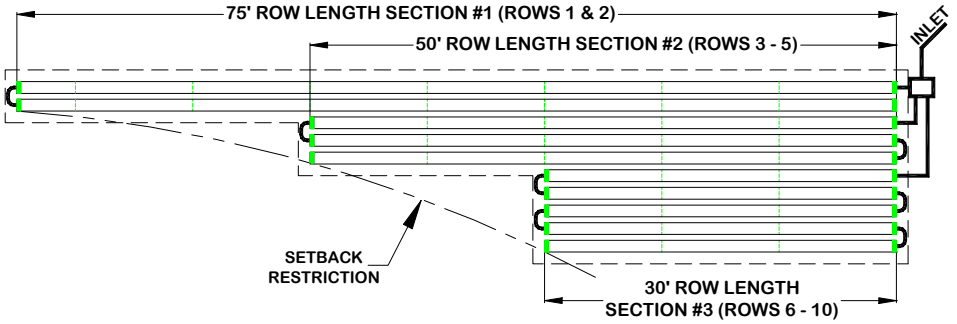
Each section in a Combination Serial system has a maximum daily design flow of 600 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 750 GPD requires (750 ÷ 600) = 1.25 (rounding up to nearest whole number = 2 sections minimum). Combination systems are only required if the daily design flow exceeds 600 GPD. Section loading does not apply to the Parallel (D-Box) configuration where each row is individually connected to the distribution box.

13.2 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.

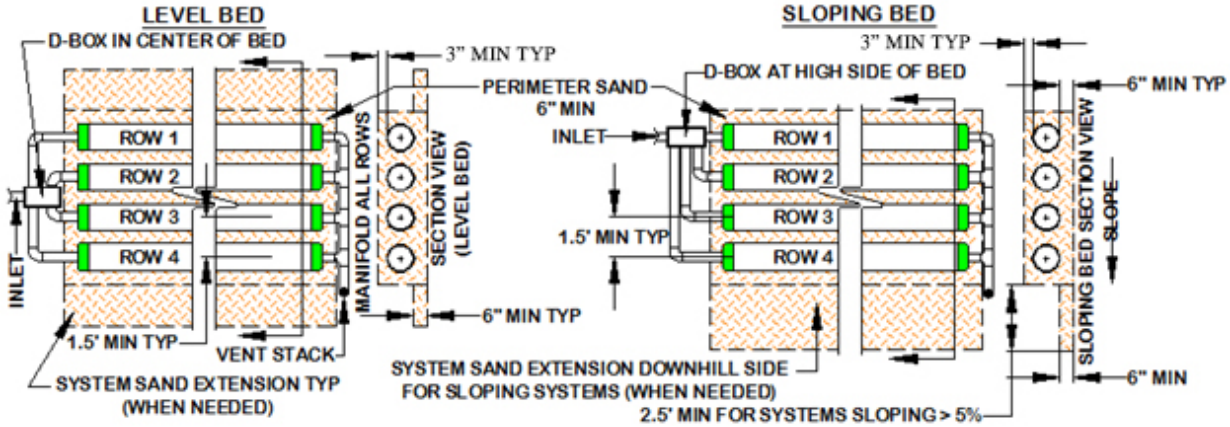
13.3 Varying Length Combination Serial Configuration

Row lengths can be varied within a single bed to accommodate site setback restrictions. These configurations are limited to soils with a percolation rate of 1 – 60 MPI. Illustration (venting not shown):



14.0 Parallel (D-Box) Distribution

a) All rows in this configuration must be the same length.
b) Flow equalizers must be used in all D-Box outlets feeding rows.
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 in. min. drop is required between the D-box outlets and the Presby Pipe inlets.
h) Level beds: System Sand extensions (if required) are divided equally to both sides of the Presby rows.
i) Sloping beds: System Sand Extension (if required) placed entirely on downhill side of bed. The System Sand extension must be at least 2.5 ft if the bed slopes over 5%.
j) Illustrations for D-Box (Parallel) Distribution:



15.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds, 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 place down slope of another. Bed separation distance is measured from pipe-to-pipe.

Illustration of End-to-End Multiple Beds:

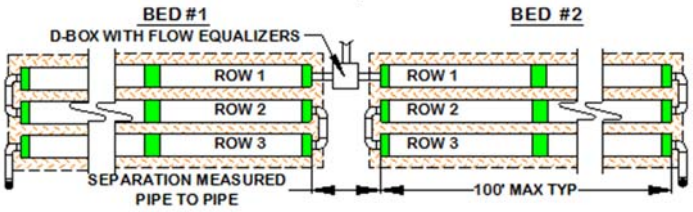
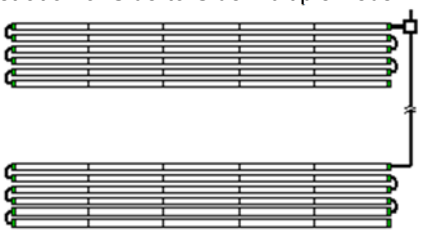
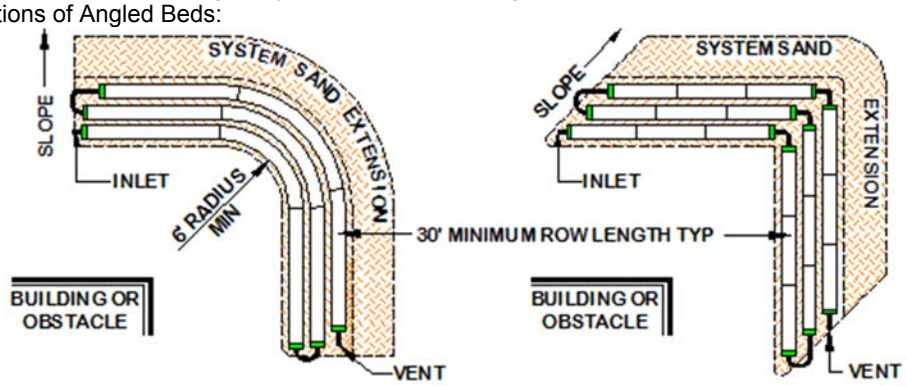


Illustration of Side-to-Side Multiple Beds:

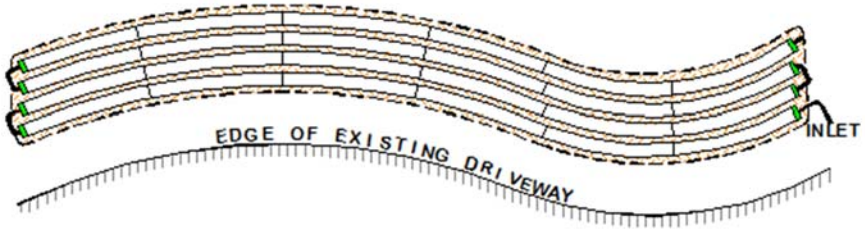


16.0 Unique Site Solutions (1 – 120 MPI)
These configurations may be used to accommodate site constraints in soils with a percolation rate of 1 – 120 MPI.

16.1 Angled Beds
Angled configurations generally have one or more specific bends, but the rows should follow the contour of the site as much as possible. Rows are angled by bending pipes or through the use of offset adapters. A 10 ft length of Presby Pipe may be bent up to 90°. The angled system shown on the right in the illustration requires 30 ft minimum row lengths. Illustrations of Angled Beds:



16.2 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.



16.3 System Sand Extension Sloping Beds
Sloping beds group the Presby rows within 6 inches of the high side of the sand bed area. If a System Sand extension is required due to sand bed area requirements, it is placed entirely on the down slope side of the field and is required to be only 6 inches thick. For Systems sloping more than 5%, a System Sand extension must extend at least 2.5 ft beyond the tall portion of the System Sand bed on the down slope edge of the bed (3 ft when measured from the Presby pipe). See illustration in para. 3.0 on page 3.

16.4 System Sand Extension In-Ground Bed Systems
Presby Systems installed below existing grade for sites with no soil restrictive features to limit placement. In-Ground systems that slope over 5% require a 2.5 ft System Sand extension on the downhill side of the field (see illustration in para. 3.0 on page 3).

16.5 Multiple Slopes in Single Bed
Multiple slopes within a single Presby System are easily accommodated. If any portion of the system slopes greater than 5%, pipes are grouped on the up-slope side of the System Sand bed, and there must be at least 3 ft. of System Sand beyond the last Presby Pipe row on the down-slope side.

17.0 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.

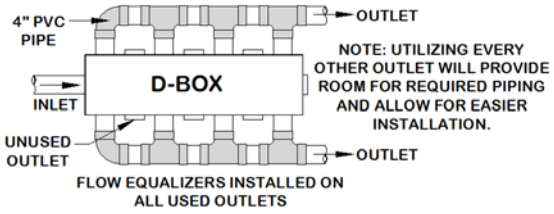
17.1 Alarm
States require all pump systems to have a high water alarm float or sensor installed inside the pump chamber.

17.2 Differential Venting
All pump systems must use differential venting (see illustration, para. 19.4, page17).

17.3 Distribution Box
All pump systems require a distribution box with some means of velocity reduction, see para. 17.5, for the effluent entering the D-Box.

17.4 Distribution Box Manifold

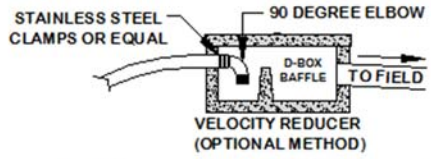
A manifolded distribution box joins several outlets to help divide flow more accurately. Dividing flow to multiple beds is a common use of manifolded D-boxes. All outlets delivering effluent to the Presby field must have a flow equalizer. Do not place an equalizer on vent outlets.

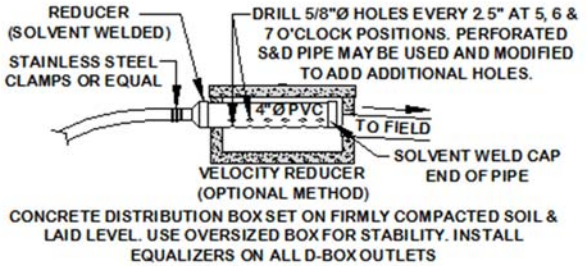


17.5 Velocity Reduction

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 below).





17.6 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.

17.7 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.

17.8 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.

18.0 System Sand Requirements for All Beds

It is critical to the proper functioning of Presby System's that the proper amount and type of System Sand be installed. See para. 5.11, on page 6 for complete System Sand specifications.

18.1 Quantity of System Sand

System Sand is placed a minimum of 6 inches below, 3 inches above and 6 inches between the Presby Rows and a minimum of 6 inches horizontally around the perimeter of the Presby rows (see illustrations in para. 3.0 on page 3.0).

18.2 Sand Fill

Sand fill is used to raise the elevation of the system in order to meet the required separation distance from the SHWT or other restrictive feature. It can also be used in the construction of side slope tapers, but is only required directly below the System Sand bed bottom. This sand shall be clean sand, free of topsoil, organic matter or debris and containing no stones larger than 6 inches. System Sand may be used in place of sand fill; however, this may increase material costs.

19.0 Venting Requirements

An adequate air supply is essential to the proper functioning of Presby Systems. Venting is required for all Presby beds. High and low vents are required for all systems. The roof (house plumbing) vent is the “high vent” in gravity systems.

19.1 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.

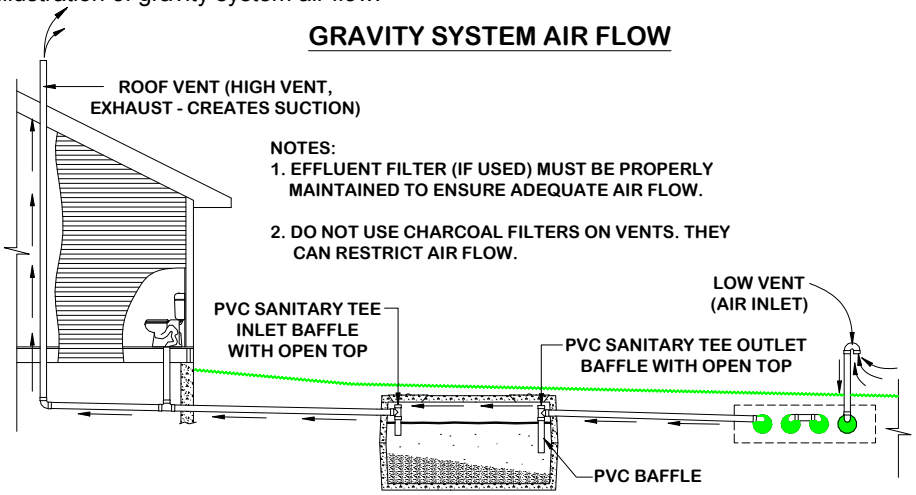
c) One 4 inch vent is required for every 1,000 ft of Presby Pipe.
d) A single 6 inch vent may be installed in place of up to three 4 inch vents.
e) If a vent manifold is used, it must be at least the same diameter as the vent(s).
f) When venting multiple beds, it is preferred that each bed be vented separately rather than manifolding bed vents together.
g) Schedule 40 PVC or equivalent should be used for all vent stacks.
h) Remote Venting may be utilized to minimize the visibility of vent stacks.

19.2 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.

19.3 Vent Locations for Gravity Systems

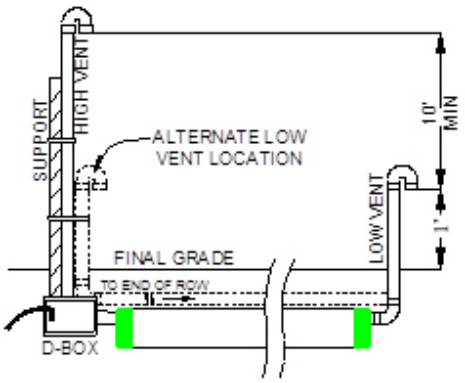
a) A low vent through an offset adapter is installed at the end of the last row of each section or the end of the last row in a Basic Serial bed, or at the end of each row in a D-Box Distribution Configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
b) The 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.

19.4 Pump System Vent Locations

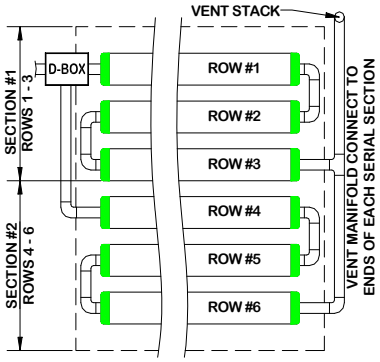
a) A low vent is installed through an offset adapter at the end of each section, Basic Serial bed or attached to a vent manifold.
b) A high vent is installed through an unused distribution box outlet.
c) A 10 ft minimum vertical differential is required between high and low vent openings.
d) When venting 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 vent may be attached to the D-box and the high vent attached to the end of the last row (or manifold) only when the D-box is insulated against freezing.
f) See Remote Venting (para. 19.7, page 18) and Bypass Venting (para. 19.8, page 19) for options to relocate or eliminate the High Vent.



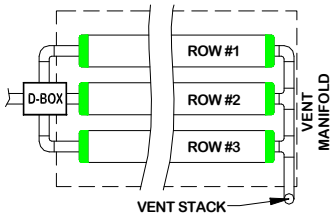
19.5 Vent Manifolds

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. See diagrams on next page.

Combination system:



D-Box system:



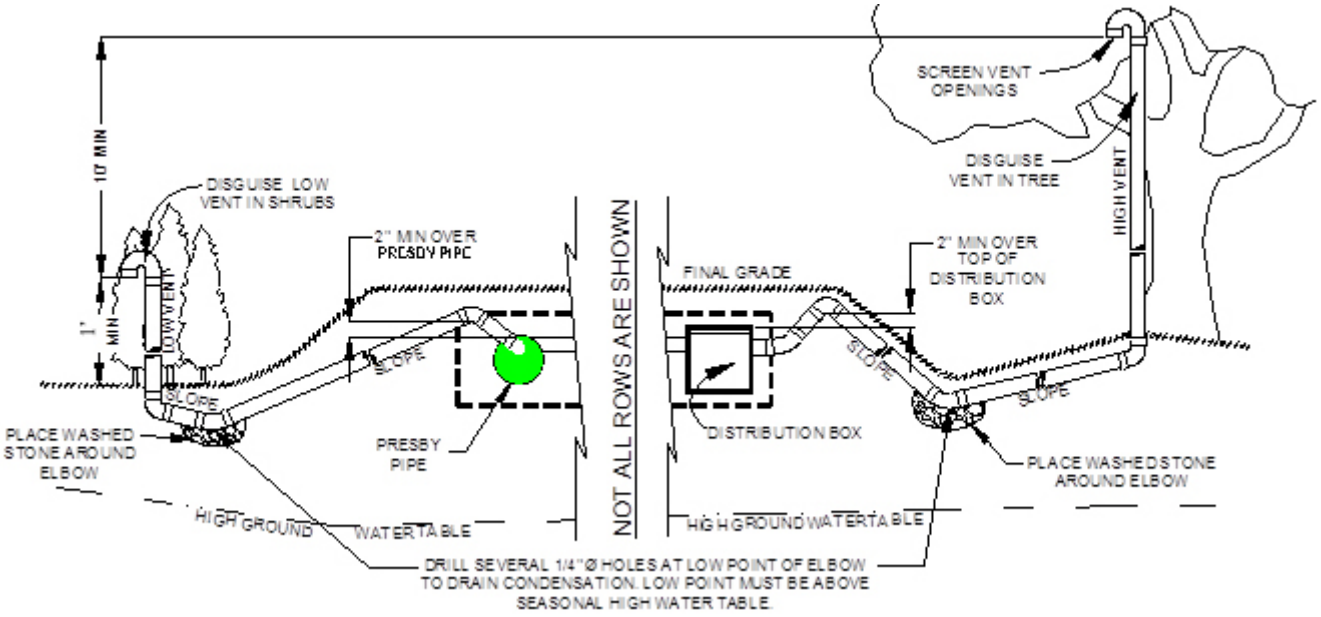
19.6 Vent Piping Slope

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

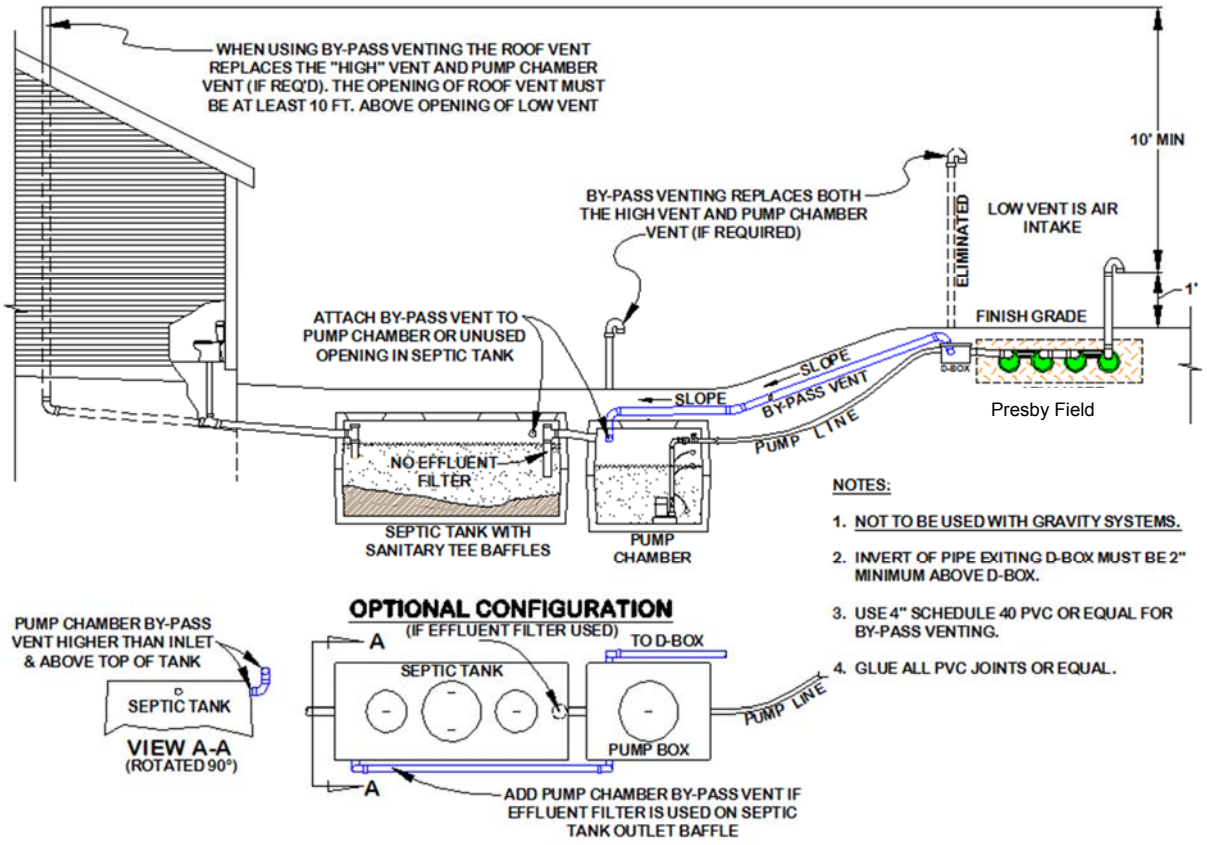
19.7 Remote Venting

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.)



19.8 By-Pass Venting



20.0 Site Selection

20.1 Determining Site Suitability
Refer to State Rules regarding site suitability requirements.

20.2 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.

20.3 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.

20.4 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.

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

20.6 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.

20.7 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.

20.8 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.

21.0 Installation Requirements, Component Handling and Site Preparation

21.1 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.

21.2 Critical Reminder 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.

21.3 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.

21.4 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.

21.5 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.

21.6 Organic and Topsoil Material Removal

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

21.7 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. 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").

21.8 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 inches 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 or travel down slope of a sloping field due to wheel compaction of underlying soil structures.

21.9 Presby Row Installation

a) Install a minimum of 6 in. of System Sand to the elevation where the bottom of Presby pipes will be, and install the sand on side slope tapering to allow machinery movement around the perimeter of the system. Rake the System Sand where the Presby pipes will be installed so it is as level as possible before placing pipes on the System Sand. This will make it easier to level the pipe rows.
b) Locate Presby rows horizontally to tie points on site.
c) Locate Presby rows vertically using a laser level or transit. Lift or lower the pipes at couplings using a hand shovel and adding or removing System Sand as necessary.
d) Drop System Sand along each row of couplings being careful to avoid moving the rows.
e) Add or remove System Sand along rows to level. The rows may be raised by straddling them and pushing additional System Sand below the pipes with your feet. A hand shovel may be scraped along the System Sand below the pipes to remove a small amount if needed.
f) Re-check horizontal and vertical locations. Re-check that pipes are level to within 1 in. end-to-end.
g) Add System Sand between and around the Presby pipes, leaving the uppermost surface of the pipe exposed to allow for system inspection (if required by local approving authority).

21.10 Distribution Box Installation

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

21.11 Level Row Tolerances

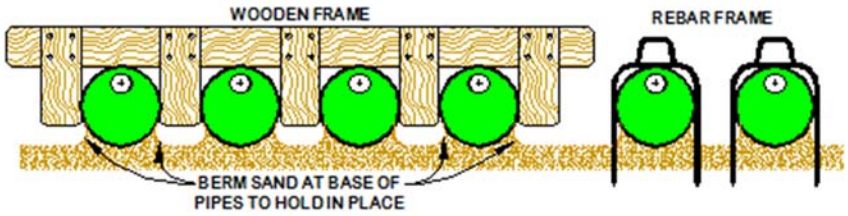
Use a laser level or transit to install rows level. Variations beyond 1 in. (±1/2") may affect system performance and are not acceptable.

21.12 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). Enviro-Septic® and Simple-Septic® pipe have no rotational orientation (sewn seam in any position).

21.13 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.



21.14 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. 5.6, page 5). Glue or mechanically fasten all pipe connections.

21.15 Backfilling Rows

a) Spread System Sand between the rows.
b) If using AES, 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.

21.16 Backfilling and Final Grading

Spread System Sand to a minimum of 3 inches over the pipe and a minimum of 6 in. 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.

21.17 System Soil Cover Material
A minimum of 4 in. 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. Crown topsoil over level fields to shed water off the top of the system.

21.18 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. Mulch may also be placed over topsoil to stabilize final grades.

21.19 Final Grading
Final grading of the entire site should redirect surface water flows so that they do not collect in the system bed area. The system bed must slope or have a crown to ensure that surface water runoffs do not collect on the system. Systems should not be located where lawn irrigation, roof drains, or natural flows increase water loading to the soils around the system.

21.20 Trees and Shrubs
No trees or shrubs should be located on or within 10 ft. of the system perimeter (including side slope tapering) to prevent roots from growing into and damaging the system. If the system includes a perimeter drain, there should be no trees or shrubs planted closer than 10 ft. from the location of the perimeter drain. Do not plant gardens for human consumption in the vicinity of or on the wastewater treatment system.

22.0 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.

22.1 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.

22.2 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.

23.0 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.

23.1 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.

24.0 Operation & Maintenance

24.1 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.

24.2 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) Antibiotic 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.

24.3 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.

24.4 Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation to within a minimum of 10 ft of the system, 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.

25.0 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.

25.1 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®.

25.2 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, 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 and must always be oriented up to place the Bio-Accelerator® fabric at the bottom. Pipes are joined together with couplings to form rows. Advanced Enviro-Septic® is a combined wastewater treatment and dispersal system.

25.3 Enviro-Septic® (ES) Pipe

A single unit comprised of corrugated plastic pipe which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric, is 10 ft in length, with an outside diameter of 12 in. and a storage capacity of approximately 58 gallons. Each foot of Enviro-Septic® provides over 25 sq ft of total surface area for bacterial activity. A white tag is sewn into the seam indicating the product is Enviro-Septic® pipe. Unlike Advanced Enviro-Septic®, the sewn seam may be placed in any orientation. Pipes are joined together with couplings to form the rows. Enviro-Septic® is a combined wastewater treatment and dispersal system.

25.4 Simple-Septic® (SS) Pipe

A single unit comprised of corrugated plastic pipe which is surrounded by a single layer of sewn geo-textile fabric, is 10 ft in length, with an outside diameter of 12 in. and a storage capacity of approximately 58 gallons. Each foot of Simple-Septic® provides over 15 sq ft of total surface area for bacterial activity. A white tag is sewn into the seam

indicating the product is Simple-Septic® pipe. Unlike Advanced Enviro-Septic®, the sewn seam may be placed in any orientation. Pipes are joined together with couplings to form rows. Simple-Septic® 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. Each foot of Simple-Septic® pipe provides over 15 sq ft of total surface area for bacterial activity.

25.5 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 12).

25.6 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. 12.2, page 12).

25.7 Center-to-Center Row Spacing
The distance from the center of one Presby Row to the center of the adjacent row and must be at least 1.5 ft.

25.8 Coarse Randomized Fiber
A mat of coarse, randomly-oriented fibers (AES & ES only) 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).

25.9 Combination Serial Distribution
Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 600 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 600 GPD or less. See Combination Serial Distribution, para. 12.2, on page 12.

25.10 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).

25.11 Coupling
A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.5.5, page 5).

25.12 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.”

25.13 Differential Venting
A method of venting a Presby System utilizing high and low vents (see para. 19.2, page 17).

25.14 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. 17.5, page 16.

25.15 D-Box Distribution (Parallel) 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. 14.0, page 14.

25.16 Distribution Box Manifold
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 17.4, on page 16.

25.17 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. 15.0, page 14 and illustration on page 14.

25.18 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet.

25.19 GPD and GPM
An acronym for Gallons per Day and Gallons per Minute respectively.

25.20 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 19.0, page 16.

25.21 High Strength Effluent
High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (CBOD) and total suspended solids (TSS) in excess of two-hundred and forty (240) mg/L.

25.22 MPI
An acronym for Minutes per Inch and is the numerical value by which percolation rates (also called "perc rates") are expressed.

25.23 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 par. 15.0, page 14).

25.24 Offset Adapter
A plastic fitting with a 4 in. hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 5.3, page 4).

25.25 Percolation Rate
Also known as Perc Rate, is a numerical indication of a soil's hydraulic capacity, expressed in minutes per inch (MPI.)

25.26 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.

25.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 17.0, page 15).

25.28 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. 5.6, page 5.

25.29 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 (see illustration in para. 5.8 on page 5).

25.30 Row / Presby Row
Consists of a number of Presby Pipe sections connected by couplings with an Offset Adapter on the inlet end and an Offset Adapter on the opposite end. Rows are typically between 30 ft and 100 ft long (see Row Requirements in para. 11.16, page 11).

25.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 18.2, page 16. 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.

25.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 600 GPD daily design flow maximum.

25.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in para. 12.0, page 12. Combination Serial distribution is described in detail in para. 12.2, page 12.

25.34 SHWT
An acronym for **S**easonal **H**igh **W**ater **T**able.

25.35 Skimmer Tabs
Projections into the AES, ES and SS pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

25.36 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another (See para. 15.0, page 14 and illustration on page 14).

25.37 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 three (3) horizontal feet (run) over an elevation difference of one (1) ft (rise).

25.38 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).

25.39 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.

25.40 Surface Diversion
A natural or manmade barrier that changes the course of water flow around an onsite system’s soil absorption field.

25.41 System Sand Bed
System Sand bed area required/used in Presby Systems. The System Sand bed extends a minimum of 6 inches below, 3 inches above and 6 inches horizontally from the outside edges of the Presby Pipes.

25.42 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. 18.0, page 16).

25.43 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep (see illustration in para. 16.3, page 15). A System Sand extension area is required on the down slope side of systems sloping more than 5% and extends a minimum of 2.5 ft beyond the edge of the System Sand (see illustration in para. 16.3, page 15).

25.44 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.

25.45 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 (see illustration in para. 17.5, page 16).