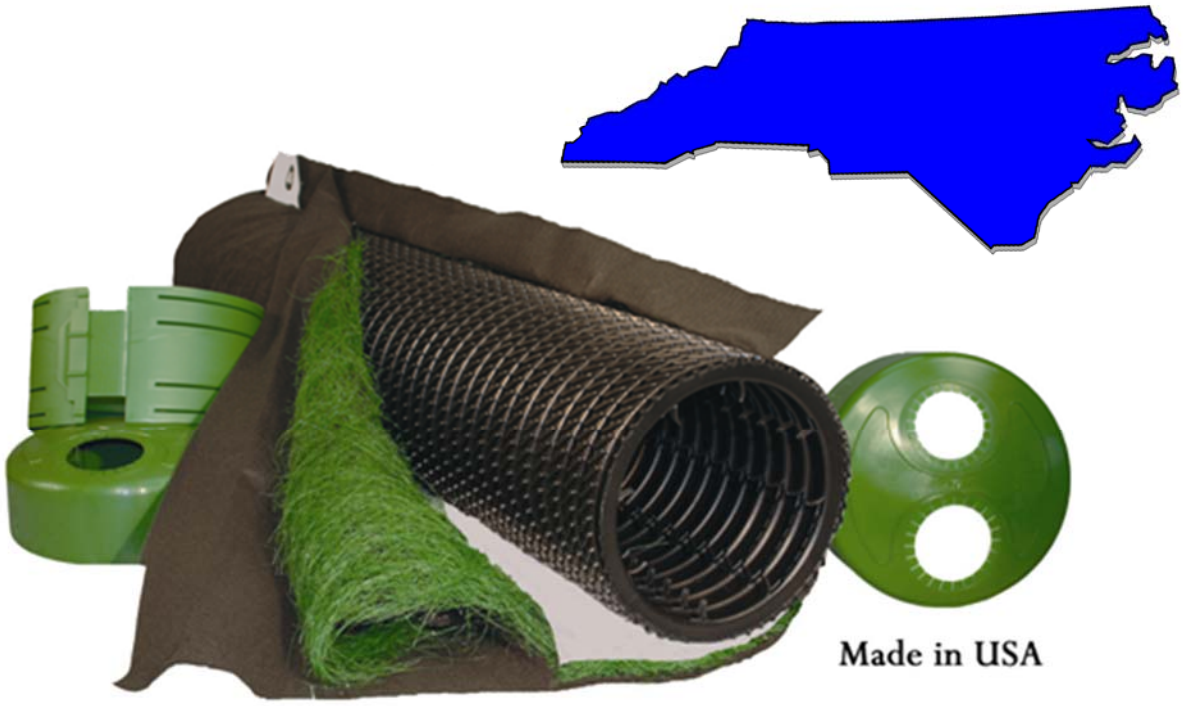
The Presby Wastewater Treatment System

North Carolina

Design & Installation Manual

for Advanced Enviro-Septic® Wastewater Treatment Systems



✔ **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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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 Purpose

The purpose of this Manual is to provide general information regarding the design criteria, installation procedures and use and care instructions for the Advanced Enviro-Septic® Treatment System for non-industrial wastewater and design flows of 1,500 GPD or less. The Advanced Enviro-Septic® System is 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.

2.0 What Our System Does

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. 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.

2.1 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.

2.2 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

2.3 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.

2.4 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 30 sq ft of total surface area for bacterial activity.

3.0 Presby Environmental Standards

All systems using the Advanced Enviro-Septic® Treatment System 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.

3.1 Conflicts between North Carolina Rules & this Manual

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

3.2 Certification Required

PEI requires all designers and installers to be certified. Certification is obtained by completing the "Advanced Enviro-Septic® 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. PEI highly recommends that all individuals involved in the approval, permitting or inspection process also complete a certification course.

3.3 Technical Support

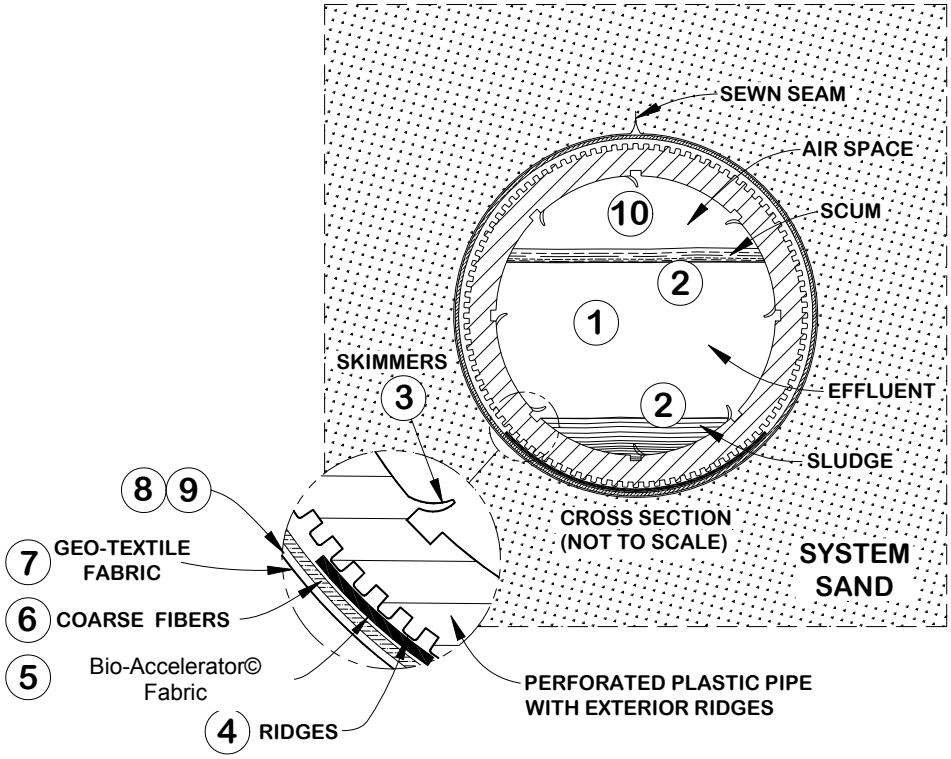
PEI provides technical support free of charge to all individuals using our products or involved in the permitting process. For any questions about our products or the information contained in this Manual, please contact us at (800) 473-5298, send an email to info@presbyeco.com or visit our website, www.PresbyEnvironmental.com.

3.4 Disclaimer

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.

4.0 Ten Stages of Advanced Enviro-Septic® 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: Bio-Accelerator™ geo-textile fabric filters 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 random fibers separates more suspended solids from the effluent.
Stage 7: Effluent passes into the geo-textile fabric and grows a protective bacterial surface.
Stage 8: Sand wicks liquid from the geo-textile fabric and enables air to transfer to transfer to the bacterial surface.
Stage 9: The fabric and fibers provide a large bacterial surface to break down solids.
Stage 10: An ample air supply and fluctuating liquid levels increase bacterial efficiency.



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® 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) Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
e) 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

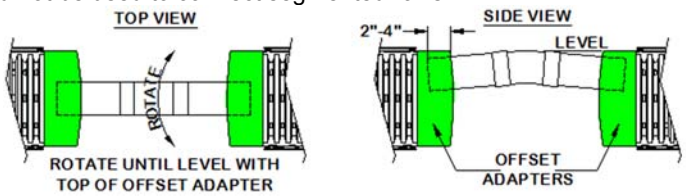
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever 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 Manifolded Distribution Box

A manifolded distribution box joins several outlets to help divide flow more accurately. 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.

5.9 Raised Straight Connection

A raised straight connection is a 4 inch diameter 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. Rasided straight connections should not be used to connect segmented rows.



5.10 Septic Tank

a) The Presby System is designed to treat effluent that has received "primary treatment" in a standard septic tank sized in accordance with North Carolina rules.
b) Septic tanks used with the Presby System must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Advanced Enviro-Septic® 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 System.
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 Specifications

The System Sand that surrounds the Advanced Enviro-Septic® pipes is an **essential** component of the system. It is **critical** that the correct type and amount of System Sand is used when constructing the system. System Sand is placed in all directions from the Presby pipes (below pipes, between rows, above pipes and around outer perimeter). System Sand must be coarse to very coarse, clean, granular sand, free of organic matter and adhere to one of the following sand specifications (note: Material passing #200 sieve obtained by washing sample):

System Sand	
Sieve Size	% Retained by Weight
3/4"	Zero
#10 (2 mm)	0 – 35
#35 (0.5 mm)	40 – 90
Not more than 3% passing a #200 Sieve	

Alternate Acceptable Material ASTM C-33	
Sieve Size	% Passing by Weight
3/8"	100
#4 (4.76 mm)	95 – 100
#8 (2.38 mm)	80 – 100
#16 (1.19 mm)	50 – 85
#30 (.595 mm)	25 – 60
#50 (.297 mm)	5 – 30
#100 (.149 mm)	0 – 10
#200 (.074 mm)	0 - 3

6.0 Soil Loading Rates: Table: A

Soil Group USDA Textures	North Carolina Soil Loading Rate GPD/ft²	NSF-40 Presby System Pad / Bed Loading Rate GPD/ft² (600 GPD daily flow maximum)	TS-I Presby System Pad / Bed Loading Rate GPD / ft² (1,500 GPD daily flow maximum)	Length to Width Ratio
Group I: Sands with S or PS Loamy Sand structure and clay mineralogy	1.2 – 0.8	1.067 – 0.711	1.600 – 1.067	2:1
Group II: Coarse Loams with S or PS Loamy Sand structure and clay mineralogy	0.8 – 0.6	0.711 – 0.533	1.067 – 0.800	3:1
Group III: Fine Loams with S or PS Loamy Sand structure and clay mineralogy	0.6 – 0.3	0.400 – 0.200	Not allowed	3:1

Notes: 1) Pad / Bed loading rates reflect approve reduction in size. 2) TS-1 systems for "fill" sites limited to 480 GPD.

7.0 Presby Pipe Required Residential Systems (normal strength effluent): Table B

Number of Bedrooms	Maximum Hydraulic Capacity GPD	Presby Pipe Required minimum ft
2	240	120
3	360	150
4	480	200
5	600	250
>5	Daily Design Flow (Q)	≥ Q ÷ 24

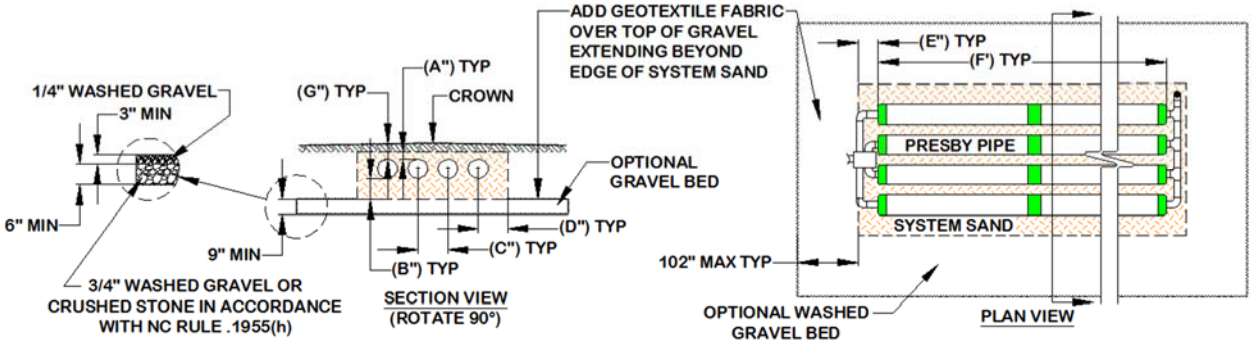
8.0 Presby Pipe Required for Industrial Systems

Non-Industrial systems are beyond the scope of this manual and requires the involvement of Presby Environmental. These systems will be evaluated by the state of North Carolina on a case-by-case basis.

9.0 System Sand Bed Dimensions and Row Length Requirements: Table C

System Sand Location	Illustration Item	NSF-40 Bed		TS-I Bed	
		System Sand Only	System Sand on 6 inches of Washed Gravel	System Sand Only	System Sand on 6 inches of Washed Gravel
Inches Above Presby Pipe (minimum)	A	4 in	4 in	4 in	4 in
Inches Below Presby Pipe (minimum)	B	12 in	12 in	24 in	24 in
Minimum Center-to-Center Row Spacing	C	18 in	18 in	18 in	18 in
Maximum Center-to-Center Row Spacing	C	48 in	102 in	48 in	102 in
Lateral Extension Distance from Center of Last Row to Limit of System Sand (parallel to outermost rows)	D	24 in – 48 in	24 in – 51 in	18 in – 48 in	18 in – 51 in
Inches of Extension Beyond Ends of Presby Pipes	E	12 in – 18 in	12 in – 45 in	12 in – 18 in	12 in – 45 in
Presby Pipe Row Length (feet)	F	20 ft – 60 ft	20 ft – 60 ft	20 ft – 60 ft	20 ft – 60 ft
Minimum Cover Over System (4 in must be System Sand)	G	8 in	8 in	8 in	8 in

Illustration Showing Location of Table Dimensions:



10.0 Design Example

Design an NSF-40 four bedroom residential Presby System in soils with a Group I, sandy soil with SLR = 1.2 GPD/ft²**:**

a) Using Table A the equivalent Presby Soil Loading Rate for 1.2 GPD/ft² = 1.067 GPD/ft²
b) (4) bedrooms @ 120 GPD = 480 GPD daily design flow
c) 480 GPD ÷ 1.067 GPD/ft² = 450 ft² System Sand bed area required (minimum)
d) Minimum Presby pipe from Table B - 4 bedrooms = 200 ft

Bed Configuration Examples (a few of the many options):

a) 6 rows of pipe 30 ft long or

b) 3 rows of pipe 60 ft long or
c) 5 rows of pipe 40 ft long
d) All use the minimum required amount of pipe of 180 ft or more

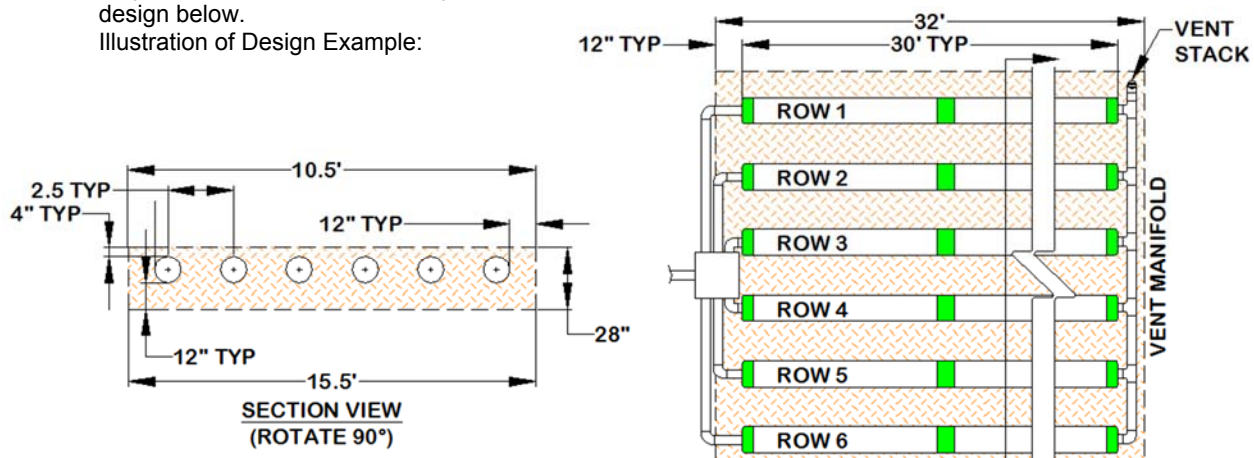
System Sand Bed Dimensions – Option #1:

a) Assume 6 rows of pipe, 30 ft long
b) Sand Bed length: 30 ft row length + 2 ft System Sand (12 inches beyond each end) = 32 ft
c) Sand Bed width: 450 ft² ÷ 32 ft. length = 14.1 ft minimum (round up to 15.5 ft for ease of construction)

Confirm Bed Width for will accommodate number of rows:

a) Minimum System Sand bed width for 6 rows using 1.5 ft. center to center spacing is 10.5 ft.
b) The 10.5 ft needed to cover all the Presby rows is less than the minimum 14.5 ft sand bed width needed to satisfy the area requirement calculated above. No increase in the sand bed width is needed.
c) System Sand extending beyond 12 inch from the lateral edges of the Presby pipe only needs to be 6 inches thick. These are called System Sand extensions and will be evenly divided to both sides of the bed. This example will require a 2 ft System Sand extension on each side of the bed. Row center-to-center spacing may be increased to eliminate System Sand extensions, but will use more sand. See an illustration of this design below.

Illustration of Design Example:

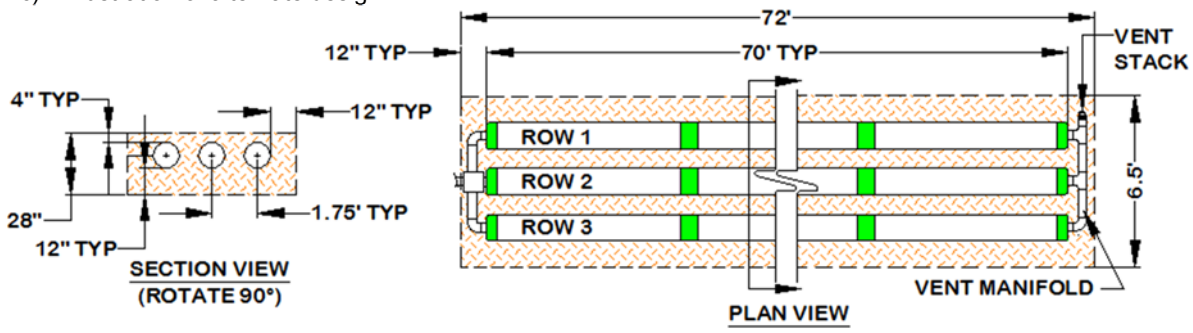


Alternate Acceptable Design Configuration:

a) Assume 3 rows of pipe, 70 ft long
b) Sand Bed length: 70 ft row length + 2 ft System Sand (12 inches beyond each end) = 72 ft
c) Sand Bed width: 450 ft² ÷ 72 ft. length = 6.25 ft minimum (use 6.5 for easy of construction)

Confirm Bed Width for will accommodate number of rows:

a) Minimum System Sand bed width for 3 rows using 1.75 ft. center to center spacing is 6.5 ft.
b) Using a row spacing of 1.75 ft will satisfy the minimum area requirement (72 ft x 6.5 ft = 468 sq ft).
c) Illustration of alternate design:



11.0 System Configurations

This section presents the various single-level design configurations of the Advanced Enviro-Septic® System. The system configuration to be used is determined by:

a) Characteristics of the naturally-occurring soils
b) The daily design flow
c) Other characteristics specific to the particular site

11.1 D-Box Distribution (Parallel) Configuration

a) All rows in a D-box configuration must be the same length and utilize flow equalizers to ensure effluent is distributed equally to each row in the system.
b) Use a vent manifold to ensure adequate air flow through each row.

11.2 Multiple Bed Distribution

Multiple Bed distribution may be used to accommodate site constraints or to handle large daily design flows. It incorporates:

a) Two or more beds with each bed receives an equal amount of effluent from a D-box with equalizers;
b) Daily design flows greater than 600 GPD in Soil Group 4

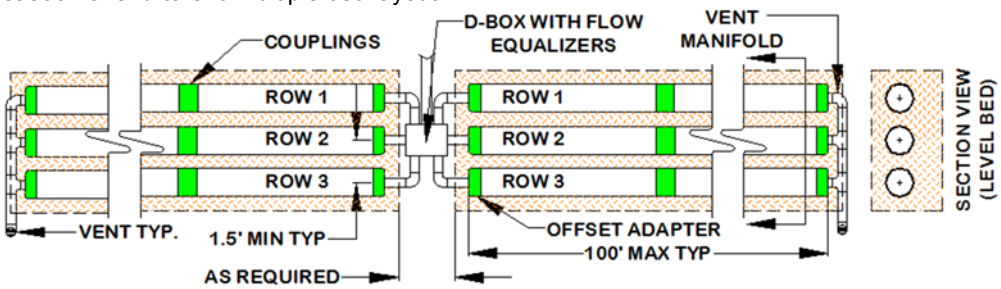
11.2.1 Bed Requirements

a) Each bed must have the same minimum total 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) Each bed must have at least two rows.
c) The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the Advanced Enviro-Septic® System by the number of beds.
d) Beds may be of different dimensions, provided that rows are not more than 100 ft. long. Longer, more narrow beds work best.
e) Recommended minimum row length is 30 ft.
f) Rows within a bed may vary in length to accommodate site constraints.

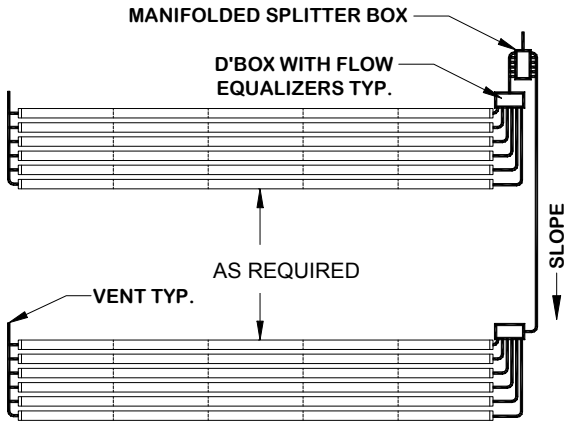
11.2.2 Multiple Bed Orientation

Multiple beds may be oriented along the contour of the site or along the slope of the site. End-to-end configurations are preferred.

a) Illustration of end-to-end multiple bed layout:



b) Illustration of side-to-side multiple bed layout:



11.2.3 Bed Separation Distances

Minimum bed separation distances per state rules.

12.0 Design Criteria for North Carolina

12.1 Center-to-Center Spacing of Rows

a) Center-to-center spacing of Presby pipe rows is controlled by Table C.
b) Spacing is measured from the center of one pipe to the center of the pipe in the next row.

c) Row spacing is increased to evenly distribute treated wastewater through the sand bed area.

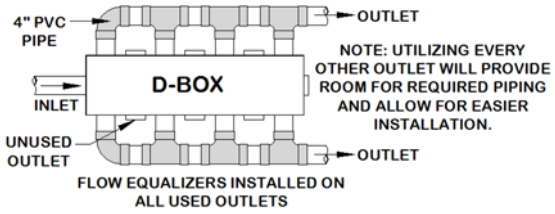
12.2 Daily Design Flow

a) Residential daily design flows are calculated based on 120 gallons per day (GPD) per bedroom.
b) The system design shall incorporate provisions for complying with a means for determining at least the daily, 7-day, and 30-day flow monitoring requirements of Rule .1970.
c) If a pump is involved: a cycle counter will be incorporated into the pump's control circuit. This cycle counter will be used to estimate daily flow.
d) For gravity fed systems the system design will either incorporate a siphon with a dosing cycle counter, a tipping D-box with a cycle counter where the counter display would be used as a mechanical logger or another mechanical approach which allows for accurate monitoring of daily flows as required Rule 1970 approved by the State
e) A data logging system will be incorporated with the cycle counter in order to allow review of flows over time.
f) Where none of the above options are feasible, a water meter can be placed on the incoming line to the house connected to a data logging system, with the understanding that not all the water entering the house will also enter the septic system due to personal consumption, landscaping purposes, etc.
g) Systems over 1,000 GPD shall be designed by a North Carolina Professional Engineer.

12.3 D-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.

a) A D-box manifold is utilized to equalize flow.
b) Flow equalizers should be used on all D-box outlets.
c) Unused D-box outlets must be covered, plugged or mortared.
d) This configuration is especially useful when designing for large daily design flows.
e) Illustration of a manifolded D-box:



12.4 End-to-End Preferred over Side-to-Side

If site conditions permit, end-to-end system bed configurations are preferable to side-to-side system bed configurations (see para. 11.2.2 on page 7).

12.5 Effluent Filters

All septic tanks must be equipped with baffles or tees to reduce the amount of solids exiting the tank and entering the Presby System. 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 Advanced Enviro-Septic® 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.

12.6 Fill system

The system shall be considered to be a fill system only if the sand bed bottom is installed directly onto native soil and is less than 12 inches below the naturally occurring soil surface.

12.7 Garbage Disposals

If a garbage disposal is used, the septic tank will likely require more frequent pumping. Multiple compartment septic tanks or multiple tanks are preferred.

12.8 Horizontal Separation Distances

Minimum horizontal separation distances (also called “set-backs”) must comply with state and/or local requirements. Horizontal separation distances are measured from the outermost edge of the System Sand bed.

12.9 Interceptor Drains

Interceptor Drains, if used, must be upslope of the Presby System and a minimum of 10 ft away from all Presby pipes. Presby pipe is excellent for use in constructing interceptor drains.

12.10 Replacement Area Not Required
In the unlikely event that an Advanced Enviro-Septic® System needs to be replaced it can be reinstalled in the same location, eliminating the need for a replacement system reserve area. All unsuitable material must be removed prior to replacement system construction. Dispose of hazardous materials properly. A reserve area may still be required per state or local regulations; contact the appropriate approving authority to determine if reserve area is required.

Note: Attempt Rejuvenation procedures **before** replacing the system. This simple process can often restore normal system function in a matter of days call PEI for technical assistance.

12.11 Row Length
To maintain efficient cycling within the Presby pipe, the maximum row length is 100 ft. The longest, narrowest system design practical for the site is recommended to facilitate infiltration.

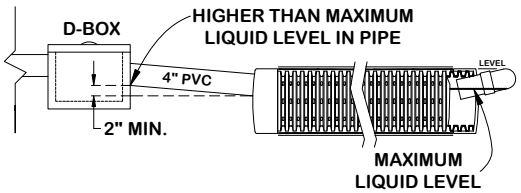
12.12 Rows - Minimum Number
All beds must have at least 2 parallel rows.

12.13 Required Depth Vertical Separation Distances for AOSS
The minimum separation distance between the Presby pipe and the highest restrictive feature in the soil profile is 24 inches. This shall be measured to the bottom of the System Sand (if installed directly on native soil) or at the gravel-native soil interface when installed on gravel. Restrictive features include seasonal high water table (SHWT) and ledge, bedrock or impermeable soils. The bottom of the sand bed for AES systems or the underlying gravel bed may be installed up to, but no deeper than, 5 feet below finished grade, provided that the vertical separation requirements are met.

12.14 Row Orientation
Presby pipe rows must be laid level to within 1 inch end-to-end (±1/2 inch from designed elevation) and preferably will be approximately parallel to the contour of the site.

12.15 Sampling Device Required
All North Carolina AOSS Advanced Enviro-Septic® Wastewater Treatment Systems are subject to periodic sampling of treated effluent. Samples of treated effluent are obtained via the Sampling Device, which is an included component. Only a manufacturer's Trained Installer may install an Advanced Enviro-Septic® System; these instructions are to be used in conjunction with the Design and Installation Manual.

12.16 Septic Tank and D-box Elevations
The outlet of a septic tank or D-box must be set at least 2 inches above the highest inlet to the first Presby row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.)
Illustration of 2 inch rule:



12.17 Side Slope Tapering
Configuration requiring side slope tapering**: i**f any part of the system (including soil cover) is above original grade, the system will require side slope tapering. If all parts of the system, including cover material, are at or below original grade, the system will not require side slope tapering. Side slope tapering is used to blend the system into the terrain, making it both less susceptible to erosion and less noticeable. Side slope tapering is not to exceed 1:3 (rise to run).

12.18 Sloping Sites
Maximum site slope is 15%. The site may contain more than one slope, provided the maximum allowed slope is not exceeded.

12.19 System Sand Bed Area (Minimum)
Refer to Table A on page 4.

12.20 System Sand Bed Vertical Dimensions
See Table C on page 5 for System Sand dimensional requirements.

12.21 System Sand Specifications
It is **critical** to the proper functioning of the Advanced Enviro-Septic® System that the proper amount and type of System Sand be installed.

12.22 Ten Foot Increments Work Best
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. Using 5 ft increments minimizes waste of pipe material.

12.23 Terrain Slope
Presby beds are allowed to slope as follows:

a) NSF-40 configurations may be placed on terrain slopes of 15% or less
b) TS-1 configurations may be placed on terrain slopes of 10% or less, however a hydraulic assessment per NC rules .1970(i)(1)(B) and (p) is required for installations sloping greater than 2%.

12.24 Topographic Position Requirement
The topographic position of the site must be convex, hill slope, or flat. No onsite system may be located on concave slopes that concentrate surface or ground water flows unless up-slope terrain is sufficiently altered or interceptor drains are used to redirect water away from the system. Presby beds must be oriented with the long axis as parallel as possible to the ground contours.

12.25 Velocity Reduction
Velocity reducers are needed when there is excessive slope between the septic tank and the Presby System. A velocity reducer at the system inlet is required if the velocity of the fluid entering the Presby pipes would create enough turbulence to disrupt the natural settling of suspended solids within the pipes. D-boxes with baffles or a velocity reducing tee are commonly used for velocity reduction. Velocity reduction is required in pumped systems.

12.26 Venting Requirements
All Presby Systems require venting. Pumped systems require differential venting (see paragraph 14.0 on page 11).

12.27 Wastewater Strength
All design criteria in this Manual assume “usual” or “typical” non-industrial wastewater strength. Designers should take any unusual wastewater characteristics into consideration when designing a system. Where wastewater strength is high or wastes are unusual, additional Presby pipe is recommended and is beyond the scope of this manual. Please contact PEI for technical assistance. Wastewater shall not have a pH or toxins that significantly inhibit microbial growth.

12.28 Water Purification Systems
Water purification systems and water softeners should not discharge into a Presby System. This backwash and the additional flow may overload the system. Designs should include an alternative means of dispersal. If there is no alternative means of disposing of this backwash, then the system will need to be “oversized.” Calculate the total amount of backwash in GPD and add this amount to the daily design flow and increase septic tank, Presby pipe and System Sand bed size accordingly. Water purification systems and water softeners require regular routine maintenance; consult and follow the manufacturer’s recommendations.

13.0 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. A state approved tank shall be provided with the required tank liquid capacity.

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

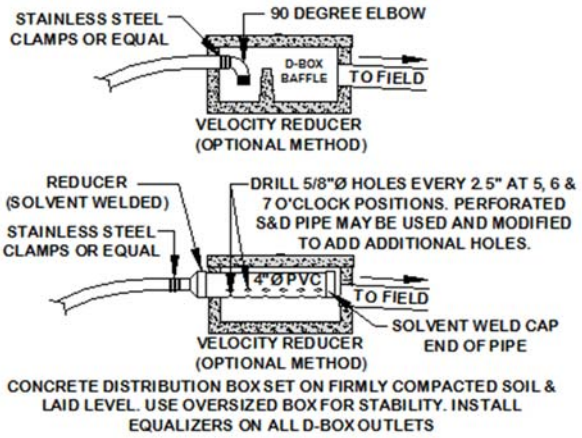
13.2 Differential Venting
All pump systems must use differential venting (see illustration, para.14.4, page 12).

13.3 Distribution Box
All pump systems require a distribution box with some means of velocity reduction.

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).



13.4 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.
d) Dosing shall be demand dosing for a system designed for up to and including 1,000 GPD.
e) Timer dosing shall be used for daily design flows over 1,000 GPD to evenly deliver wastewater to the field.
f) Dosing frequency shall be from 4 to 8 doses per day.
g) The dose volume shall not exceed more than one gallon per foot of Presby pipe in the bed.

14.0 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.

14.1 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.

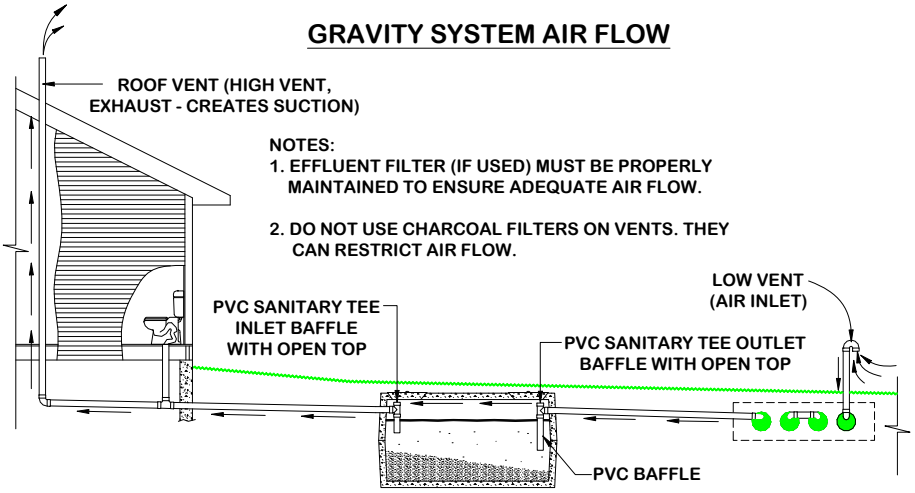
14.2 Differential Venting

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.

14.3 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.

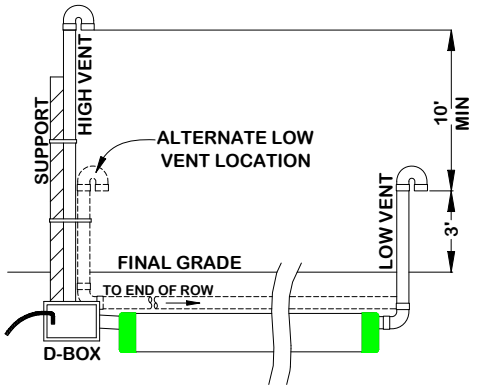
d) Illustration of gravity system air flow:



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.

14.4 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. 14.6, page12) and Bypass Venting (para.14.7, page 13) for options to relocate or eliminate the High Vent.



14.5 Vent Piping Slope

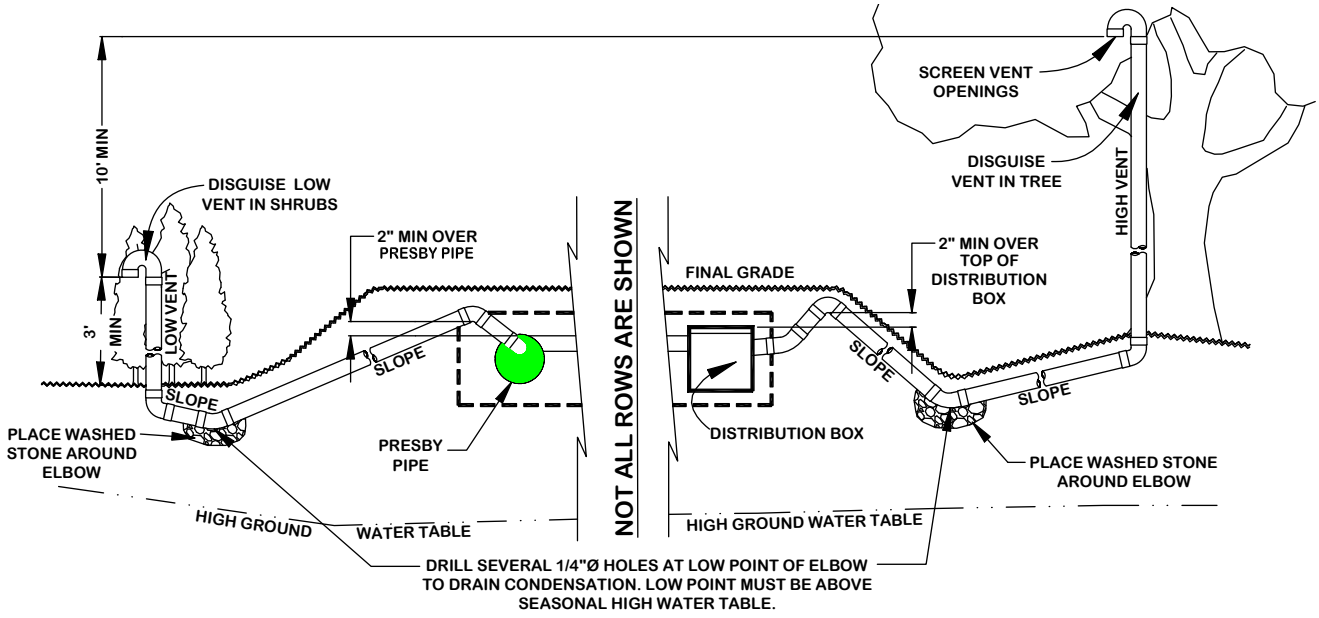
Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.

14.6 Remote Venting

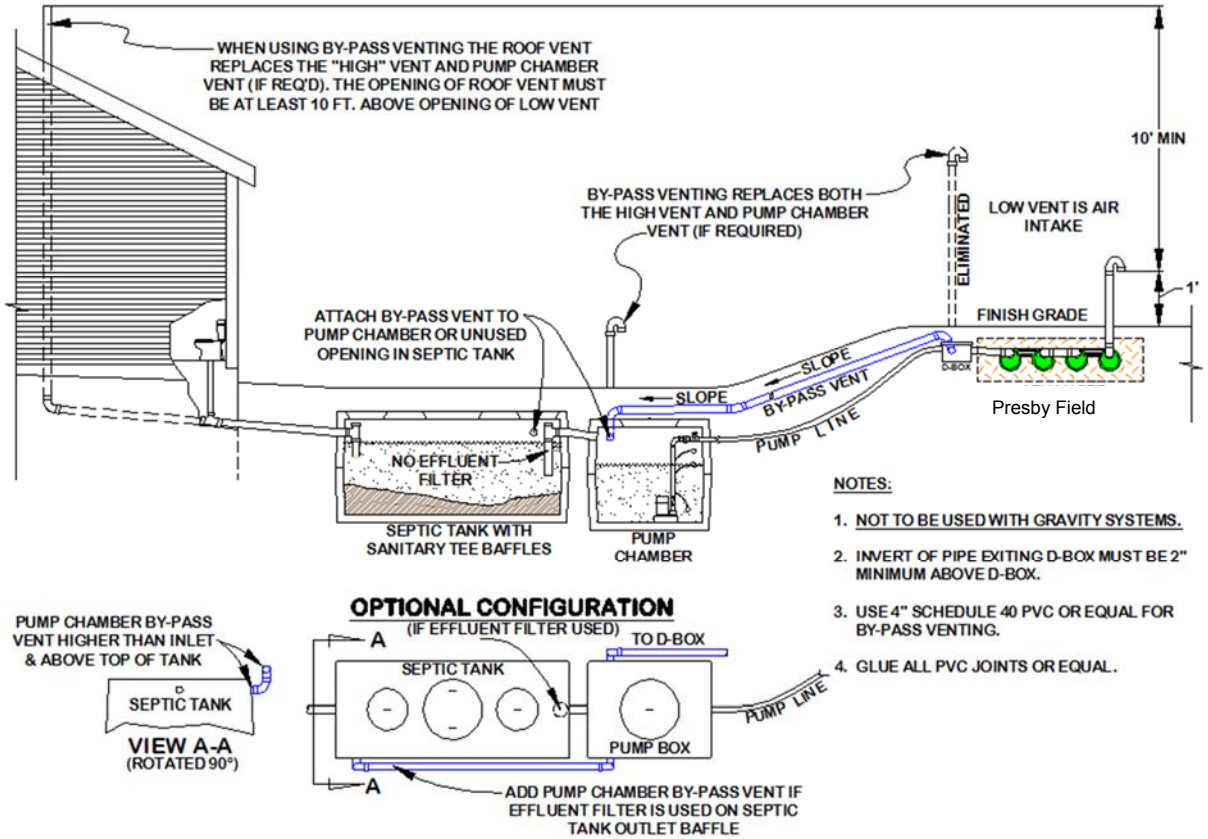
If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in. holes to allow drainage of condensation.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



14.7 By-Pass Venting



15.0 Site Selection

15.1 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.

15.2 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.

15.3 Determining Site Suitability
In order to decide if a particular site is suitable for a Presby system, measure the distance down from existing grade to the highest layer of SHWT, ledge, bedrock or impermeable soil in the soil horizon in the proposed system site. There must be a minimum of 6 inches of unsaturated in situ soil in order to install a Presby system, or the distance required by North Carolina regulations

15.4 Dispersal Area
Systems must be located where adjacent soils in the proposed system location are suitable for dispersing surface water away from the system.

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

15.6 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.

15.7 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. Contact the appropriate approving authority to determine if a reserve area is required in your 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.

15.8 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.

15.9 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.

16.0 Installation Requirements, Component Handling and Site Preparation

16.1 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.

16.2 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.

16.3 Installer
The company/individual contracted to install the Presby System must be a Level IV installer and certified by Presby

Environmental Inc.

16.4 Preconstruction conference

A preconstruction conference shall be required to be attended by the designer engineer (if applicable), installer and UID prior to beginning construction of the Presby AES system.

16.5 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.

16.6 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.

16.7 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.

16.8 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.

16.9 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"). Rake the prepared surface to the required elevation (+ ¼" tolerance) before placing the System Sand.

16.10 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 inches 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.

16.11 Presby Row Installation

a) Install a minimum of 6 inches 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.

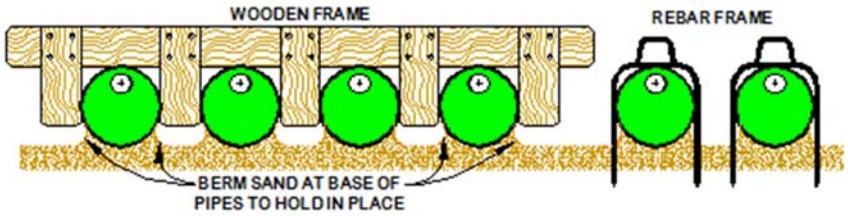
e) Add or remove System Sand along rows to level. The rows may be raised by straddling them and pushing additional System Sand below the pipes with your feet. A hand shovel may be scraped along the System Sand below the pipes to remove a small amount if needed.
f) Re-check horizontal and vertical locations. 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).

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

16.13 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.

16.14 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).

16.15 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.



16.16 Manifold Far Ends of Rows
Manifold connect all the ends of the Presby rows using 4 inch PVC sewer and drain pipe (or equal), and 90° elbows. Lift the manifold until it is level with the top of the Presby pipe. This will all any condensation to drain into the field. Attach the vent stack to a suitable location on the manifold. Glue or mechanically fasten all pipe connections.

16.17 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) If System Sand is placed on gravel, cover all gravel beyond the edges of System Sand with geotextile fabric before backfilling.
d) 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.
e) Finish spreading System Sand to the top of the rows and leave them exposed for inspection purposes.

16.18 Backfilling and Final Grading
Spread System Sand to a minimum of 4 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.

16.19 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. Crown topsoil over level fields to shed water off the top of the system.

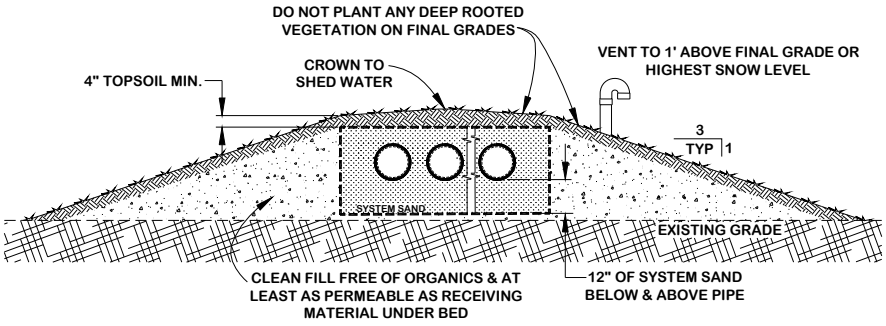
16.20 Erosion Control
To prevent erosion, soil cover above the system shall be planted with native, shallow-rooted vegetation such as grass, wildflowers and certain perennials or ground covers. Mulch may also be placed over topsoil to stabilize final grades.

16.21 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.

16.22 Sand Fill or Fill Material
Sand fill is to be used to raise the elevation of the system in order to meet the required separation distance from the SHWT or other restrictive feature. It is also used in constructing side slope tapering. This sand shall be clean, bank run sand, free of topsoil, organic matter or debris and containing no stones larger than 6 inches. No more than 30% of this sand shall pass through a #100 sieve and no more than 5% shall pass through a #200 sieve. Naturally occurring soils removed when excavating the site may be used for constructing side slope tapering, provided the soil contains no organics, stones larger than 6 inches, stumps or other debris. System Sand may be used in place of sand fill.

16.23 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.

16.24 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.



16.25 Final Inspection
The certified installer or the certified engineer or the certified designer and the ORC authorized in writing by Presby Environmental Inc. shall conduct an inspection/start-up of the Presby AES system and all associated system components. The LHD personnel will attend and observe the inspection/startup. During the inspection/start-up to include:
I. System water tightness testing.
2. Control panel operation and alarm settings, if needed.
3. Pump model numbers and time clock settings, if needed.

17.0 Operation & Maintenance

17.1 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.

17.2 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.

17.3 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.

17.4 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.

18.0 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.

18.1 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.

18.2 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.

19.0 Monitoring and Reporting

Presby AES systems are classified, at a minimum, as a Type Va system in accordance with North Carolina Table V(a) of Rule .1961 (b). Management and inspection shall be in accordance with Rules .1961 and .1970.

19.1 Maintenance Agreement

All Presby AES systems require an operation and maintenance agreement between the system owner and a Presby Environmental Inc., authorized representative, or with an operator authorized in writing by Presby Environmental Inc. as per Rule .1970. The system shall be inspected according to Rule .1961 by a certified subsurface operator authorized in writing by Presby Environmental Inc. The ORC shall be either an employee of Presby Environmental

Inc. or authorized in writing by Presby Environmental Inc. to operate and maintain the system. The operator authorized in writing by Presby Environmental Inc. must have proper equipment and training as applicable.

19.2 Inspection Requirements

At each Presby AES inspection the ORC authorized in writing by Presby Environmental Inc. shall, at a minimum, observe, monitor, and record the following:

1. Wastewater level in the tanks.
2. Sludge, scum, and grease levels in all the tanks.
3. Clogging of effluent filter.
4. Water tightness of tanks, risers and pipe penetrations at tanks.
5. Operation of pumps, floats, valves, electrical controls and alarms, where applicable.
6. Drain field pump delivery rate (drawdown test), determination of the average pump run time, and drain field dosing volume, where applicable.
7. Any structural damage, accessibility issues, adequate ventilation, excess odors, ponding of effluent, insect infestations, vegetative growth over the drain field, or surfacing of effluent on the drain field area.
8. Sample of Presby AES system effluent collected from the sampling point to check for effluent clarity and odor and a sample of influent, as required.
9. Readings from -pump cycle counters and run time meters and any water meter readings, as applicable.
10. System operating conditions, from the review stored data for indication of 7-day and 30-day flows and flow variances or other abnormal conditions.

19.3 Sampling and Testing

1. All sampling shall be done in accordance with Rule .l970(n)(3) and (5). Presby AES systems shall be sampled annually (semi-annually for systems with a design flow of 1,501 to 3,000 GPD)
2. Influent for all systems shall be analyzed for BOD5 and TKN
3. All NSF-40 systems shall have effluent tested for effluent CBOD5 and TSS. All TS-I systems shall have effluent tested for CBOD5, TSS, NH4-N, and fecal coli forms. Field testing of effluent for pH and DO is also highly recommended for all systems.
4. Additional sampling of effluent or influent may be determined to be necessary by the authorized ORC during a system inspection to assist with troubleshooting or to verify system performance.
5. Influent samples shall be taken from a sampling port located between the septic tank and the drain field or from the in fluent dosing tank (where applicable).
6. Effluent samples shall be collected from the sampling device.

19.4 Notification and Performance of Maintenance and Repairs

1. The authorized ORC shall alert Presby Environmental Inc., the LHD, and the system owner within 48 hours of needed maintenance or repair activities including, but not limited to landscaping, tank sealing, tank pumping, pipe or control system repairs, AES unit replacement, and/or adjustments to any other system component.
2. System troubleshooting and needed maintenance shall be provided to maintain the pump delivery rate and average pump run time within 25% of initial measurements conducted during system startup. The authorized ORC shall notify the system owner, Presby Environmental Inc., and the LHD whenever the pump delivery rate efficiency or average pump ran times are not within 25% of initial measurements conducted prior to system start-up.
3. The septic tank will be pumped as needed upon recommendation of the authorized ORC and in accordance with the Presby AES system operation and maintenance instructions. However, at a minimum, the septic tank will be pumped whenever the solids level exceeds 25% of the tank's total liquid working capacity or the scum layer is more than four inches thick.
4. The tanks shall be pumped by a properly permitted septage management firm, and the septage handled in accordance with 15A NCAC 13B .0800.
5. The authorized ORC shall notify the LHD, Presby Environmental Inc., and the system owner in writing whenever repairs are indicated. All maintenance activities shall be recorded in the ORC reports provided to the system owner,
6. LHD, and Presby Environmental lnc.

19.5 Reporting

The authorized ORC shall provide a completed written report to the system owner, Presby Environmental Inc., and the LHD within 30 days of each inspection. At a minimum this report shall specify:

1. The date and time of inspection,
2. System operating conditions according to Section VII.D, VII.E, and VII. F.
3. Results from any laboratory analysis of any influent and effluent samples,
4. Maintenance activities performed since the last inspection report,

5. An assessment of overall system performance,
6. A list of any improvements or maintenance needed,
7. A determination of whether the system is malfunctioning, and the specific nature of the malfunction,
8. Any changes made in system settings, based on recommendations by Presby Environmental and
9. A summary report of data retrieved from the control panel or other storage device verifying actual daily, 7-day, and 30-clay flows, flow variances, and other operating conditions.

20.0 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.

20.1 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.

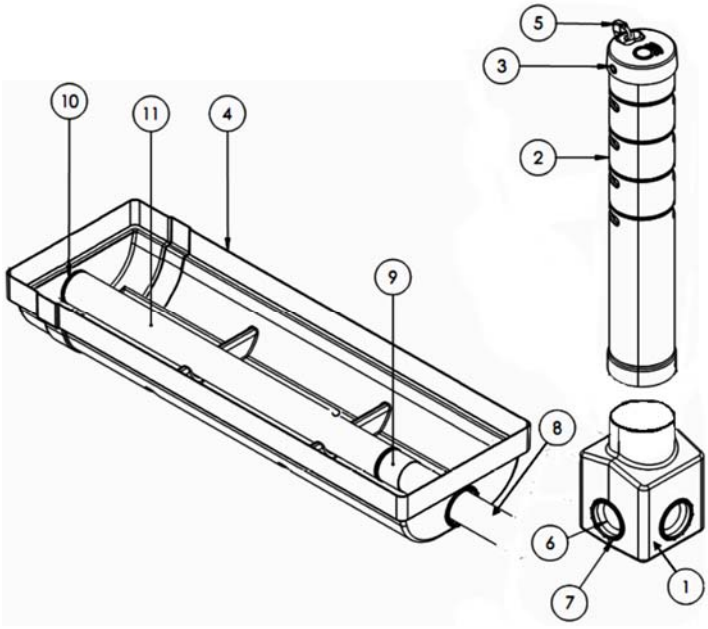
21.0 Sampling Device Installation and Use Instructions

All North Carolina AOSS Advanced Enviro-Septic® Wastewater Treatment Systems are subject to periodic sampling of treated effluent. Samples of treated effluent are obtained via the Sampling Device, which is an included component. These instructions are to be used in conjunction with the Design and Installation Manual.

21.1 Sampling Device

The Sampling Device consists of two major elements, the Collector and the Sampling Port. The Sampling Port consists of a detachable base and an adjustable (trim-to-fit) riser which snap together. See schematic on next page. Illustration of Sampling Device:

SAMPLING DEVICE
1 Sample Port
2 Access Pipe
3 Locking Cover
4 Collector
5 Padlock
6 Pipe Adapter
7 Adapter Locking Ring
8 PVC Pipe
9 Fitting and Adapter
10 End Cap
11 Collector pipe



21.2 Collector

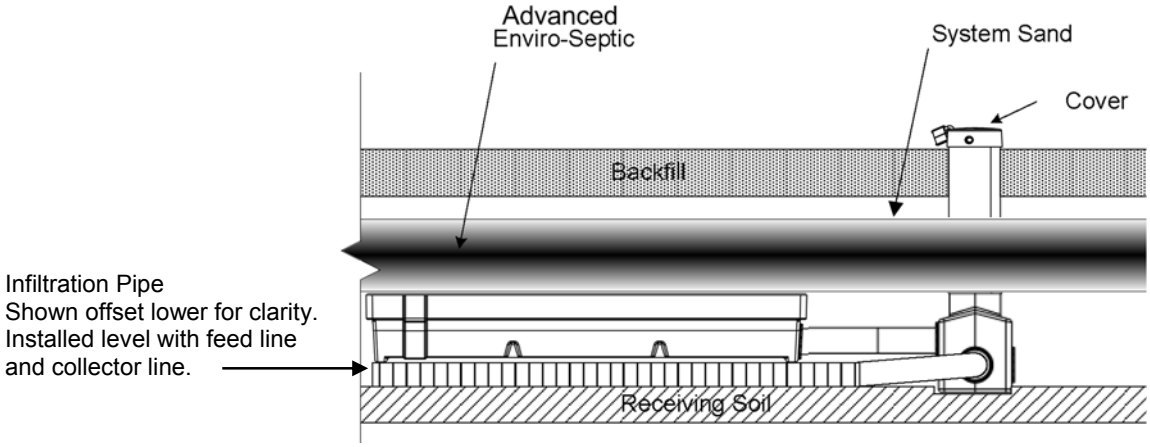
The Collector is a plastic trough which is installed directly under and perpendicular to the Advanced Enviro-Septic® pipe in order to collect a representative sample of treated effluent. It is filled with System Sand. A perforated 4" diameter PVC drainage pipe that is covered by filter fabric lies in the bottom trough.

21.3 Sampling Port

After treated wastewater collects in the Collector, it is routed towards the Sampling Port through PVC piping. The Sampling Port access pipe can be cut-to-size as needed so that the locking cover is accessible above final grade. By removing the locking cover, a sample of treated effluent can be obtained from the base of the sampling port. Any treated effluent not removed for sampling purposes is released back into the System Sand via the Infiltration Pipe attached to one of the two outlets in the base of the Sampling Port (these two holes are level with the hole that is used to connect the Collector to the Sampling Port).

21.4 Infiltration Pipe

The Infiltration Pipe consists of a 4 in. diameter perforated drainage pipe that is covered by a fabric filter to prevent the infiltration of System Sand into the pipe. This pipe attaches to the Sampling Port base through one of the two unused holes in the base of the Sampling Port. The Infiltration Pipe is positioned in a "U" shape and encased in the 4 in. of System Sand around the Collector.

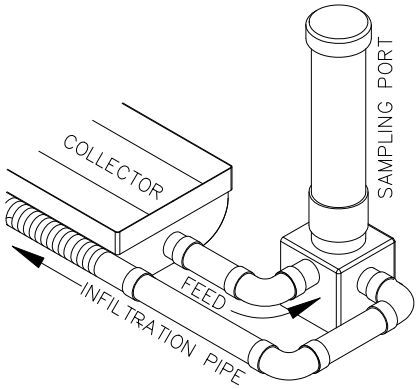


21.5 Assembly

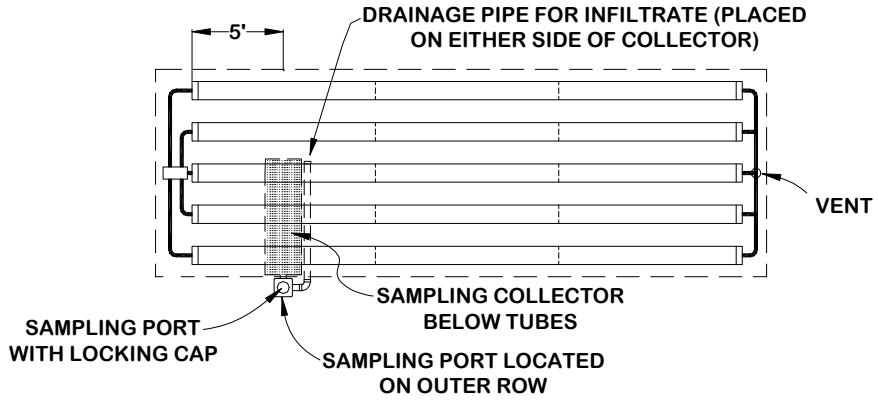
The Sampling Device is constructed so that the Collector and the Sampling Port are detachable for ease of installation. These two parts are connected with 4 in. PVC pipe which exits the Collector and goes straight into or makes a 90 degree turn before connecting to the inlet of the sampling port base as shown below.

21.6 Proper Location of the Sampling Device

The Sampling Device is installed perpendicular to the Advanced Enviro-Septic® pipe rows as shown below. The Sampling Port is offset from the Collector such that the riser is positioned so it extends upward along the outer edge of the Advanced Enviro-Septic® pipe (see illustration at right).



Sampling Device location in Plan View:



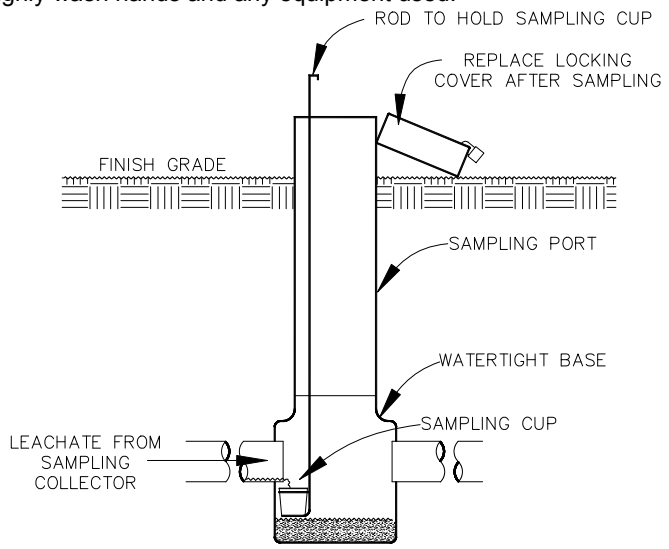
21.7 Installation Instructions

1. Place the System Sand; the Collector will be aligned with and directly under where the first Advanced Enviro-Septic® pipes will be (see detail on previous page).
2. Base of Sampling Port sits 4 in. lower than bottom of Collector and is off-set so that riser extends upwardly along the outside edge of Advanced Enviro-Septic® pipe.
3. Excavate an area where the Sampling Device will be located. The upper edge of Collector will be the same elevation as bottom of AES pipe.
4. Properly position base of sampling port and the infiltration pipe.
5. Install 4 in. of System Sand, filling the excavated area described above and covering the infiltration pipe and holding it in place.
6. Install Collector and connect to base of Sampling Port with 4 in. Install Infiltration Pipe so that each end connects into an outlet in base of Sampling Port.
7. Install System Sand in and around Sampling Device to hold it in place.
8. Continue installing System Sand until it reaches 12 in. depth (measured from bottom of Collector).
9. Continue with installation of Advanced Enviro-Septic® Treatment System.
10. Install cover material.
11. Trim the riser of the sampling port so that the top is approximately 6 in. above final grade.
12. Install cap and padlock.

21.8 Sampling Procedures

These procedures are to be performed only by a trained technician:

1. Use proper safety equipment, including gloves and eye protection.
2. Remove padlock and locking cover from riser of Sampling Port.
3. Pump out water in base of Sampling Port.
4. Insert the sampling rod with attached cup and lower it to the level of the inlet in the base of the watertight sampling port (where the PVC pipe connects from the Collector into the base of the Sampling Port. Refer to illustration below.)
5. Leave in place until a sufficient amount of treated effluent has been obtained.
6. When obtaining samples, use care not to touch collection cup against the side walls or bottom of the sampling port to prevent contamination.
7. Immediately perform visual and olfactory assessment of collected sample.
8. Reinstall cap, re-seal and re-lock.
9. Thoroughly wash hands and any equipment used.



22.0 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.

22.1 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®.

22.2 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 30 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.

22.3 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.

22.4 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.

22.5 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. 4.0, page 2).

22.6 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. 4.0, page 2).

22.7 Coupling
A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.5.5, page3).

22.8 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.”

22.9 Differential Venting
A method of venting a Presby System utilizing high and low vents (see para. 14.2, page 11).

22.10 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. 0, page 11.

22.11 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. 11.1, page 7.

22.12 Distribution Box Manifold
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 5.8, on page 4.

22.13 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. 11.2.2, page 7 and illustration on page 14.

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

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

22.16 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 14.0, page 11.

22.17 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.

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

22.19 Multiple Bed Distribution
Incorporates two or more beds receiving effluent from a distribution box (see para. 11.2, page 7).

22.20 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 3).

22.21 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.

22.22 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 13.0, page 10).

22.23 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. 5.9 on page 4).

22.24 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. 12.0, page 7).

22.25 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 16.22, page 17. 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.

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

22.27 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. 4.0, page 2).

22.28 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another (See para. 11.2.2, page 7).

22.29 Slope (1:3)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. Example: A slope with a grade of (1:3) is the difference in (run) over an elevation difference of one (1) ft (rise) and the distance of three (3) horizontal feet.

22.30 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).

22.31 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.

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

22.33 System Sand Bed
System Sand bed area required/used in Presby Systems. The System Sand bed extends a minimum of 6 inches below, 4 inches above and 6 inches horizontally from the outside edges of the Presby Pipes.

22.34 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. **Error! Reference source not found.**, page **Error! Bookmark not defined.**).

22.35 System Sand Extension Area
The System Sand extension area is a minimum of 6 inches deep (see illustration in para. 11.1, page 7). A System Sand extension area is sometimes required to satisfy the minimum sand bed area requirement.

22.36 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.

22.37 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. 0, page 11).