DBO EXPERT

System O MD

Design and Installation Manual
Province of New Brunswick

March 2024

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Introduction

Context

The purpose of this manual is to provide information specific to the Province of New Brunswick for use in the design and installation of System O)).

Project of more than 5,460 Litres

This design manual is applicable to systems that have a daily design sewage flow of 5,460 litres or less.

Systems that have a daily design sewage flow of greater that 5,460 litres per day need to be designed by a Professional Engineer licensed through the Association of Professional Engineers and Geoscientists of New Brunswick.

Provincial Standards

This manual is applicable to the Province of New Brunswick. This design and installation manual is to be used in conjunction with manufacturer recommendations and the New Brunswick Technical Guidelines for Onsite Sewage disposal Systems.

Technical Support

The authorized distributor of System O)) products provides technical support to all individuals using System O)). For questions about System O)) product or the information contained in this manual, please contact J&L Marketing Ltd. at (506) 363-2108.

Section A - System O)) Basics

Background

Sewage effluent that exits from a septic tank (primary treatment 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 clog the underlying soil, interfering with its ability to absorb liquid.

What our System Does

By utilizing simple, yet effective natural processes, System O)) treats septic tank effluent in a manner that prevents solids from entering surrounding soils, increases system aeration, and provides a greater bacterial area (mat) than traditional systems.

Why our System Excels?

By utilizing simple yet effective natural processes, System O)) treats septic tank effluent in a manner that prevents suspended solids from clogging the underlying soil, increases system aeration, and provides a greater bacterial area (“biomat”) than traditional leaching systems. No other passive wastewater

treatment system design offers this functionality. System O)) excel because they are more efficient, last longer, and have a minimal environmental impact.

System Components

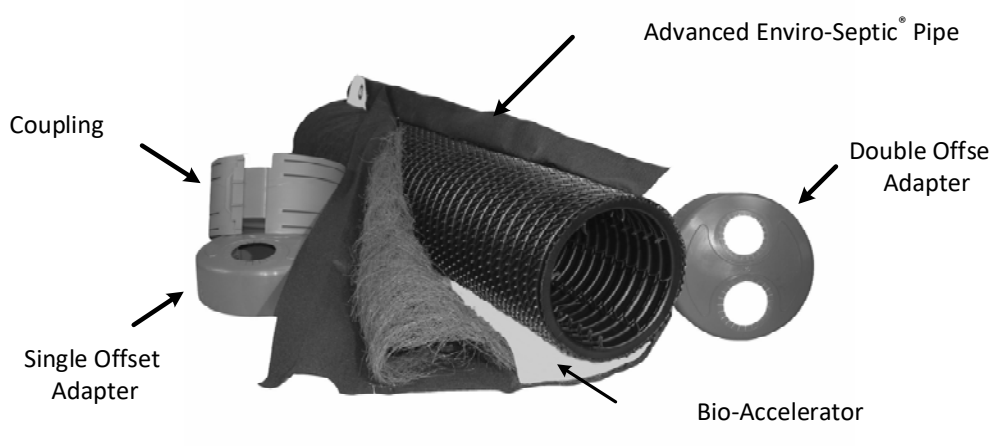

Figure 1. System O)) Components

Overview of Components and their Functions

Advanced Enviro))Septic pipe consists of:

- A 300 mm diameter, high-density plastic pipe which is corrugated and perforated. Skimmer tabs extend into the pipe at the point of each perforation.
- A dense mat of coarse, randomly oriented plastic fibres surrounds the outside of the pipe.
- The Bio-Accelerator™ geo-textile fabric layer partially covers the fibres on the lower half of the pipes. It is located between the pipe and the plastic fibres.
- The outer layer non-woven geo-textile fabric holds the other components in place and provides a protected surface on which a biomat develops.

The Advanced Enviro))Septic pipes are surrounded by a bed of System Sand, which facilitates the process by wicking the liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria.

Pipe Cross-Section

The following schematic presents the four components of the Advanced Enviro))Septic pipe.

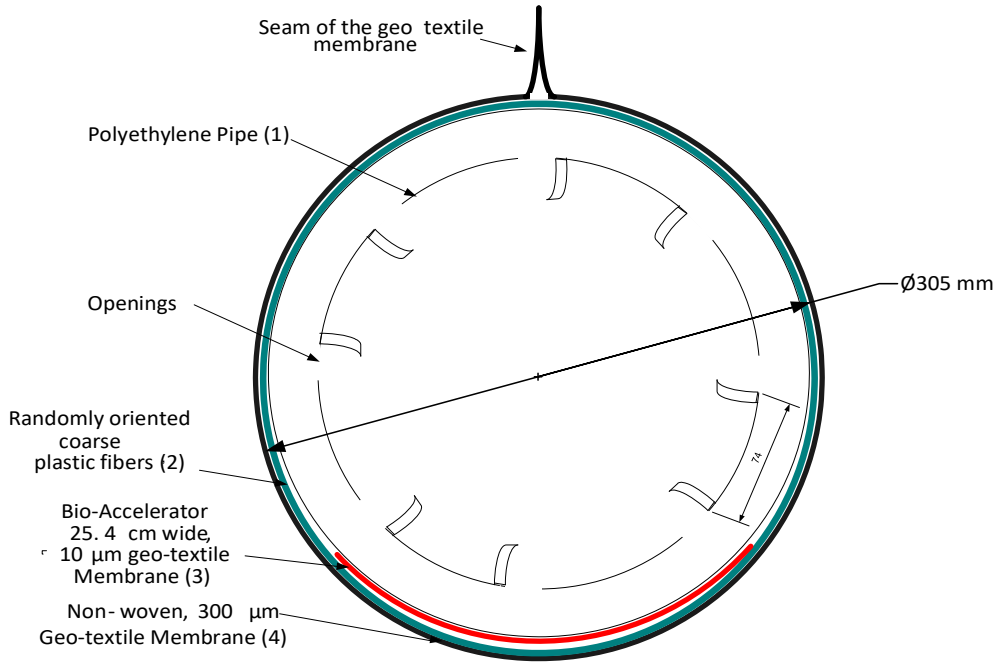

Figure 2. Pipe Cross-Section

Operating Principles

When effluent leaves the septic tank (primary treatment tank), it still contains some suspended material, fats and grease and other pollutants. The presence of these elements eventually causes clogging of traditional leaching fields. System O)) facilitates the treatment of sewage effluent by using natural bacterial processes in a more efficient way. The cooling of the effluent in the pipes and the aerobic bacterial activity around the geo-textiles allow for the separation of suspended solids, which are retained inside the pipes. The combination of air flow and continually fluctuating liquid levels in the pipes increases the effectiveness of bacterial activity in the membranes. These processes create a system with an interior balance, prolonging the system's lifespan and allowing the system to treat the wastewater effectively before it is dispersed into the environment. System O)) Wastewater Treatment System is passive, requiring no electricity or complicated mechanical devices.

System Advantages

Here's a brief list of the advantages of System O)).

- Eliminates "septic mounds" through sloping system installations
- Adapts to difficult sites
- Installs more easily and quickly than traditional systems
- Eliminates the need for expensive washed stone
- Adapts easily to both residential and commercial sites
- No mechanical equipment for treatment performance
- Allows for gravity discharge with often no requirement for pumps
- Lower cost than comparable level IV (tertiary) treatment systems

What it Looks Like

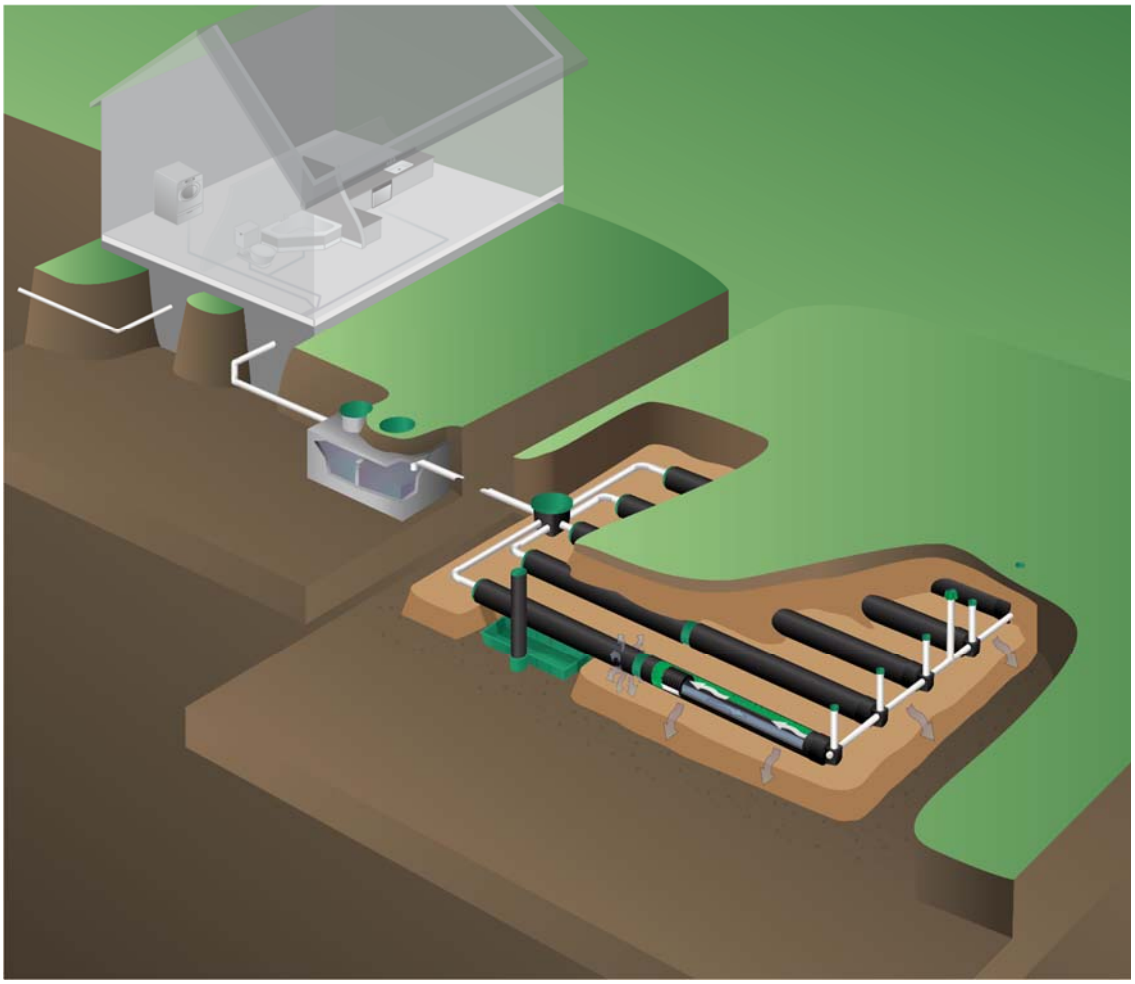

Figure 3. System O)) Wastewater Treatment System

How it Works

These are the basic stages that take effect in System O)).

Stage	What Happens
1	Warm effluent enters the pipe and is cooled to ground temperature.
2	Suspended solids and grease separate from the cooled liquid effluent.
3	Skimmers further capture grease and suspended solids from the effluent as it exits through perforations in the pipe.
4	Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.
5	Bio-Accelerator fabric screens additional solids from the effluent and develops a biomat which provides treatment and ensures effluent distribution along the entire length of the pipes
6	A mat of coarse random fibers separates more suspended solids from the effluent.

7	Effluent passes into the geo-textile fabric and grows a protected bacterial surface.
8	Liquid exiting the geo-textile fabric is wicked away from the piping by the surrounding System sand. This enables air to transfer to the bacterial surface.
9	Bacteria grow on the fibrous mat and geo-textile surfaces to create a biomat and break down the sewage solids.
10	Bacterial efficiency is increased by the large air supply and fluctuating liquid levels which provide for optimum bacterial activity.

System O)) Chain of Treatment

There are five (5) main components in System O)) chain of treatment. They are:

- Septic Tank
- Effluent filter.
- Distribution device
- Advanced Enviro))Septic pipe and
- System Sand.

Treatment Components of System O))

The following Diagram displays the treatment components that are included in System O)).

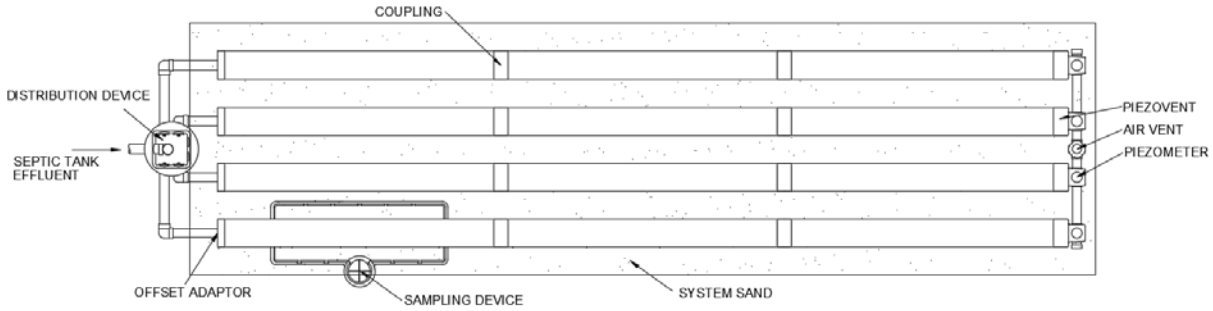

Figure 4. System O)) Treatment Components

Components of Treatment System

System O)) Component	Function
Septic Tank	Used as primary Treatment
Effluent Filter	Used to prevent solids from passing out of the septic tank.
Pump Station (optional)	Used between the Septic Tank and the distribution device when the effluent cannot be sent to the Advanced Enviro))Septic pipe rows by gravity
Velocity Reducer	Always required when a pump station is used[1]. Can be done with a minimum 3 m length 100 mm watertight pipe placed horizontally or in an upwards slope towards the distribution box. Used to reduce the velocity of the septic tank effluent before arriving at the distribution device.
Distribution Device	Used to distribute the septic effluent between the rows of Advanced Enviro))Septic pipe. For example, a distribution box with flow equalizers.
System O)) Contact Area	Area of infiltrative surface, directly below System O)), required to absorb the treated effluent into the underlying native soil.
Advanced Enviro))Septic pipe rows	Used to treat and distribute the septic tank effluent over System O)) Contact Area. System O)) rows are comprised of the 3.05 m lengths of Advanced Enviro))Septic pipes, offset adaptors and couplings.
System Sand	Used to increase the development of microorganisms that treat wastewater before it infiltrates into the soil. Also helps in providing air to the system.
(Optional) Sampling Device	The sampling device is used to retrieve samples of the treated effluent from System O)). The sampling device is placed at the base of System O)), below the System Sand.
Vents	The vents are to allow the circulation of air throughout the system. Venting occurs through a combination of a high and low vent to create a vacuum. The low (entry) vent is located at the end of the rows of Advanced Enviro))Septic pipe and the high vent (exit) is located on the roof of the building. Other configurations may be used when the roof vent is not viable.

[1] The velocity reducer is not required with a Low Pressure Distribution System.

Piezometers	The piezometers are located at the end of each row or a combination of rows. They are used to monitor the system.

Section B - Definitions of Terms

Introduction

As you read through the information in this manual, you will encounter common terms, terms that are common to our industry, and terms that are unique to System O)). While alternative definitions may exist, this section defines these terms as they are used in this manual.

List of Terms

Here's a list of the terms defined in this section.

- Center to center spacing
- Coupling
- Daily design sewage flow
- D-Box
- Differential venting
- Distribution box
- Distribution box manifold
- Distribution Device
- Piezovent
- Cap
- End extension distance
- System O)) Contact Area
- Advanced Enviro))Septic pipe
- Equalizer
- High and low vents
- Imported sand
- Infiltrative surface
- L/day
- Lateral extension distance
- Offset adapter
- Raised or partially raised system
- Row length
- Sloping system
- System Sand
- Uniform distribution
- Vertical Separation

Center to Center Spacing

Center to center spacing is the horizontal distance from the center of one System O)) row to the center of the adjacent row. The abbreviation for this term is $\mathbf{E_{cc}}$.

Coupling

A coupling is a fitting that joins two pieces of Advanced Enviro))Septic pipe together.

Daily Design Sewage Flow

Daily design sewage flow is the determined liters/day flow for sewage systems as detailed by the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems

D-Box

D-Box is an abbreviation for distribution box.

Differential Venting

Differential venting is a method of venting a System O)) utilizing high and low vents.

Distribution Box

A distribution box is a device used to divide and/or control the septic tank effluent flow into System O)) rows of pipe.

Distribution Box Manifold	A distribution box manifold is a method of joining any number of distribution box outlets to a single pipe.
Distribution Device	A distribution device is a device used to divide and/or control the septic tank effluent flow. The distribution device can be a distribution box, or another flow splitting device.
Piezovent	An end cap for the Advanced Enviro))Septic pipes with three 300 mm openings. The piezovent combines and simplifies the installation of the ventilation network and the piezometers.
Piezometer Cap	A solid cap used to seal the end of the piezometer.
End Extension Distance	The end extension distance is the distance filled with additional sand material extending from the end of a row to the side of the treatment system contact area. The abbreviation for this term is $\mathbf{E_e}$.
System O)) Contact Area	System O)) contact area means the area of infiltrative surface, directly below the treatment system, required to absorb the treated effluent into the underlying native soil.
Advanced Enviro))Septic pipe	An Advanced Enviro))Septic pipe is a single unit of pipe, 3.05 m in length, with an outside diameter of 300 mm and a storage capacity of approximately 220 liters. The set of membranes surrounding the pipe includes the Bio-Accelerator.
Equalizer	An equalizer is a plastic insert installed in the outlet lines of a distribution box to provide more equal effluent distribution to each outlet, and allow future adjustments.
High and Low Vents	High and low vents are pipes used in differential venting.
Imported Sand	Imported Sand is imported leaching bed fill having a permeability (K_{FS}) of 5×10^{-5} to 6×10^{-4} m/s with less than 5% fine passing #200 sieve, that is imported to the site to raise the system to achieve vertical separation. This does not include the System Sand which is part of the treatment system. The imported sand must meet the criteria of Table 3 of the New Brunswick Technical Guidelines for On-Site Sewage Disposal Systems.
Infiltrative Surface	The infiltrative surface means the area of interface where effluent migrates downward from System O)) and passes into the native soil or leaching bed fill.
L/day	Abbreviation for liters per day.

Lateral Extension Distance	The Lateral extension distance is the distance filled with System Sand extending from the center of the last lateral row to the side of the treatment system. The abbreviation for this term is $\mathbf{E_L}$.
Offset Adapter	An offset adapter is an end cap fitted with a 100 mm offset opening at the 12 o'clock position.
Raised or Partially Raised System O))	Raised or Partially Raised System O)) means a System O)) in which any part of the system is above the natural ground elevation.
Row Length	The row length is the length of the Advanced Enviro))Septic pipes that are connected together with the couplings. The abbreviation for row length is L_r.
Sloping System	A Sloping system is a system in which rows of Advanced Enviro))Septic pipes are at different elevations.
System Sand	System sand is sand that has specific criteria and is used to surround the Advanced Enviro))Septic pipe. See Section F for sand criteria.
Uniform Distribution	The uniform distribution means the even dispersal of septic tank effluent to the rows of pipe and the equal distribution of the rows of pipe over System O)) Contact Area.
Vertical Separation	The Vertical separation means the depth of unsaturated soil including any imported sand below System O)) as measured from the bottom of the system (System Sand layer) to a limiting surface such as high ground water table, rock or soil with a permeability of < $3x10^{-6}$ m/s.

Section C - Designing Steps for System O))

Context

In this section we will present the necessary steps required to design a System O)). The necessary steps required are:

On site

- Determine the total daily design sewage flow.
- Determine the available area for the treatment system.
- Determine the slope of the site.
- Evaluate the ability of the soil to infiltrate the treated effluent from the system.

Determine the available options

- Discuss the treatment alternatives with the clients while taking into account the advantages and disadvantages of each of them.

Design the system dimensions and prepare the drawings.

These steps will be discussed in the following pages

Determine the Daily Design Sewage Flow	***Reference: New Brunswick Technical Guidelines for On-site Sewage Disposal Systems version 6 Appendix D p. 50-55.*** The total daily design sewage flow shall be at least the Peak Flow (LPD) as determined in the Appendix D. Where the building contains more than one establishment, the total daily design sewage flow shall be the sum of the total daily design sewage flows for each establishment. Note: As per Section 2.1 of the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems, systems with sewage flow of greater than 5,460 L/d must be designed by a Professional Engineer licensed through the Association of Professional Engineers and Geoscientists of New Brunswick.
Separation Distances	The separation distances for System O)) are governed by New Brunswick Technical Guidelines for On-site Sewage Disposal Systems Version 6. The Advanced Enviro))Septic pipes, as measured from the center of the pipes, shall meet the separation distances in Section 3 of the NB Technical Guidelines for On-site Sewage Disposal Systems with the exception of limiting factors.
Evaluating the Native Soil Permeability	The soil's ability to infiltrate treated effluent is critical to a successful onsite septic system installation. The ability to infiltrate treated effluent will determine the size of the contact area which will distribute the treated effluent to the natural soils. Refer to Table 6 of the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems for a description of the various soil and how they can be used to classify an in-situ soil.
Basic Profile of System O))	The rows of Advanced Enviro))Septic pipes must be installed in a layer of System Sand, following the specifications shown in **Figure *5***.

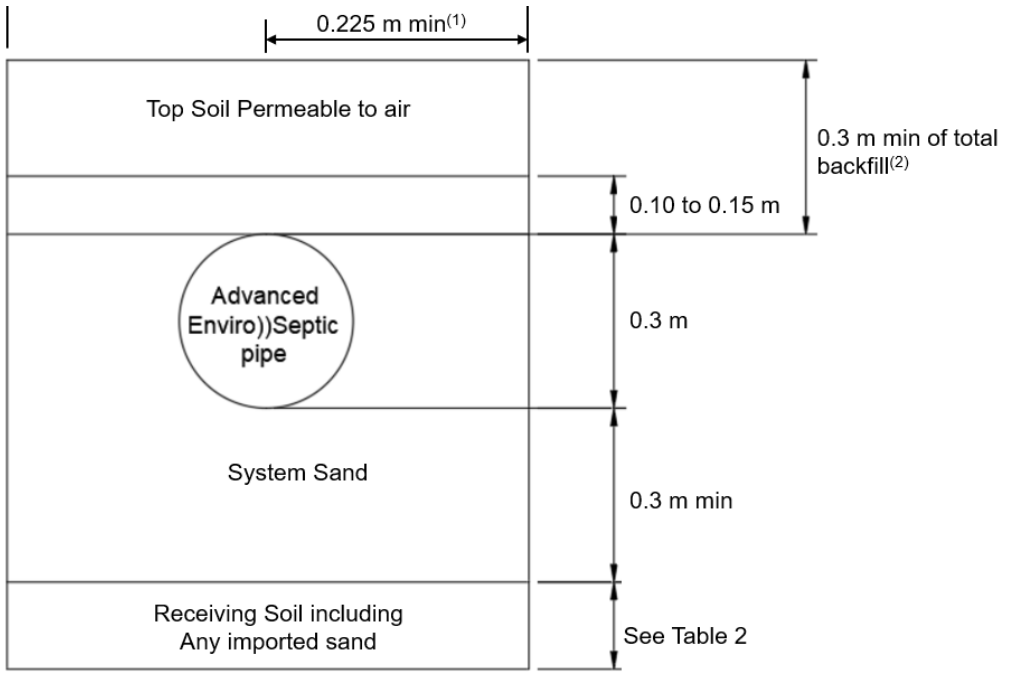

Figure 5. Basic profile of System O))

Notes: (1) At the edge of the system contact area, the minimum distance from the centre of the pipe to the edge of the System Sand needs to be 0.45 m.

(2) The layer of the System Sand above the Advanced Enviro))Septic pipes added to the air permeable backfill on top of it needs to be as least 300 mm thick (i.e. If the sand layer above the pipes is 100 mm, the air permeable backfill needs to be 200 mm thick → 100 mm + 200 mm = 300 mm).

Separation	The vertical separation from the system sand interface and the limiting layer (high groundwater table, bedrock or impermeable soil) should be a minimum of 450 mm.
In-Ground or Above Ground System	Taking into consideration the properties of the soil, the depth of soil before getting to the position of the high-water table or the rock, determine if the system will be in-ground, partially raised or raised system.
Sizing the System	The size of the Contact Area is determined using the formulas presented in the next section.

Adjust the configuration of System O)) to fit the constraints of the site and to respect the minimum spacing requirements between pipes, the separation distances and the minimum infiltrative surface required to properly infiltrate the treated effluent.

Informing the Client

When a septic system is being planned, it is important to have a good discussion with the client to determine his/her expectations:

- Future home renovation or addition to the building.
- Any plans they have for the site i.e. pool, garden, patio etc.
- Site aesthetics.
- Maintenance and annual costs associated with System O)).

Section D - System O)) Layout and Sizing

Procedure

System O)) can be installed as an in-ground system, a partially raised system or as a raised system. The site conditions will determine how the system will be installed.

There are three main steps in sizing this system:

- Determine the septic tank size.
- Determine the number of Advanced Enviro))Septic pipes required.
- Determine the dimensions of System O)) and the total footprint of this installation required to properly infiltrate the treated effluent.

Septic Tank Sizing

System O)) is designed to receive septic tank effluent for treatment and dispersal. As such, the septic tank requires no specific upfront treatment for incoming sewage which is of domestic nature. All raw sewage will enter into a septic tank sized in accordance with Appendix B of the New Brunswick Technical Guidelines for On-site Sewage.

The septic tank shall have two compartments, where the liquid capacity of the first compartment is equal to two-thirds of the septic tank capacity and be equipped with an effluent filter.
Please note that the effluent filter used must not hinder the free passage of air travelling through the system. Please call your local distributor for more information.

At no time shall the septic tank be less than 3410 L working capacity.

Number of Advanced Enviro))Septic pipes

This step applies to all options for System O)). Each section of Advanced Enviro))Septic pipe (AES) has the capacity to treat 126 L of wastewater per day. Therefore, the formula to determine the minimum number of Advanced Enviro))Septic pipe (N_{AES}) required is Q/126.

$$N_{AES} = Q/126 \quad (1)$$

The number of Advanced Enviro))Septic pipe obtained must be rounded up at all time.

As each section of pipe is 3.05 m in length thus the total linear length of pipe is the number of pipes multiplied by the length.

E.g. For a 3 bedroom house: Q = 1,365 L/day
N_{AES} = 1,365 / 126 = 10.8 AES.

Rounded up, it gives a minimum of 11 AES required. The minimum length of pipe is:

11 x 3.05 = 33.55 m of pipe.

Minimum / Maximum Length of Row

To maintain efficient effluent cycling, the minimum length of a row of Advanced Enviro))Septic pipes is 3.05 m and the maximum length is 30 m. These lengths have been tested and have shown that there is longitudinal distribution that occurs at these lengths thanks to the homologous distribution of a biomass that ensures treatment along the entire length of the row.

System O)) Contact Area Sizing

System O)) contact area is the interface of the base of System O)) and any imported sand with the native soil.

System O)) contact area is obtained from the larger of two possibilities:

- Minimum evacuation surface (S_E): the minimum surface required to evacuate the water from System O)).
- Minimum surface for spacing requirements (S_{SR}): the minimum surface calculated using the minimum spacing required between and around the length of a row of Advanced Enviro))Septic pipes to properly install the System Sand.

Scenario 1: For soil category A

The minimum surface required to evacuate the treated effluent from the system is calculated from formula 2:

$$S_E = Q / (88\ L/m^2/d) \quad (2)$$

Where:

- S_E is the contact area in m² between the base of the sand layer and the underlying native soil,
- Q is the total daily design sewage flow in L/day.

Scenario 2: – For soil category B

The minimum surface required to evacuate the treated effluent from the system is calculated from formula 3:

$$S_E = Q / (75\ L/m^2/d) \qquad (3)$$

Where:

- S_E is the contact area in m² between the base of the sand layer and the underlying native soil,
- Q is the total daily design sewage flow in litres.

Scenario 3- For soil category C

The minimum surface required to evacuate the treated effluent from the system is calculated from formula 4:

$$S_E = Q / (29\ L/m^2/d) \qquad (4)$$

Where:

- S_E is the contact area in m² between the base of the sand layer and the underlying native soil,
- Q is the total daily design sewage flow in litres.

Please refer to **Table *2*** for further information regarding these formulas.

In some cases, the minimum excavation surface/contact area is not sufficient to accommodate the minimum spacing requirements for The Advanced Enviro))Septic pipe. In these cases, the area must be increased to accommodate the spacing requirements.

The area required is based on the number of rows within the system and the extension of System Sand material around the limits of the pipes. The minimum pipe spacings are the following:

Table 1.

Acronym	Description	Minimum horizontal spacing (m)
E_{cc}	Centre to centre spacing from one row of pipes to the next.	0.45
E_L	Lateral extension distance from the center of the last lateral row of pipes to the limit of System O)).	0.45
E_E	End extension distance from the end of a row of pipes to the limit of System O)).	0.30

System O)) is based on a standard rectangle. However, other special configurations can be permitted providing that the flow is properly distributed between pipes and over the infiltration area. The horizontal spacings mentioned in **Table *1*** can be manipulated in order to reach the required contact area. Wherever possible the design should be based on Length > Width. The dispersal surface/contact area shall have the long dimension perpendicular to the direction in which effluent entering the soil will move horizontally.

No row is to be greater than 30.5 m in length.

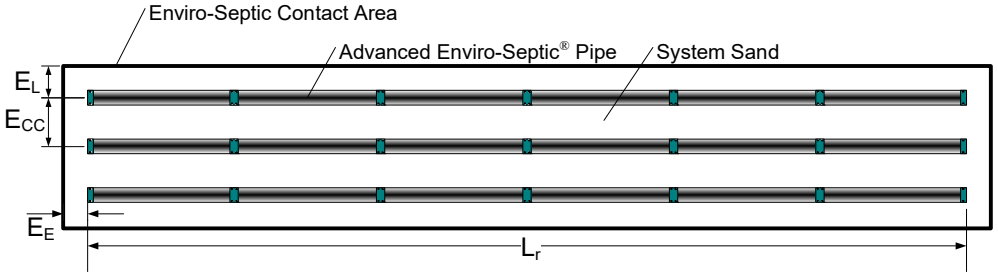

Figure 6. Spacing

Therefore, the minimum surface for spacing requirement is:

$$S_{SR} = W_{SR} \times L_{SR}$$

$$L_{SR} = L_r + (2 \times E_E)$$

$$W_{SR} = (E_{cc} \times (N_r\text{-}1)) + (2 \times E_L)$$

$$S_{SR} = [L_r + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] \qquad (4)$$

Where:

- S_{SR} is the minimum surface/contact area for spacing requirement
- S_{CA} is the surface contact area of the system
- L_{SR} is the length of the minimum surface/contact area for spacing requirement
- W_{SR} is the width of the minimum surface/contact area for spacing requirement
- N_r is the number of rows of Advanced Enviro))Septic pipes

System O)) minimum contact area is the larger of S_E or S_{SR}.

If $S_{SR} > S_{E,}$ $S_{CA} = S_{SR}$
If $S_{SR} < S_E$, $S_{CA} = S_E$

Note: When the spacing between System O)) length (E_{cc}) is more than 0.9 m, imported sand could be added between System O)) length instead of using System Sand (see **Figure *7***). There is no maximum spacing, but efforts should be taken to reduce the amount of imported sand required in order to minimize the cost of the project for the client.

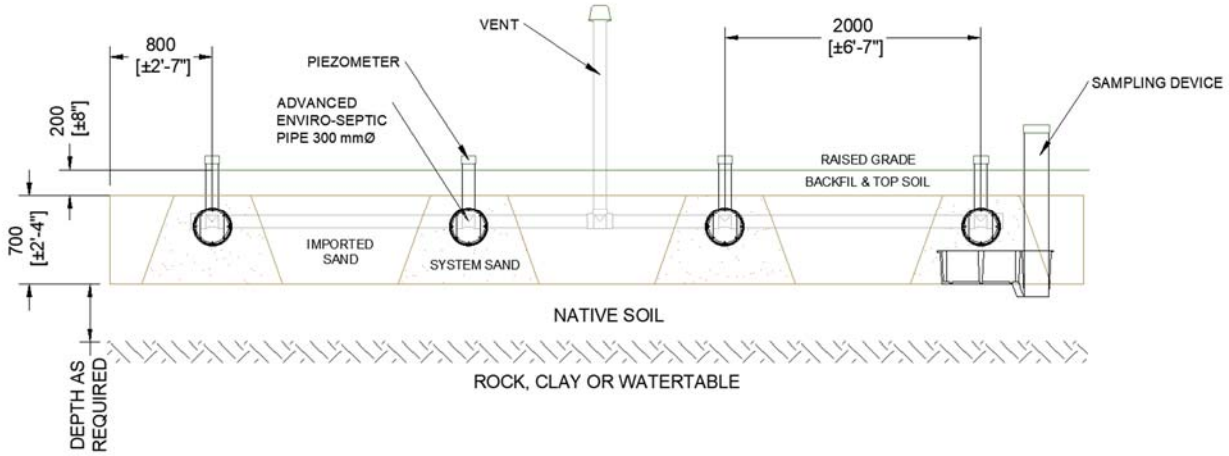

Figure 7. Using imported sand for large Ecc spacings

Design Criteria Summary

System O)) can be installed directly in-ground or partially raised when the site conditions permit it. The soil category must be type A, B or C and is determined as per the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems.

When the site conditions do not allow the system to be installed in-ground or partially raised, it can be installed above ground, as a fully raised system.

The vertical separations must be met, as detailed in **Table *2*** in this manual.

The table below displays the design criteria required for in ground, partially raised or above ground systems:

Table 2. Hydraulic Conductivity of Native Soil

Soil Type	A	B	C
Type of installation	In-ground, partially raised or fully raised systems		
Minimum System O)) Contact Area (m^2)	Q / (88 L/m^2/day) or Min. AES Spacing requirement (Formula 2)	Q / (75 L/m^2/day) or Min. AES Spacing requirement (Formula 3)	Q / (29 L/m^2/day) or Min. AES Spacing requirement (Formula 4)
System sand layer under Advanced Enviro))Septic pipes	300 mm		
System Sand layer above Advanced Enviro))Septic pipe	100 mm		
Topsoil permeable to air on top of the System Sand	200 mm minimum		
Minimum Vertical Separation as measured from the bottom of System O)) Sand to limiting layer[1]	450 mm minimum		

1. Limiting layer could be high water table, bedrock or not permeable soil.

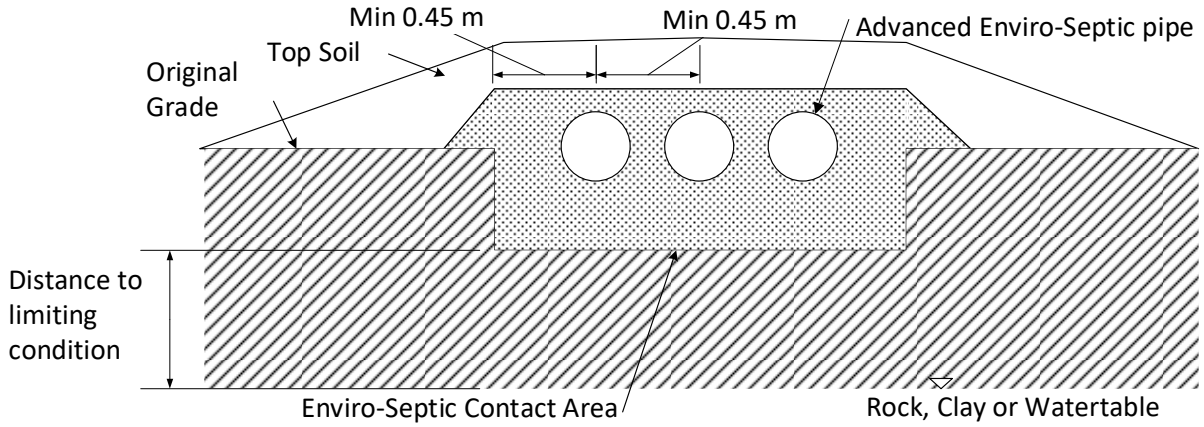

Figure 8. Partially raised system cross-section

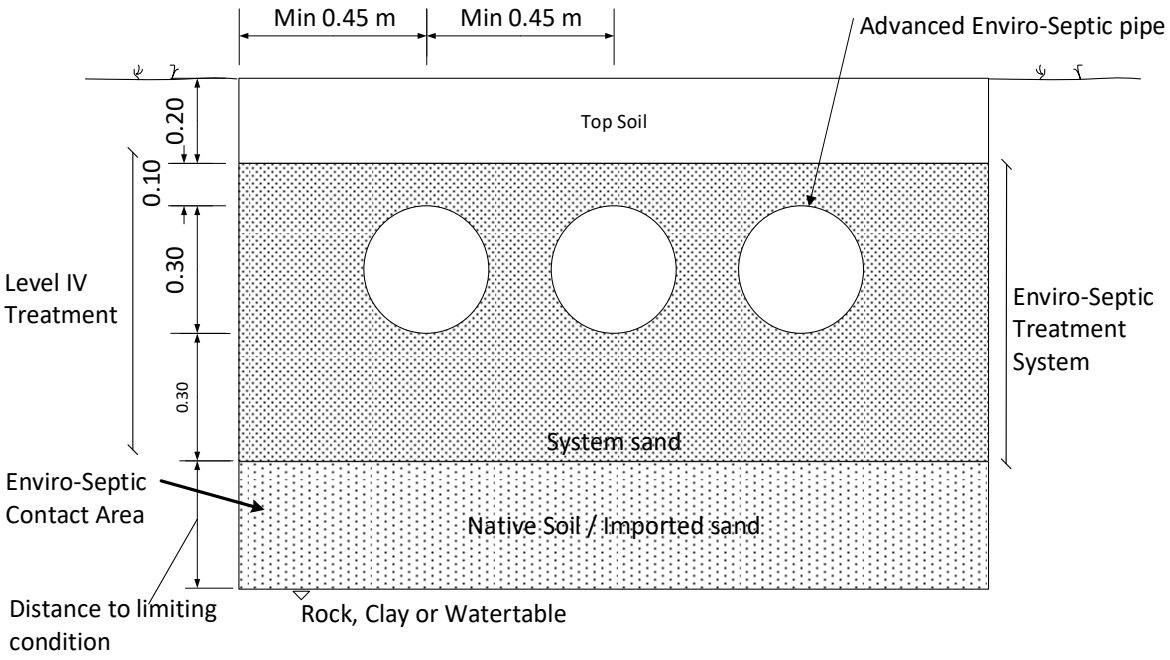

Figure 9. In-Ground system cross-section

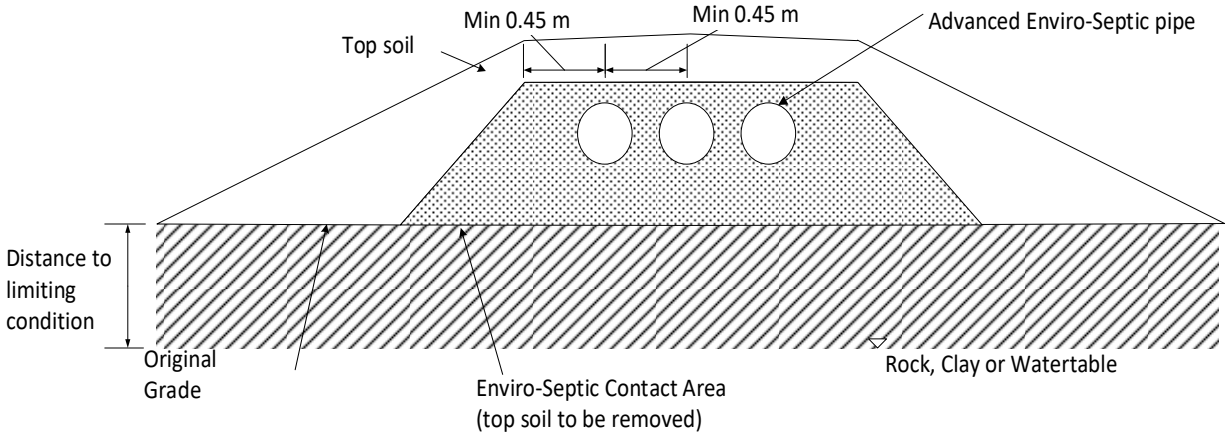

Figure 10. Fully raised system

Note: Top soil must be removed since its permeability is not taken into consideration during the soil analysis.

Section E - General Design Criteria

Background	This section presents the basic design criteria for a System O)).
Row Orientation	Rows of Advanced Enviro))Septic pipes must be laid level and should run parallel to contours (perpendicular to sloping terrain), where possible. If known, the Advanced Enviro))Septic pipes should be placed perpendicular to the hydraulic gradient of the ground water.
Preferred Row Length	In general, fewer long rows are preferable to a greater number of short rows. Longer rows provide more efficient settling of solids. In addition, longer more narrow systems reduce the potential for ground water mounding.
Minimum / Maximum Row Lengths	The minimum row length is 3.05 m of Advanced Enviro))Septic pipe and the maximum length is 30.5 metres.
3.05 Metre Increments Work Best	It is easier for the installer if systems are designed in 3.05 m increments since Advanced Enviro))Septic pipe is 3.05 m in length. However, the pipe is easily cut to any length necessary with a sharp knife.
Row Elevations	For sloping systems, provide elevations on the design drawings for each pipe row of the system.
Septic Tank and D-Box Elevations	The pipe between the building and the septic tank should have a 2% minimum downward slope. The pipe coming out of a septic tank to a D-Box must have a downward slope of a minimum of 1%.

System Sand on the Installation Perimeter

Systems sloping 10% or less require the System Sand area to extend a minimum of 300 mm around the perimeter of the Advanced Enviro))Septic pipes.

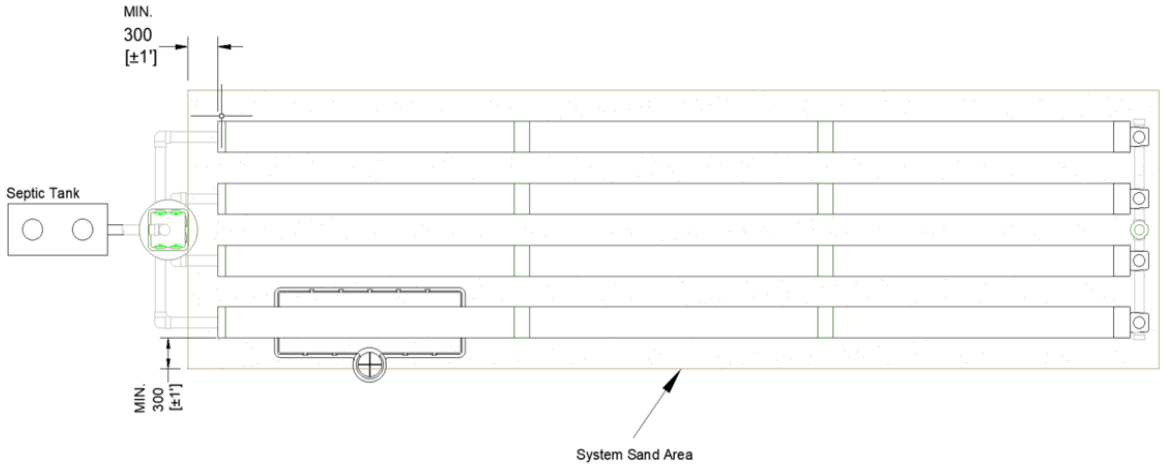

Figure 11. System sand perimeter (10% slope or less)

Systems sloping greater than 10% require the System Sand area to extend a minimum of 300 mm on three sides and 1.2 m beyond the Advanced Enviro))Septic pipe on the down-slope side.

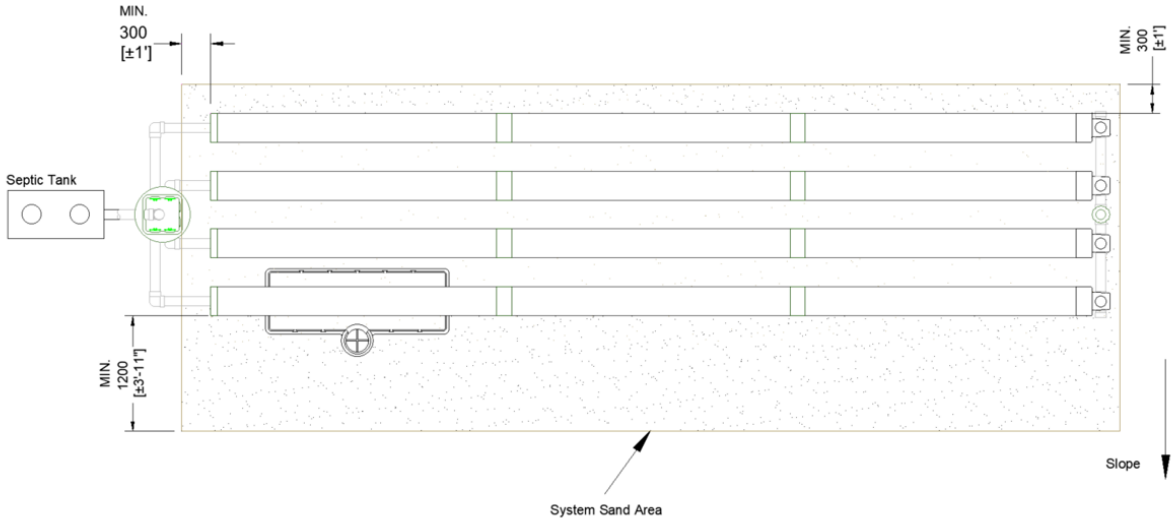

Figure 12. System sand perimeter (10% slope or more)

Sloping Systems

The percentage of slope refers to the slope of System O)), not the existing terrain. The slope of the system and the existing terrain are not required to be equal. A sloping system can be designed in multiple sections, with more than one distinct slope and/or center-to-center pipe spacing in the same system. Maximum backfill slope are 1 unit vertical to 4 units horizontal for the first 6 m.

User Guide

The installer must give the client a copy of System O)) User Guide. The User Guide describes in detail the proper instructions and procedures that must be followed so that System O)) continues to operate properly. The User Guide has details on topics such as abusive substances, additives, and constant discharge. Suggested tank pumping and inspection schedules are also detailed.

Regulations in Effect

When designing a System O)), it is important to ensure that the system is designed according to the New Brunswick Technical Guidelines for On-site Sewage Disposal System, as well as this manual.

Section F - Sand and Fill Requirements

Introduction

This Section describes the sand requirements for System O)).

System Sand

All System O)) configurations require System Sand to surround the Advanced Enviro))Septic pipes by at least

- 300 mm below the pipes
- 300 mm on both sides
- 100 mm above.

The System Sand can be natural sand, or filter sand that has been modified, and it must meet the requirements stated below:

- Effective diameter (D_{10}) between 0.2 and 1.0 mm;
- Coefficient of Uniformity (Cu) ≤ 4.5;
- Less than 3% of material smaller than 80 µm; and
- Less than 20% of material larger than 2.5 mm.

Compliance with the system sand requirements must be verified with a sieve analysis. The sample that is analysed should be a mixture sourced from multiple places in the sand pile. DBO Expert's technical team has prepared an Excel spreadsheet that allows rapid and easy verification of the conformity of a system sand sieve analysis.

It is the responsibility of the installer to not confuse the different piles of material used in the installation of a System O)).

Contact your System O)) distributor for a list of System Sand suppliers.

Imported Sand Fill to Achieve Vertical Separation

For partially raised and fully raised systems, it is possible to achieve vertical separation by adding a layer of imported sand. Proper evaluation needs to be done to verify that the native soil layer will have the capacity to evacuate the treated water. The imported sand shall have a permeability rate (K_{FS}) of 5 x 10^{-5} to 6 x 10^{-4} m/s, with less than 5% fines passing the 200 sieve. The quality of the sand should be ensured using either a sieve analysis to verify the grain size distribution, or a permeability test to determine K_{FS}.

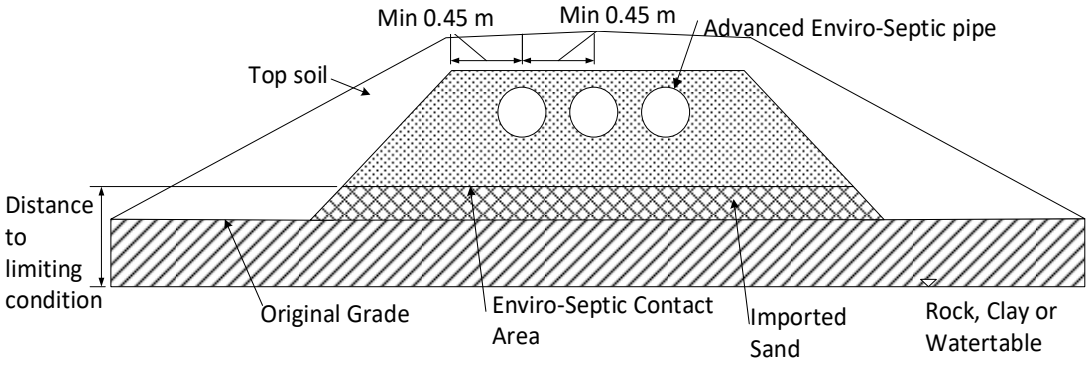

Figure 13. Imported sand fill

Perimeter Sand Requirements

The System Sand / Imported Sand shall extend a minimum of 300 mm around the perimeter of the Advanced Enviro))Septic pipe, for systems on ground sloping 10% or less.

The System Sand / Imported Sand shall extend a minimum of 300 mm on three (3) sides and 1200 mm beyond the Advanced Enviro))Septic pipe on the down-slope side, for systems on ground sloping greater than 10%.

No system shall be installed in an area in which the original ground has a slope in excess of 30%.

Section G - System Configurations

Introduction

The following Sections describe the variations of the flow splitting devices and the design rules associated with them as well as some different system configurations.

Row Orientation	System O)) rows must be laid level and should run parallel to contours (perpendicular to sloping terrain), where possible.
Trenches	A System O)) installed on a slope greater than 10% and less than 30% can also be installed in an infiltration trench configuration. A trench-based System O)) must respect the following criteria:

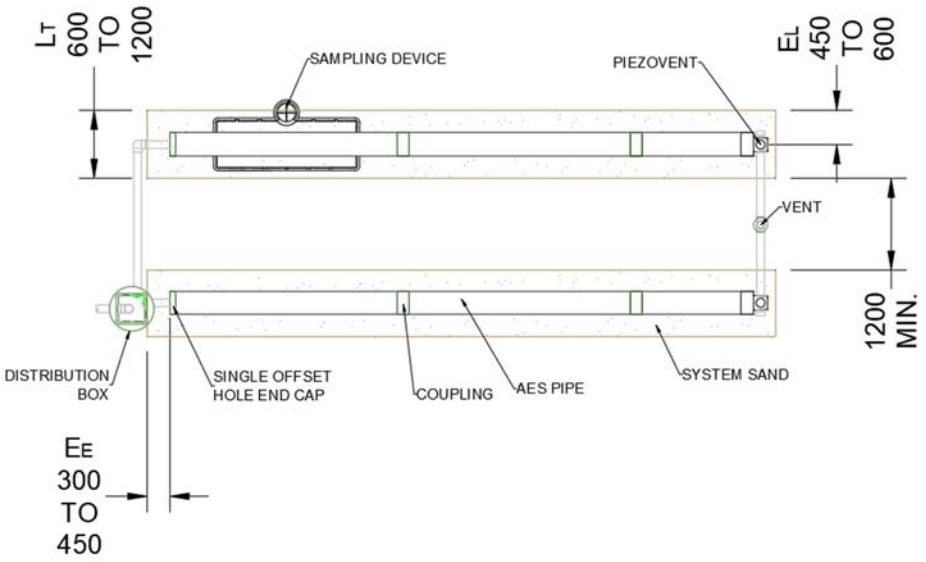

Figure 14. An overhead view of a trench-based System O))

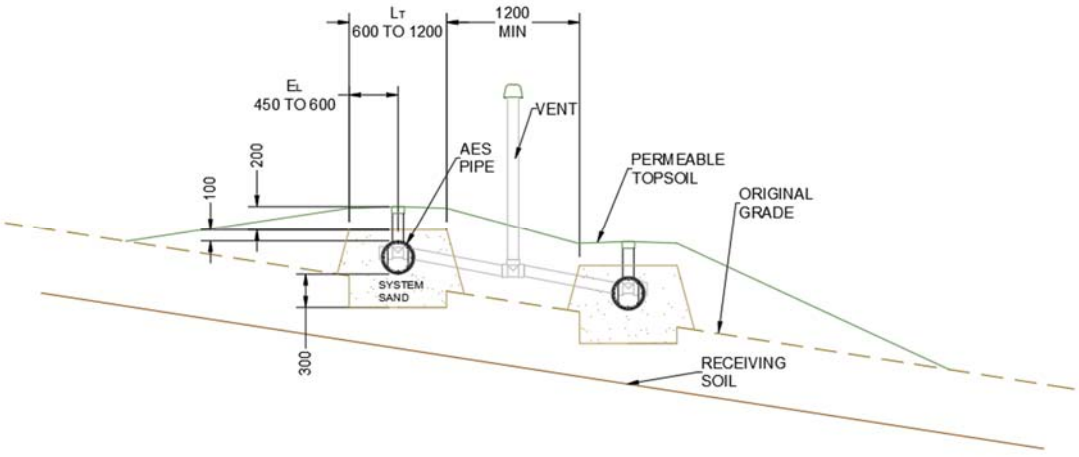

Figure 15. Partially above ground trench-based System O))

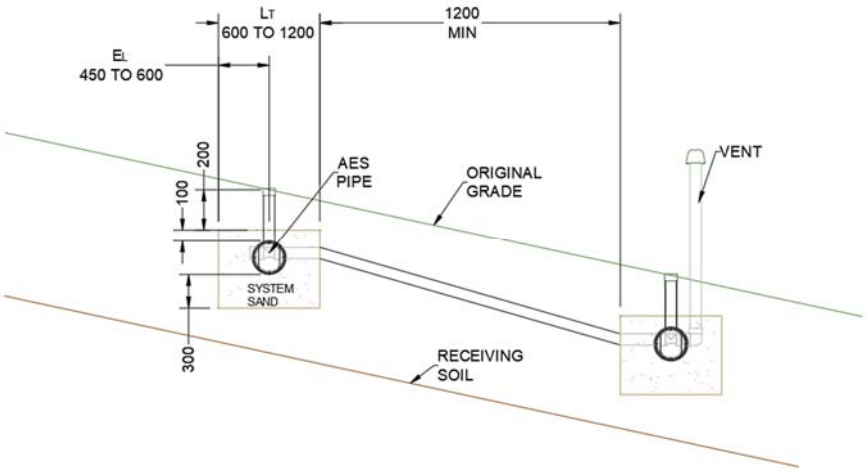

Figure 16. In-ground trench-based System O))

Table 3 System O)) Trench Criteria

Acronym	Description	System placed directly on the receiving soil (m)	0.15 m layer of gravel or crushed stone between the receiving soil and the system (m)
E_L	Lateral spacing from the centre of a row to the outside of the absorption surface.	**0.45 to 0.6**	**0.6 to 1.3**
E_E	Spacing of the end of a row of pipes from the outside of the absorption surface.	**0.3 to 0.45**	**0.45 to 1.15**
L_T	Minimum width of an absorption trench.	**0.6 to 1.2**	**1.2 to 2.6**

When the polishing field consists of infiltration trenches, the following rules must be followed:

- The total area of the trenches must be equal to or greater than the minimum area required in accordance with the regulations in effect.
- The distance between the bottom of the trench and the bedrock, the water table in the average high position or a less permeable or impermeable underlying soil layer must respect the minimum distance provided in **Table *2*** of this document for the polishing field according to the type of receiving soil.

- The distance between each of the absorption trenches must be sufficient to allow the hydraulic barrier separating 2 consecutive absorption trenches to have a minimum width of 1.2 metres.

System Using a Distribution Box (Parallel Distribution)

Definition

A distribution box system is a number of rows of Advanced Enviro))Septic pipes of equal length, each supplied evenly with septic tank effluent through a distribution box.

Equalizers Required

All distribution boxes that divide effluent flow in pump or gravity systems require an Equalizer, or equivalent, in their outlets.

Note: To prevent movement, be sure distribution boxes are placed on a stable soil base or concrete pad.

D-Box Diagram

This is a top view of a basic system with a distribution box. This system has four rows of pipes.

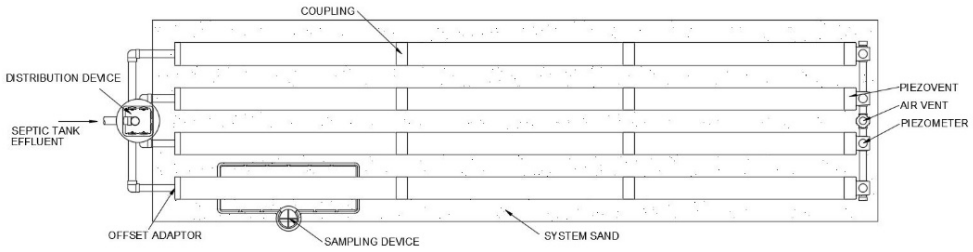

Figure 17. Basic System with D-Box

D-Box Pipe Drop

This side view shows the minimum drop from a D-Box to a row of pipes. The minimum drop between the D-Box and The Advanced Enviro))Septic pipe needs to be 1% and at least 50 mm.

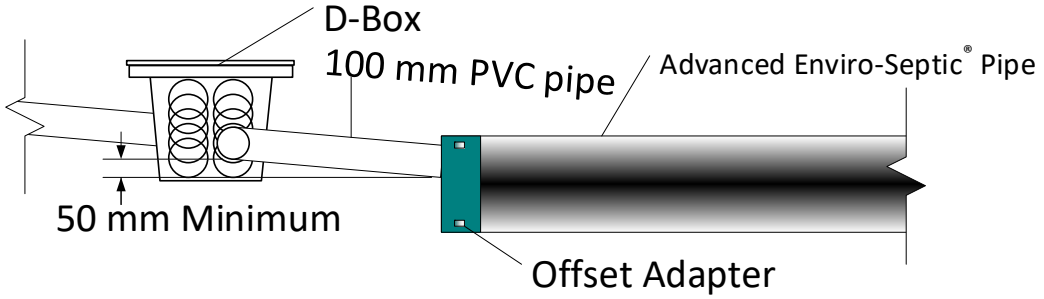

Figure 18. D-Box Pipe Drop

Level In-Ground

Top and side views of a level in-ground D-Box system.

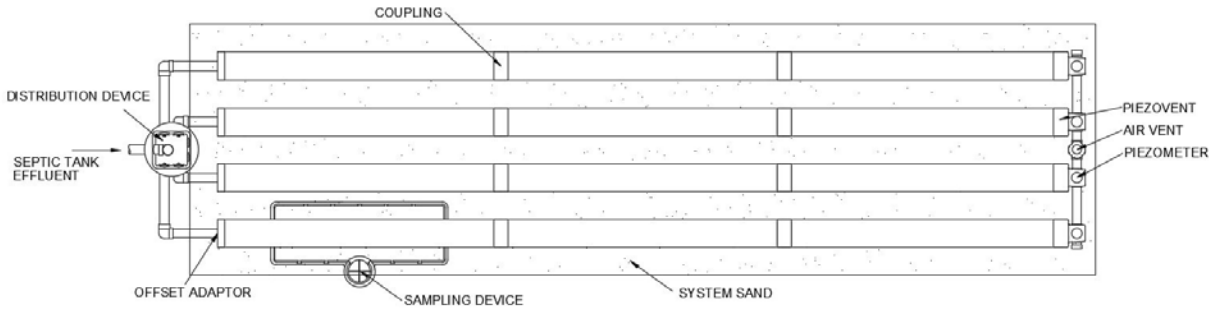

Figure 19. Top view level in ground

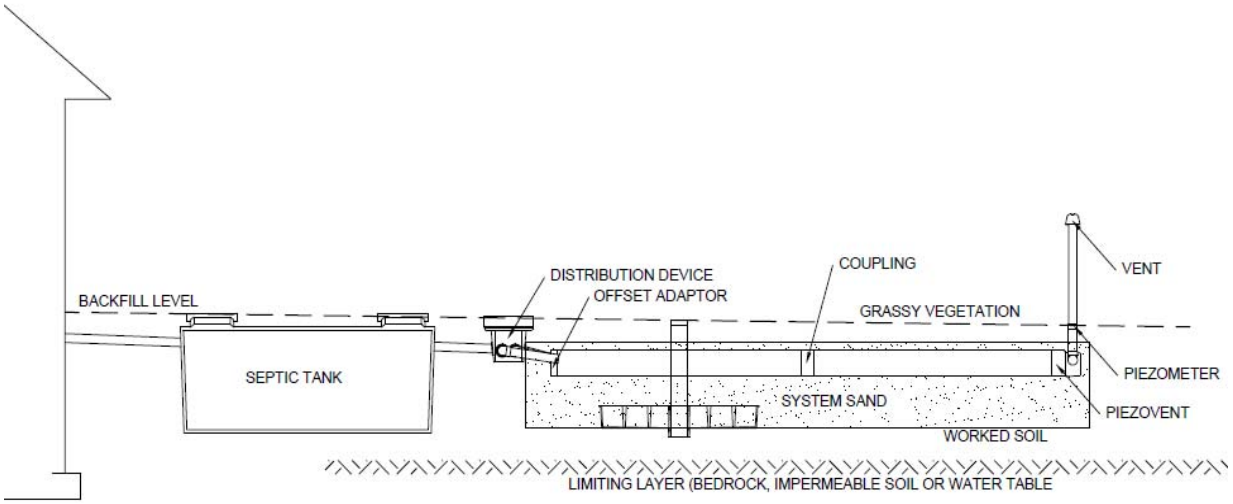

Figure 20. In-ground system side view

Level Raised

Cross-Section, side and top views of a level raised D-Box system.

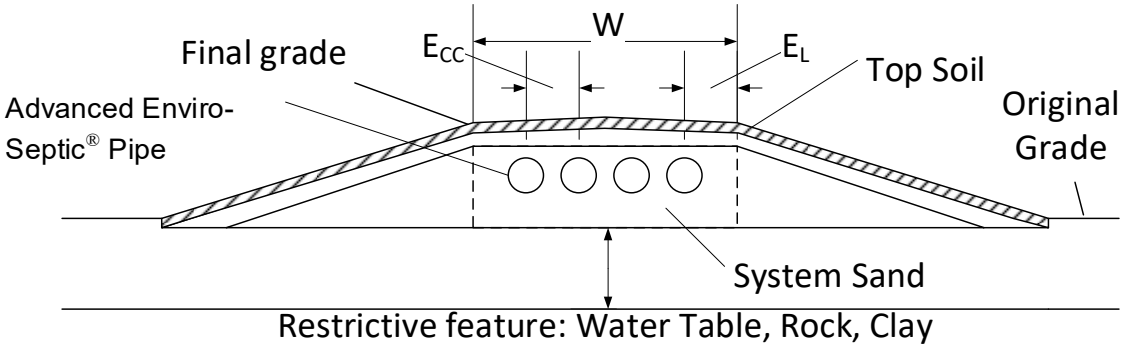

Figure 21. Cross-view above ground system

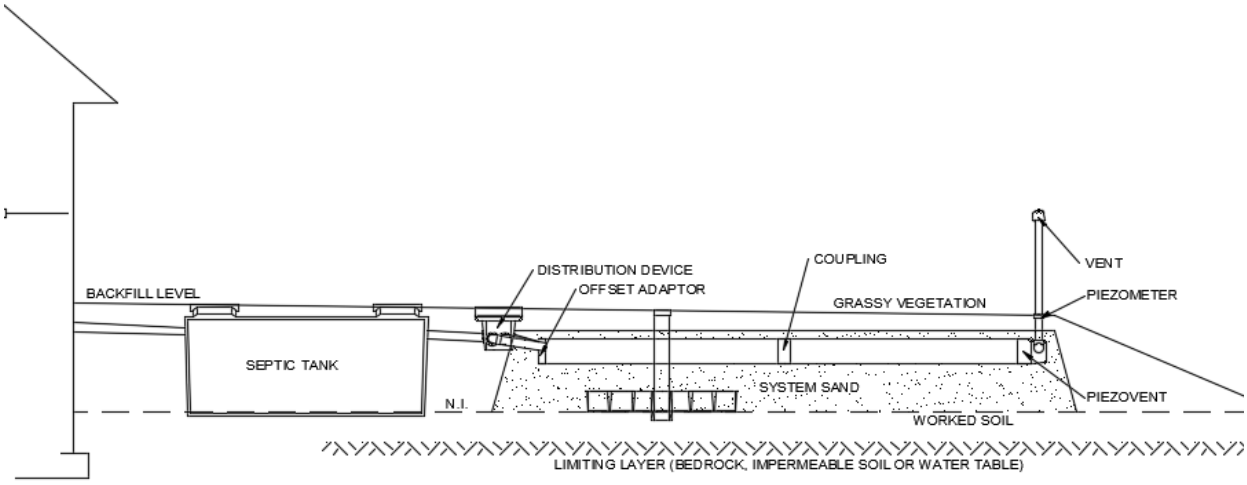

Figure 22. Raised system side view

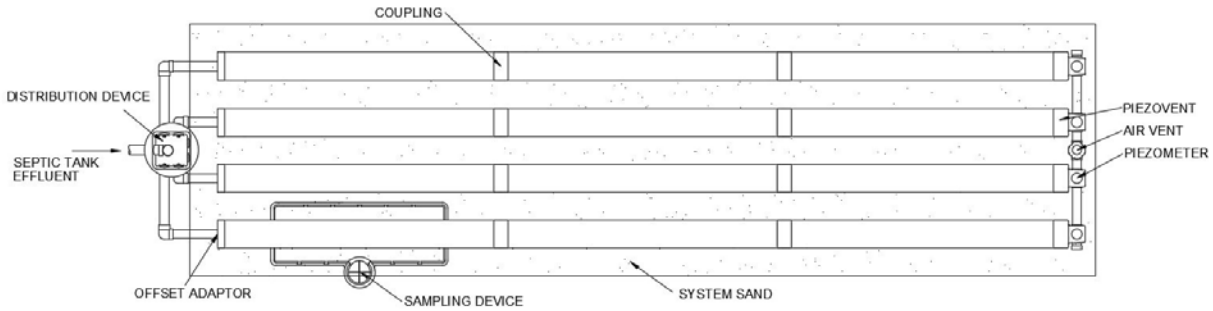

Figure 23. Raised system top view

In-Ground Sloping

A system on a slope can be designed using either a trench-based system or a sloping system. Each section can be laid flat or follow the natural slope of the land.

Distribution of the Rows of Pipes

The Advanced Enviro))Septic pipes must be placed level lengthwise. They are to be placed parallel to the level of the land (perpendicular to the slope).

In-Ground Sloping D-Box System

In-ground sloping D-Box system, cross-section and side views.

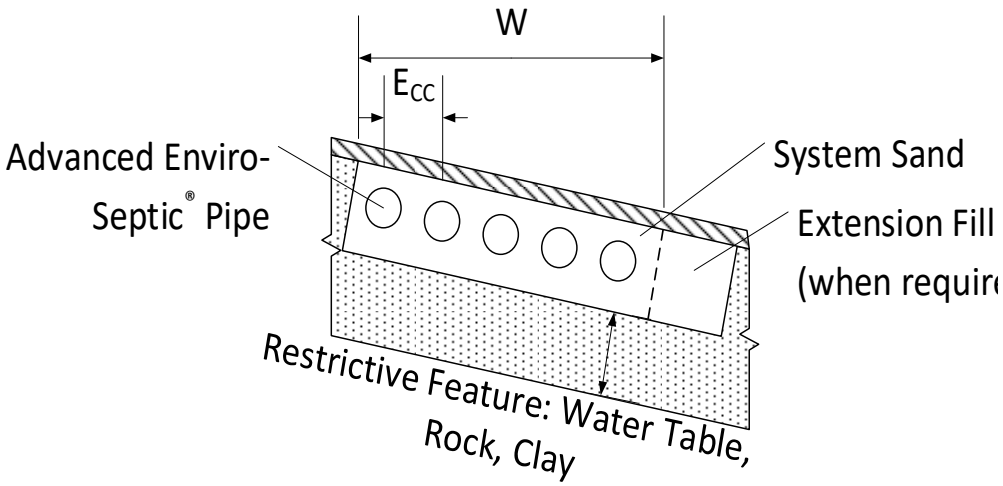

Figure 24. In-ground sloping system side view

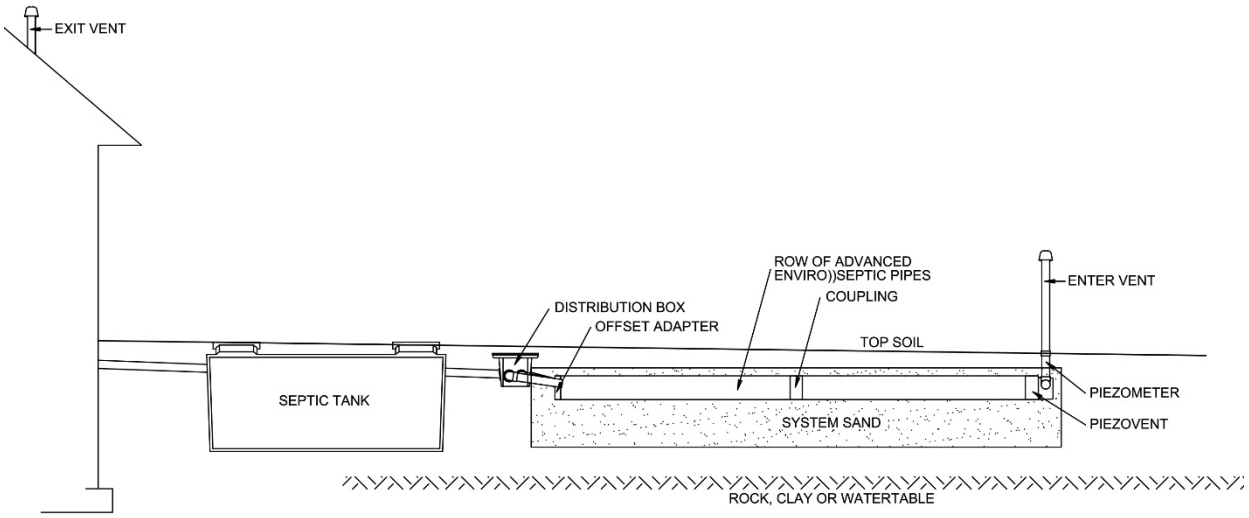

Figure 25. In-ground system side view

Raised Sloping

Cross-section and top views of a Raised Sloping D-Box system.

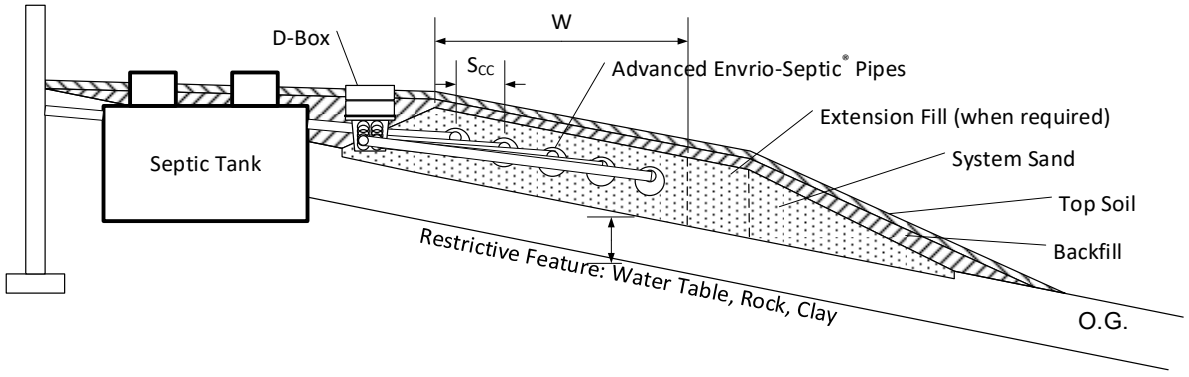

Figure 26. Cross-Section, Raised Sloping

Note: Extended fill may be required to maintain a 4:1 slope for the downslope taper for the first 6 m.

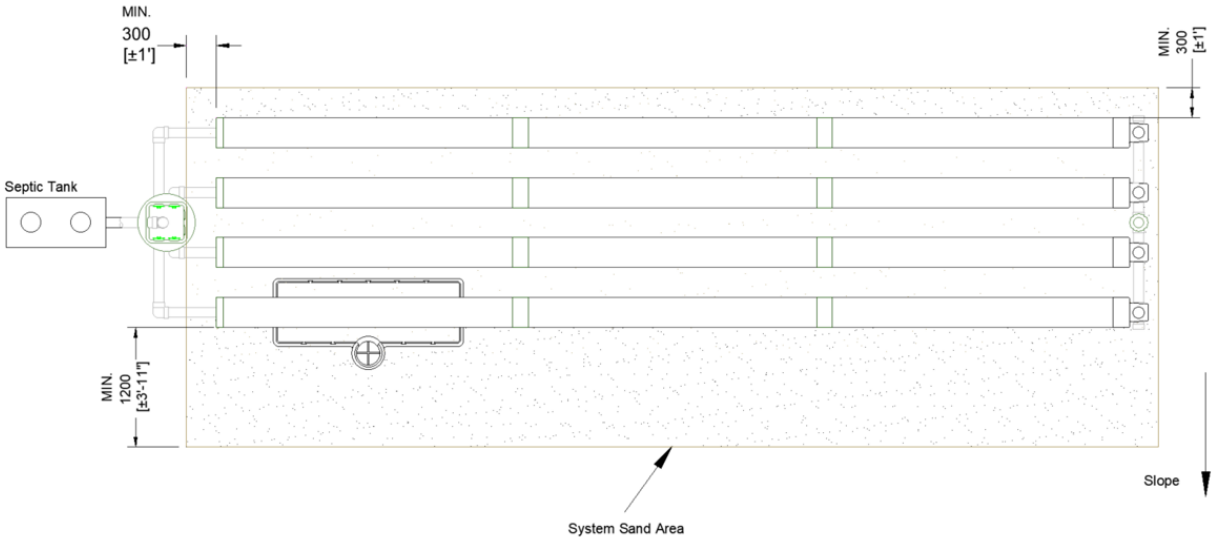

Figure 27. Top view, raised sloping

Section H - Flow Distribution Device Configurations

Context

System O)) uses multiple rows of Advanced Enviro))Septic pipe in parallel to treat septic tank sewage effluent. In order for the system to function properly the effluent must be distributed equally to each row of Advanced Enviro))Septic pipe.

This can be done by using a distribution box with equalizers. Other techniques are used and are discussed within the next Sections.

Where the total length of pipe required is 150 m or more, the sewage system shall have at least 1 pump contained in a dosing tank.[2]

Distribution Box Device

A distribution box with equalizers can be used to distribute the septic tank effluent to each row. The distribution box should be accessible from grade.

For this type of installation, the designer must consider the following:

- The dimensions of the distribution box to be used. The inlet should be 50 mm above the outlets of the box.
- The use of equalizers for each outlet is required to ensure proper distribution.
- Wherever possible, the use of a vertical tee is required on the inlet pipe. The tee is positioned in the middle of the box allowing effluent to drain down at the bottom and the air to circulate at the top.
- Place the distribution box in an area where the effluent will be able to flow by gravity.
- Minimize the length of the feed piping from the distribution box to each row.
- A minimum 1% downward slope is required for all piping. The pipe slope is toward the Advanced Enviro))Septic pipe (minimum 50 mm).

[2] See New Brunswick Technical Guidelines for On-site Sewage Disposal Systems section 4.4.7

Figure 28. 7-hole D-Box with T in vertical position (left) and with internal insulation

Mandatory Equalizers

Any distribution box used to divide the septic tank effluent either from a pump station, or directly from the septic tank, must be equipped with equalizers on every exit pipe.

Velocity Reduction/ Equalizer

If the system is gravity-fed, a velocity reducer at the system inlet is necessary. A distribution box with a baffle or an inlet tee may be an adequate velocity reducer. If the wastewater is pumped to a distribution box, a velocity reducer should be added so that the maximum flow of the equalizers is not exceeded.

Note: An equalizer is limited to a maximum of 38 liters / minute in gravity systems and 75 liters / minute in pumped systems.

System with a Pump Station

If the Advanced Enviro))Septic pipes are above the septic tank outlet a pump station will be required to distribute the septic tank effluent to the rows of Advanced Enviro))Septic pipe.

A Velocity Reduction Device must be used to reduce the velocity of the effluent entering the distribution box. Sections J and K describe the pump station and ventilation requirements in more detail.

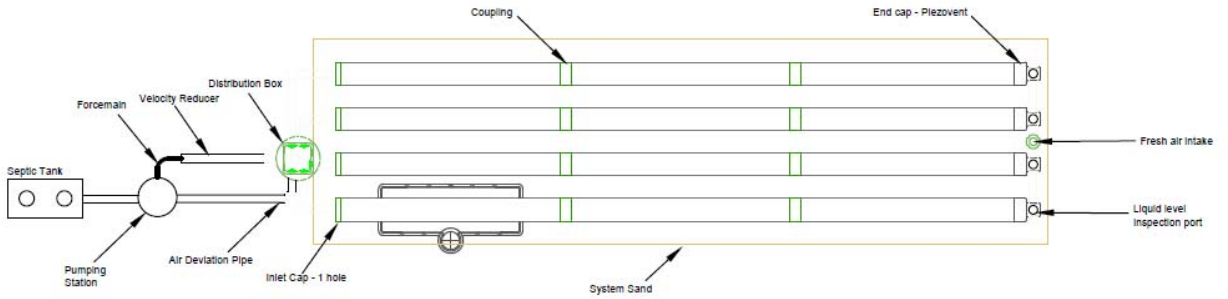

Figure 29. System with a pump station

Low Pressure Repartition System

The pump station can be combined with flow restricting devices called “headers” located at the beginning of each row to evenly distribute wastewater. That is what we call a “Low Pressure Repartition System”. An air vent bypass or a high vent must be installed to permit the circulation of air. Section K explains the venting requirements in more detail.

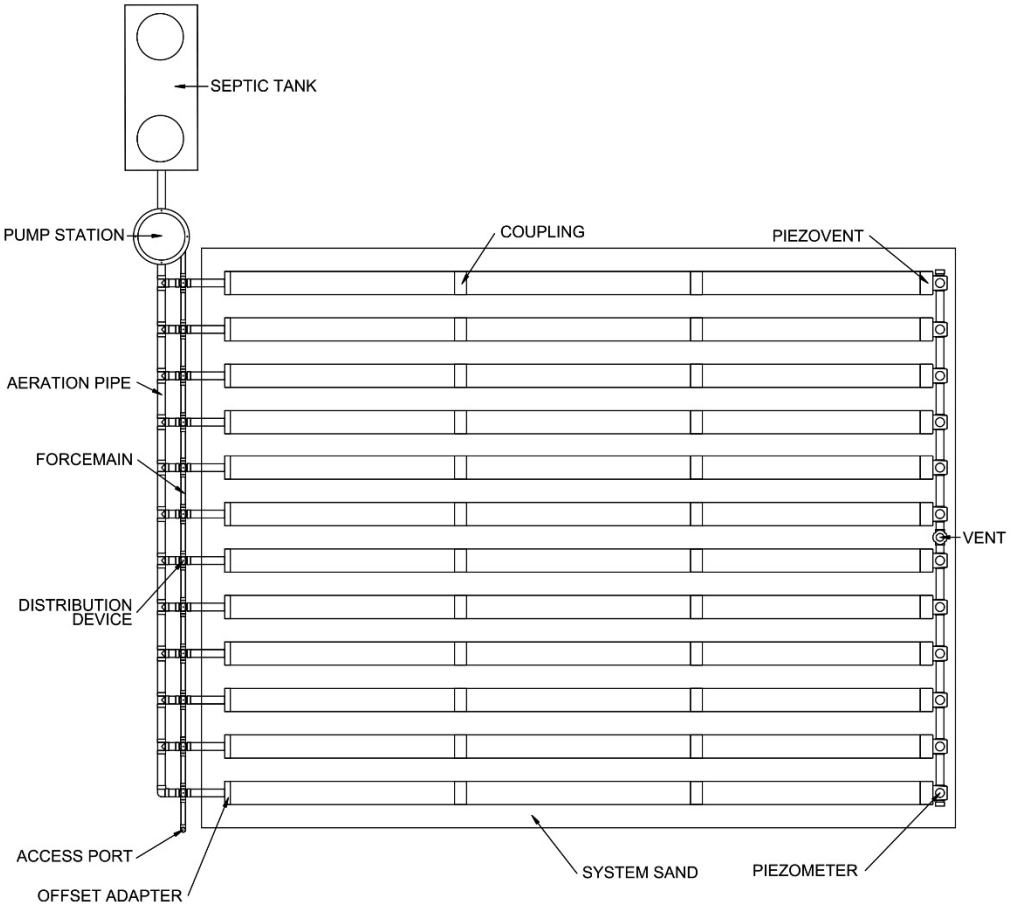

Figure 30. Low-Pressure Repartition System

Low-Pressure Repartition System

For systems with a flow greater than 10,000 L/day a pressured system should be used. It consists of low-pressure repartition headers and the feed piping that evenly distributes the effluent to each row.

Please contact J&L Marketing Ltd. at (506) 363-2108 if you have any questions regarding the design or installation of a pressured system.

Please note that any system with an Estimated Daily Sewage Flow that exceeds 5,460 LPD is to be designed by a professional engineer.

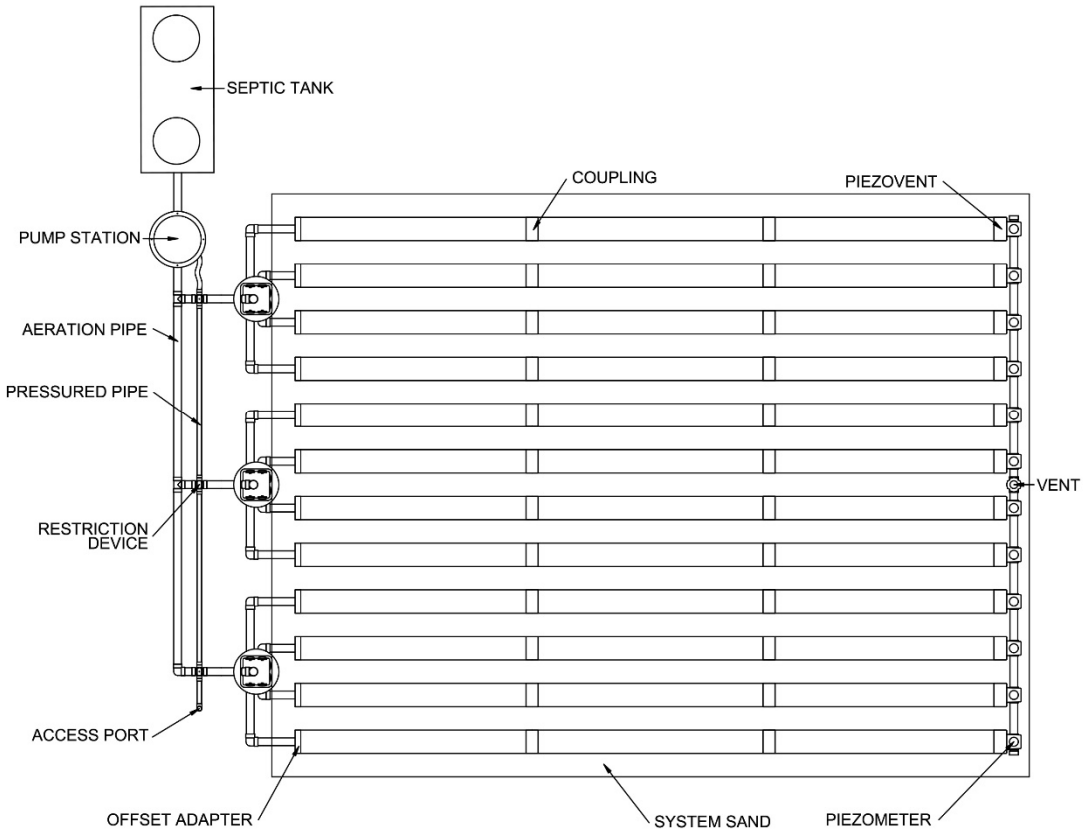

Figure 31. Hybrid Low-Pressure Distribution System

Multiple Cells System

Another variation consists of using distribution valve to distribute the water into 2 to 6 cells of Advanced Enviro))Septic pipes. These mechanical rotating distribution valves are available with 2 to 6 exit positions. With each cycle of the pump, the rotating valve turns one position to allow the water to reach the next cell.

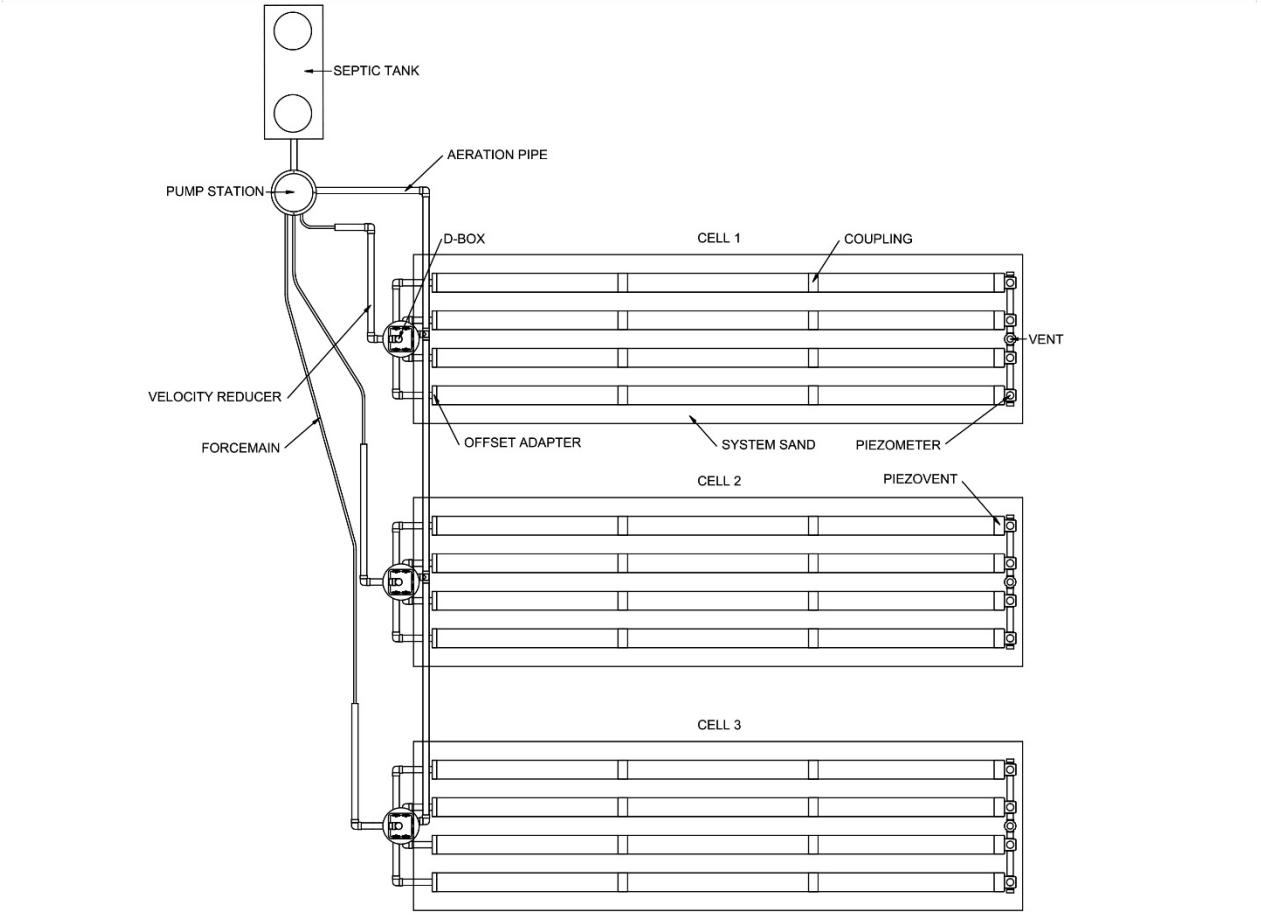

Figure 32. Multiple cell systems

Section I - Special Configurations

Introduction

Non-conventional system configurations may be used for difficult site conditions. They may take irregular shapes to accommodate site constraints.

Curved Bed Configuration

Curved configurations work well around objects, setbacks, and slopes. Please note that this type of configuration is to be designed by a professional engineer.

Section J - Pump and Dosing System Requirements

Introduction

Pump systems typically supply wastewater effluent to Advanced Enviro))Septic pipe using a forcemain (pressured line), a distribution box and a velocity reducer when site conditions do not permit a gravity system.

Differential Venting

All pump systems must use differential venting.

Reference: See
Section K - Venting Requirements

Velocity Control

Never pump septic tank effluent directly into the Advanced Enviro))Septic pipes. Install a velocity reducer prior to the distribution box.

Force mains must discharge into a 100 mm pipe that is 3 m long. The change in diameter reduces the pressure in the pipe. If the distribution box is not equipped with a baffle, then the 100 mm pipe must be terminated with a vertical tee fitting inside the D-Box.

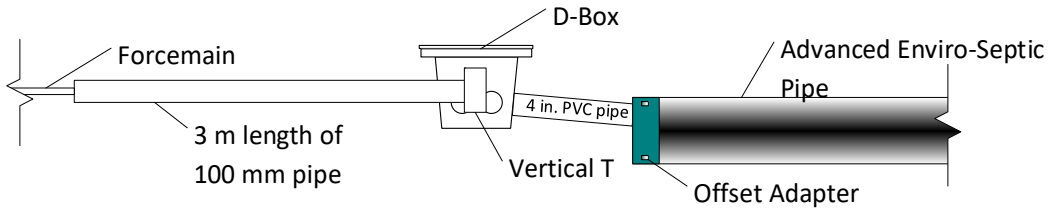

Figure 33. Velocity control

Maximum Loading Rate per Pumped Cycle

The maximum volume of effluent pumped per cycle per length of Advanced Enviro))Septic pipe (3.05 m) is 55 litres.

Taking into consideration the daily design sewage flow, the volume of wastewater per cycle should be specified to be 6 to 8 cycles per day with a minimum of 6 cycles and a maximum of 24 cycles.

Maximum Flow in Litre per Minute

Equalizers
An equalizer used in a system with a pump station cannot receive more than 75 liters per minute.

Rows
Each row in a system using a pump and a distribution box cannot receive a flow higher than 75 liters per minute.

Example

A system has 6 rows of 6 Advanced Enviro))Septic pipes each for a total of 36 pipes.

What is the maximum volume allowed per pumping cycle?

Max Volume / Cycle = number of pipes x 55 L/pipe
= 36 x 55
= 1440 litres/cycle

What are the minimum and maximum volume per cycle that should be used?

System Capacity= Number pipes. x 126 L/pipe
= 36 x 126
= 4536 litres/day

Volume for 8 pumping cycles Cycle / Day
= System capacity / Number of cycles
= 4536 / 8
= 567 L/cycle

Volume for 24 pumping cycles Cycle / Day
= System capacity / Number of cycles
= 4536 / 24
= 189 L/cycle

Minimum volume per cycle: 189 L / pump cycle
Maximum volume per cycle: 756 L / pump cycle

What will be the flow per equalizer and per row if a distribution box with 6 exit equalizers is used and the flow of the effluent pump is 4.5 litres per second?

FlowStation = 60 Sec/min x 4.5 L/sec
= 270 L/min

FlowEqualizer = FlowStation / Number Equalizer
= 270 L/min / 6 equalizers
= 45 L/min/equalizer (less than 75 L/min – OK)

Section K - Venting Requirements

General Rule

All System O)) require the use of a vent pipe as well as appropriate aeration pipes. Locate vent openings to ensure air is drawn completely through each row or section of Advanced Enviro))Septic pipe. In the summer the vent can be located just above ground level, but in the winter an extension needs to be added in order to keep the vent above snow level.

When to Vent

A 100 mm vent pipe is required for every 300 metres of Advanced Enviro))Septic pipes. If necessary, a single 150 mm vent opening may be installed in place of a maximum of three 100 mm vent openings.

Many pipe rows can be connected together with an aeration pipe (vent manifold), as shown in the following figure.

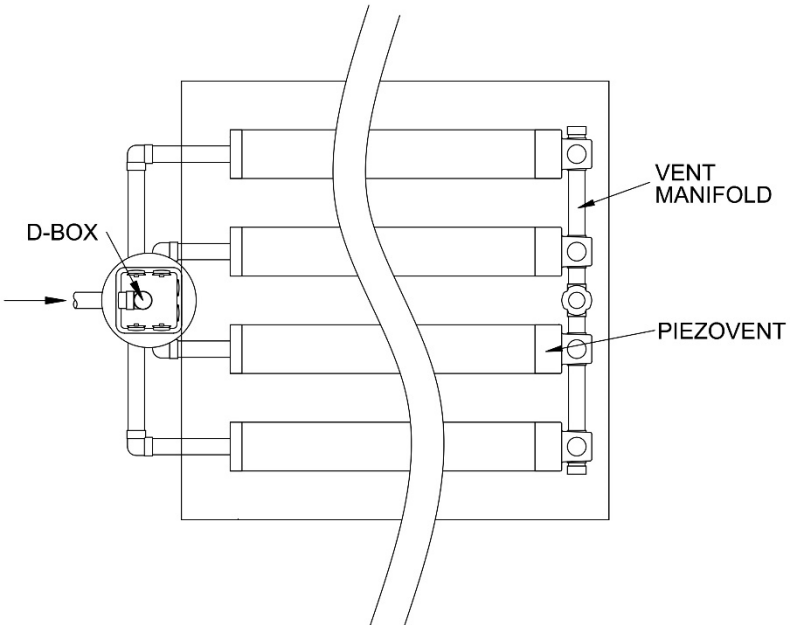

Figure 34. When to vent

Design Standards

The entry vent (located after the Advanced Enviro))Septic pipes) must meet the following standards:

- Must be high enough to rise above snow during winter (min 1.2 m);
- Can be hidden among trees, located at fence post, Etc.;

The entry vent must be at least 3 m lower than the exit vent.

Vent Piping Slope

Vent piping should slope 1% downward toward the Advanced Enviro))Septic pipes to prevent moisture from collecting in the piping and blocking air passage.

Air Flow Circuit

The aeration circuit must be continuous between the entry and exit vent. The vent installed at the end of the rows of pipes acts as the entry point. The most common setup is when the air flows through the Advanced Enviro))Septic pipes, the D-Box and the septic tank and exits through the vent stack of the residence.

On systems that use a pump station or low-pressure distribution, special considerations need to be taken to ensure that the air flows efficiently through the system. This leaves the designer with 2 options:

- Install a shunt pipe between the treatment system and the pump station;
- Install an additional vent pipe (see next paragraph).

Vent Locations

System O)) can be vented at the following areas:

Entry vent (Low) located downstream from the system at the end of a section or row.

.

- The vent pipe is to be connected to the air manifold between two pipe rows.
- If the vent is located away from the Advanced Enviro))Septic pipes, use an open T-shaped fitting at the base of the aeration pipe to prevent condensation build up.

Exit vent (High) located upstream from the treatment system.

- First choice is to use the building vent stack

- Vent pipe connected on the supply pipe between the septic tank and the distribution box.

And if the use of a shunt pipe is impossible:

- Install a vent onto one of the distribution box outlets (if available) or close to the distribution box onto one of the feed pipes from the rows of Advanced Enviro))Septic pipes.

The designer must make sure that there is a well-vented line between both high and low vent pipes.

Differential Venting

Differential venting is the use of high and low vents in a system. High vents are connected to the distribution box and low vents are connected to the opposite end of the system. This arrangement enhances the circulation of air throughout the entire system.

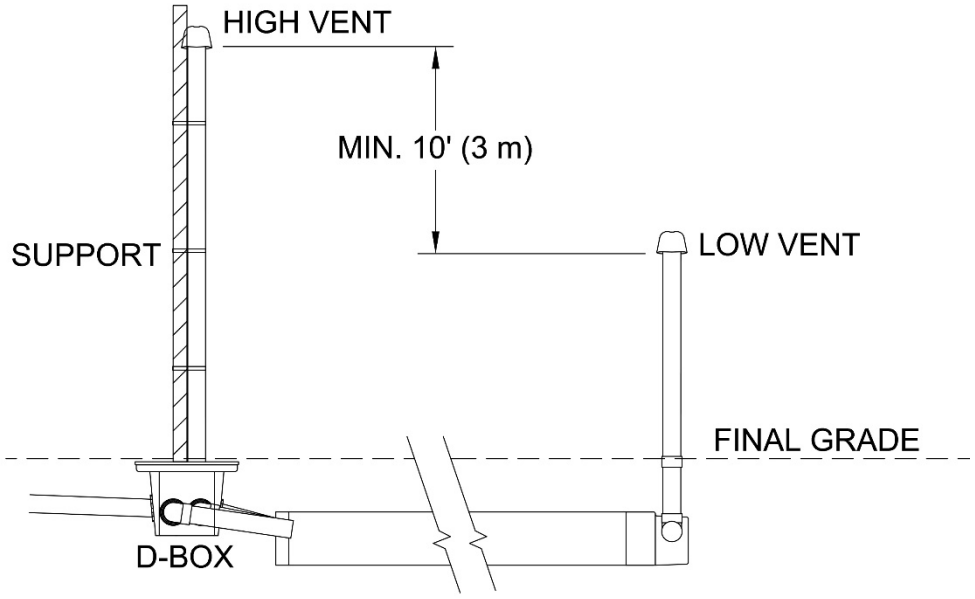

Figure 35. Differential Venting

Section L - Piezometers

Background

The piezometer serves two purposes:

- Allows the measuring of the water level in the pipes;
- Allows the pumping of water from the pipe row if the system needs to be regenerated.

It is preferable to install a piezometer at the end of each row of Advanced Enviro))Septic pipes. It is also possible to install one piezometer per group of interconnected rows all at the same level.

Piezometer Design

The figure below shows a piezometer installed at the end of a row of Advanced Enviro))Septic pipe.

The piezometer is to be capped at finish grade level.

The watertight cap at the end of the piezometer needs to be on at all times, except during follow-up or maintenance of the system.

Piezometer Model

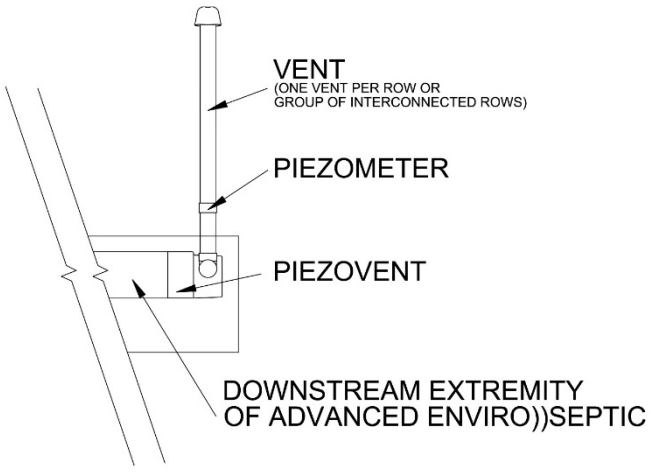

Figure 36. Piezometer model

Section M - Sampling device (Optional)

Background

Some System O)) wastewater treatment systems may have a device installed that allows sampling of the quality of the treated wastewater leaving the system.

Regular sampling is not necessary. Samples may be taken by any person trained on System O)) when trying to diagnose a potential problem or if required by local regulations. The frequency as well as the parameters to be tested depend on the local regulations if applicable.

If samples taken do not meet the expected performances, please contact your local distributor.

Influent Sampling

Context

System O)) has been in use in North America since the late 1980s and has been tested by independent agencies over the years.

The Standards Council of Canada has authorized the BNQ in Canada to create a standard of sewage wastewater treatment plants for the onsite sewage industry and has authorized them to perform testing of technology and equipment in accordance with this standard. This standard was developed after and adds to the NSF-40 standard which was developed by NSF international[3].

The 12 months of testing conducted by an independent agency, the BNQ, reveals that System O)) produces an effluent of better than 15 mg/l of CBOD5 and 15 mg/L of TSS respectively when it receives domestic wastewater.

Hydraulic Loading

Hydraulic Loading (daily sewage flow rate) is another factor that needs to be monitored to show that the system is used properly and therefore will perform according to the treatment levels expected.

On a single visit, it will be difficult to determine if the hydraulic loading is within the daily design sewage flow. Other than observation that the system is not receiving flow from leaking facility fixtures or septic tank, the technician will not be able to evaluate the hydraulic loading to the system unless a flow measuring device is installed in the system.

[3] NSF Standard 40 is for residential wastewater treatment systems. The NSF has a product certification accreditation from the Standards Council of Canada. This accreditation attest to the competency of services provided by NSF and compliance with established national and international standards for third-party certification. The NSF-40 is a standard for residential wastewater treatment systems.

If System O)) includes a pump station, it can be used to install a flow measuring device. A water meter can also be installed on the main water entry in the mechanical / utility room to measure the amount of water use and the volume of wastewater generated.

Influent Sampling and Hydraulic Loading Combination

The combination of influent sampling and hydraulic loading measurement will indicate if the system is being used within the limits. If System O)) works within these limits, it means that the installation is operating in similar conditions to the systems that were tested and certified. Therefore, the system treats the wastewater at the expected treatment levels.

System O)) is designed to treat residential strength sewage wastewater that is generally accepted as being defined as:

- Biochemical Oxygen Demand (BOD_5) of 300 mg/L
- Total Suspended Solids (TSS) of 350 mg/L
- pH level of 6.5 – 7.5
- Fats, Oils and Greases of 35 mg/L

Treated Effluent Sampling

Context

System O)) has an optional effluent sampling device. The following paragraphs describe the sampling device to be used.

Sampling Device Description

When included, the System O)) sampling device is placed over a polishing field that allows water to be evacuated by infiltration into the ground. The following paragraphs describe the sampling device to be used.

The sampling device has two components:
• The basin
• The sampling well

The thermoformed basin is placed under a row of Advanced Enviro))Septic pipes. The basin has a location reserved for the sampling well. It is from this well where the samples are taken. The figure below shows the sampling device as a whole**.**

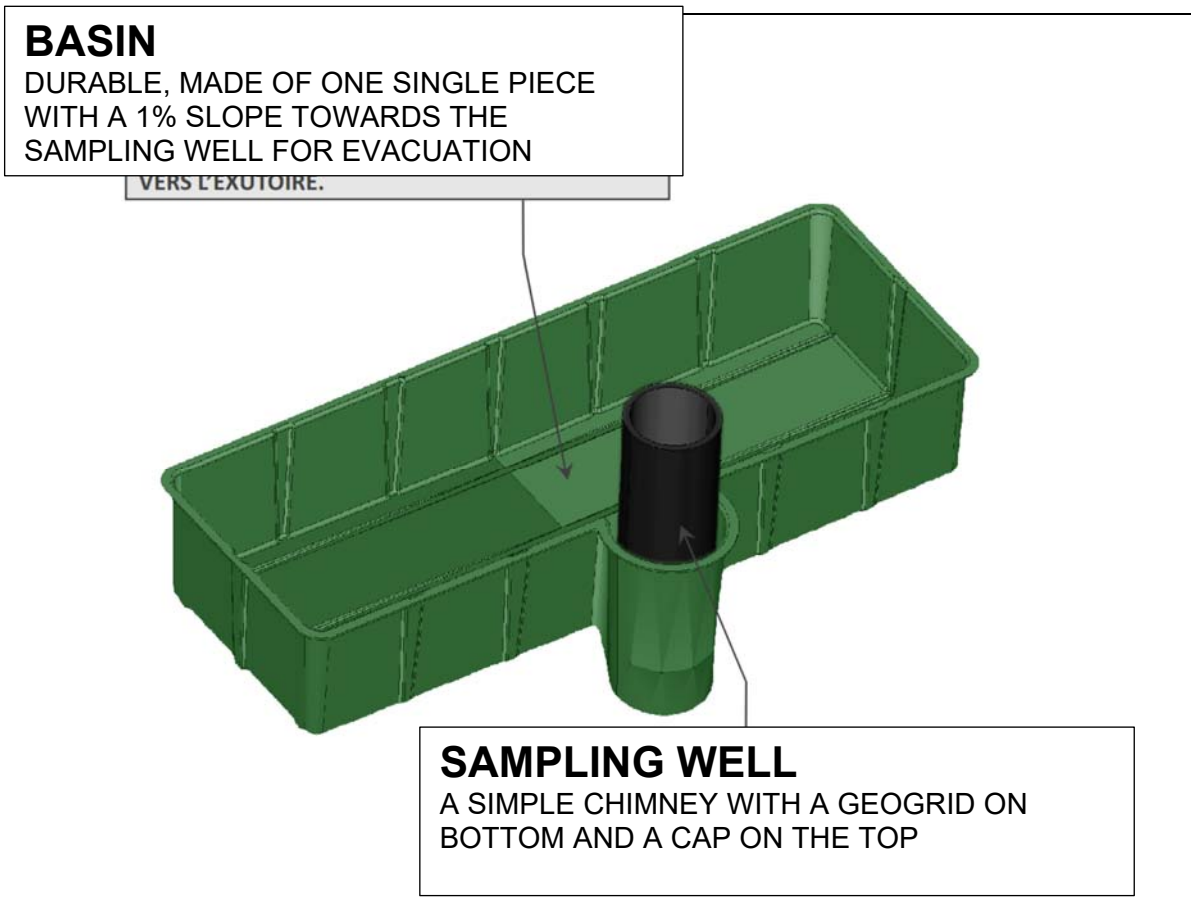

Figure 37. Sampling device

The basin is installed in the filter sand layer under a row of Advanced Enviro))Septic pipes.

The sampling well is placed directly into the basin.

If not sampled, the water that passes through the sampling well must be infiltrated into the soil as it is collected. There is therefore an opening to allow the water to leave the sampling well and return to the receiving soil.

The final length of the access shaft must be sufficient for the shaft opening to be above the final level of the backfill. This is important to prevent runoff water from entering the opening. To facilitate water recovery, the basin is placed directly under a row of Advanced Enviro))Septic pipes.

The basin is covered with a layer of sand that then extends to the Advanced Enviro))Septic pipes.

The diagram in **Figure *38*** shows the position of the basin and infiltration pipe and the thickness of the material layers for using the sampling device with an advanced secondary treatment System O)).

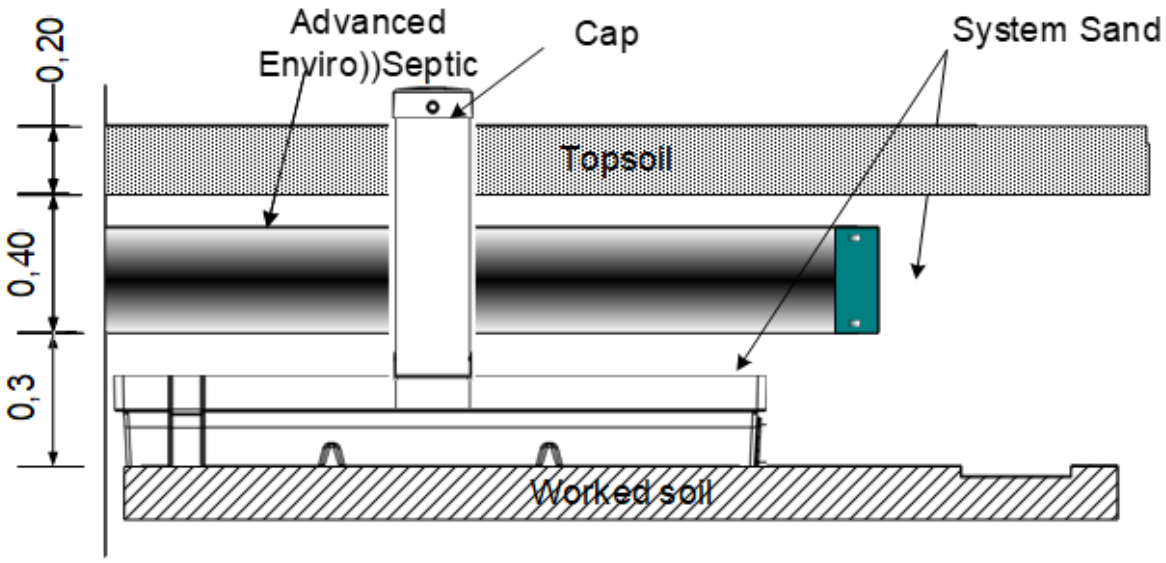

Figure 38. Sampling well

The basin is installed under the first pipe, with the end between 30 and 60 cm from the first sleeve.

The basin can be placed under either row of pipes. However, it is preferable to choose a row of side pipes and when there is a slope, a row downhill of the slope.

To make it easier for the installer to position the basin correctly, the designer must indicate on his plans the position from the limits set for the System O))

$A = E_E + 0{,}61$ m
$B = E_E + 2{,}44$ m
$C = E_L$

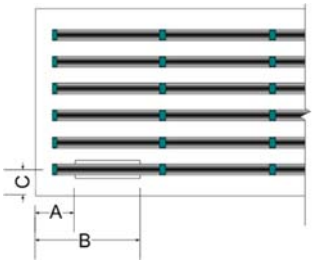

Figure 39. Sampling well location

Lockable Cover

The lockable cover at the top of the sampling well is snapped in place by pushing its two inside knobs into the keyways of the access port pipe. Once installed, the cover is locked with a plastic seal.

Section N – Description Tag, Handling and Storage

Background

The following paragraphs give information regarding the description tag found on each Advanced Enviro))Septic pipe as well as rules to follow regarding the handling and storing of System O)) products.

Further installation details are available in Section O.

Pipe Description Tag

Each Advanced Enviro))Septic pipe used in a System O)) bears a descriptive tag similar to the one below in **Figure *40***.

This tag is sewn onto the membrane covering the pipe. It must be present on each pipe at the time of installation. It must be left in place. It is made from non-biodegradable material designed for use in soil.

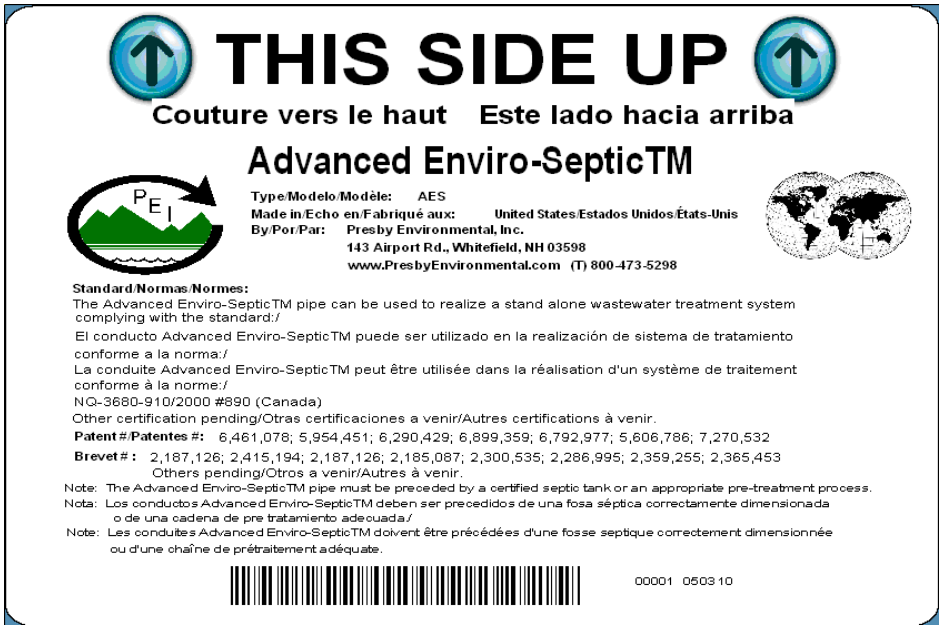

Figure 40

Handling

Advanced Enviro))Septic pipes should be handled with care to avoid tearing the membrane or breaking the polyethylene pipe.

It is important not to contaminate the membrane of the pipe with sludge, grease, oil or other substances which may alter the properties of the product.

If the exterior membrane is dirty, wash it with a hose to return it to its' original condition.

Storage

The outer fabric of the Advanced Enviro))Septic pipe is ultra-violet stabilized. However, the protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp.

Store the pipe in an elevated and dry area to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.

Section O – Sequential Installation Procedure

Sequential Procedure

Background

The following paragraphs provide the necessary steps for the installation of a System O)). The installation sequence of the components may vary according to the constraints of the installation site. For example, the pump station may be installed before the septic tank.

Authorized Installer Required

This manual is for the exclusive use of designers and/or installers who:

a. Are licensed to conduct this type of work in accordance with laws, regulations, code or bylaws issued by the appropriate authorities
b. Hold a Certificate of authorization issued by the System O)) master distributor that states that the person has completed training in the design and installation of the System O)).

Installers are trained during a 4-hour technical seminar given by the distributor. As a result of this seminar, field training is done by the distributor during the installer's first System O)) installation. Only after having followed this training can the installer receive his certificate of authorization.

This manual is not designed to be used by persons who do not meet both of the above-stated conditions.

It is the responsibility of the authorized distributor to follow the Provincial laws and regulations that apply to the work being conducted.

Steps to Follow

The installer must follow a series of steps in the construction of a System O)):

- Obtain the plans, specifications and necessary permit authorizations.
- Follow the plans and specifications as filed with the authorities.
- Excavate the contact area and scarify the surface of the receiving soil.
- If required, install the waterproof membrane and the collection zone,
- If required, install the sampling device.
- Install the System Sand on System O)) Contact Area.
- Install the Advanced Enviro))Septic pipe rows.
- Place System Sand between rows
- Pack System Sand between rows by walking on top of the System Sand between the rows.
- Cover the Advanced Enviro))Septic pipes with System Sand exposing the ends.
- Install the Distribution Box and the Equalizers or other distribution device for distribution of the septic tank effluent.
- Install the feed, and ventilation piping.
- Cover the System Sand with clean top soil (no silt / clay) permeable to air.

The installation of the septic tank should be done following the manufacturer's recommendations. Depending on site conditions, the septic tank may be installed before or after System O)) is installed.

Installation of a pump station or low-pressure distribution system should be done according to this manual. Every Low-pressure distribution System is manufactured and provided by DBO Expert.

Diagram of Installation

The following diagram shows the components which must be installed to complete System O)).

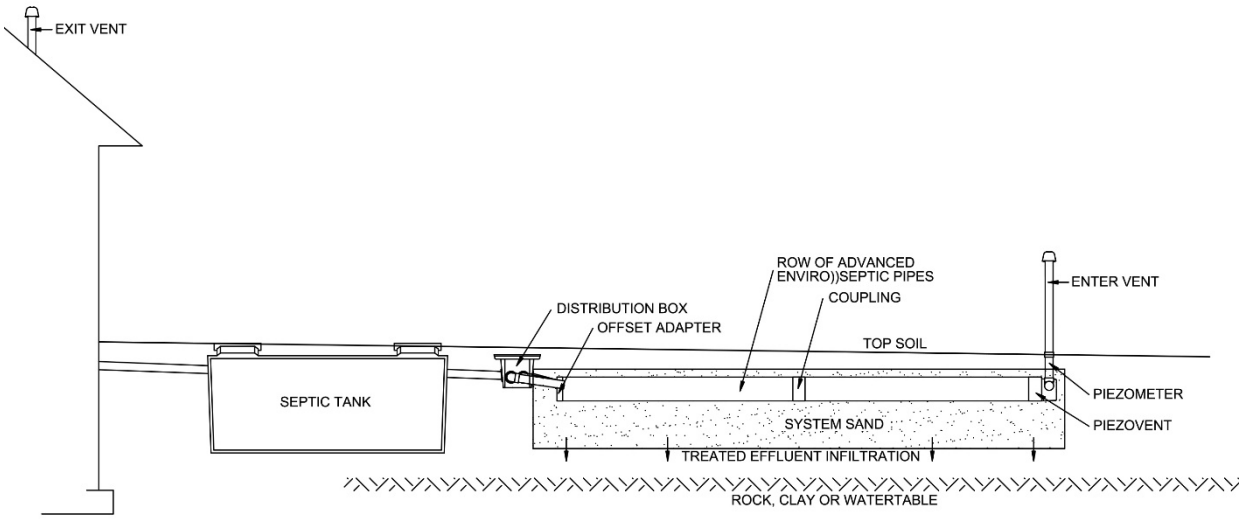

Figure 41. Diagram of installation

List of Typical Materials

System O))

- Advanced Enviro))Septic pipes
- Couplings
- Offset adapters
- Piezovents
- Distribution system (i.e.; Distribution box with equalizers)
- Optional sampling device
- PVC pipes, 100 mm
- PVC 90^{o} elbows and ``T`` adapters of 100mm
- PVC Cleanout 100 mm
- System Sand that meets specifications
- Air permeable top soil with no silt for final fill or side walls
- Pump station (optional)

Planning the Installation

Find the optimal order of steps for the installation:

- According to site constraints.
- Taking into account the movement of machinery.

The System Sand must meet the following specifications:

- Effective diameter (D_{10}): 0.20 < D_{10} < 1 mm.
- Coefficient of uniformity (D_{60}/D_{10}): Cu < 4.5%
- Less than 3% silt; diameter < 80 μm (0.080 mm)
- Less than 20% particles with diameter > 2.5 mm.

Calculating the different elevations:

- 1% slope between:
  - the exit from the septic tank and the distribution box (gravity feed)
  - the distribution box and the entry to the furthest pipe
- Typical incline of 125 mm in the septic tank.[4]
- Typical incline of 50 mm in the distribution box[4].
- Minimum separation between the interface of the System Sand / receiving soil and the high point of groundwater, rock or limiting soil.
- 1% incline in the ventilation pipes leading to the vent (sloping toward the Advanced Enviro))Septic pipes)

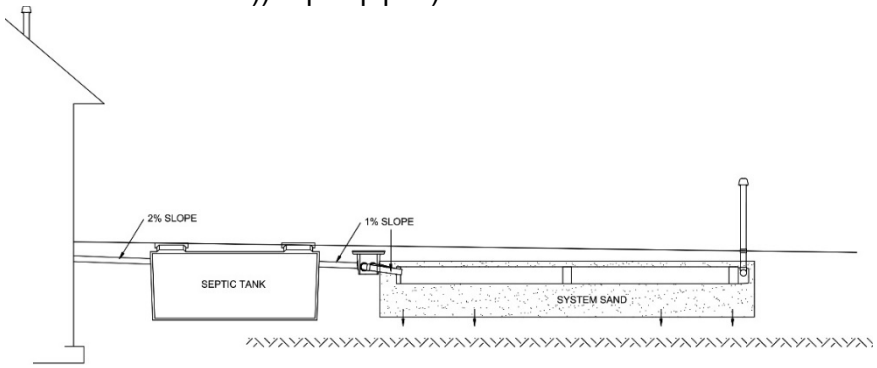

Figure 42. Planning the installation

Necessary Modifications to Plans and Estimates	When planning the installation, if the installer realizes that modifications must be made, he must communicate with the designer or engineer to discuss the modifications and obtain permission to make changes to the plan, filing or specifications. It is important that all the constraints analyzed by the designer be taken into account before making modifications.
Septic Tank	Install the septic tank in accordance with manufacturer's recommendations. Minimum of two days retention is required in a 2-compartment septic tank. An effluent filter is required.
Preparation of the Installation Site	• Outline the contact area / surface to be excavated. • Excavate the layer of soil required according to whether the installation will be raised partially raised or in-ground.

[4] Septic tank and D-Box incline may vary depending on manufacturers.

- Scarify the surface of the receiving soil where the System Sand (or imported sand if required) will be spread out including the side walls. At the interface between sand and soil, the soil surface must not be smoothed or compacted. It must be scarified to allow for optimal percolation of the treater effluent from the sand in to the receiving soil.
- To the extent possible, conserve the existing conditions of the soil underneath. Avoid compaction of the soil as this will affect its permeability.

Note:

- Install the imported sand (when required) and the System Sand the same day as the excavation.
- Avoid the accumulation of rain water or surface runoff in or on the system during the construction period.
- Do not do an installation in a saturated or frozen soil. This could be an indication that the soil doesn't drain appropriately or is too close to the water table. If there is frost or an overly saturated soil, the system may not settle correctly.

Soil Compaction

Minimize machine movement to avoid soil compaction and destruction of the soil structure under and around the system. Be especially careful not to compact soil on the down slope side of the system. Only tracked equipment should be utilised, i.e. no rubber tired vehicle.

Optional Sampling Device Installation

Once the surface of the receiving soil has been scarified, the installer must install the sampling device. Here are the steps:

Place the collector of the sampling device:

- Under the first pipe of one of the rows of Advanced Enviro))Septic pipes (on the supply side),
- Preferably under the side rows.
- In the case of sloping land, under the side row down the slope.

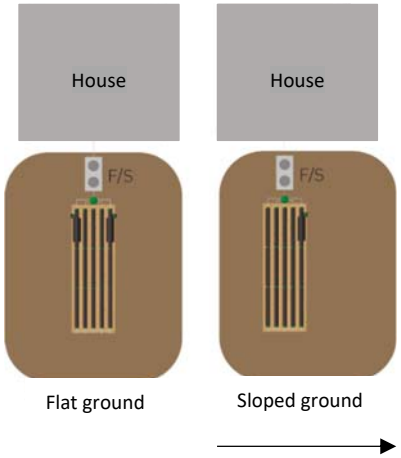

Figure 43

Once the collector is in place, place the sampling well in the base defined for this purpose.

While holding the elements in place, cover the well and the filter sand collector according to the selection criteria provided.
Add sand inside and outside the collector so that the collector retains its original shape.
Raise the positioning blades that will allow you to properly align the row of pipes above the sampling device

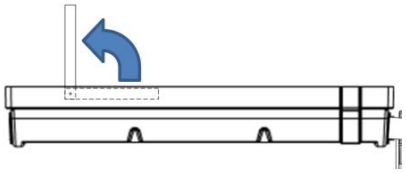

Figure 44

Complete the installation of the sampling device as shown below

Figure 45

The following figure shows other perspectives of the sampler once it is installed.

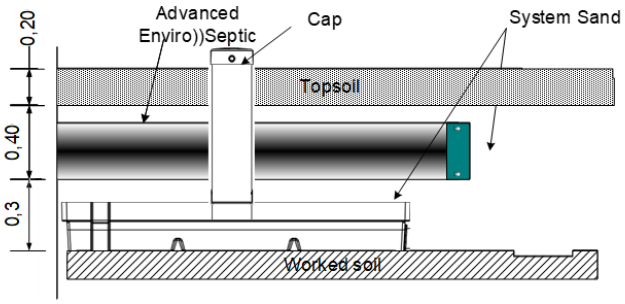

Figure 46

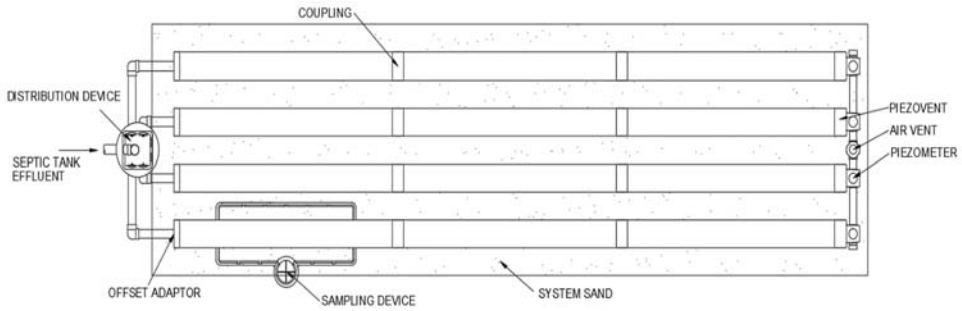

Figure 47

Sand Layer and Rows of Pipe

Preparing the Layer of System Sand Under the Pipes

After having scarified the receiving soil and after having installed the sampling device (see previous paragraph):

- Add a layer of imported sand over System O)) Contact Area if required.
- Add a layer of 0.3 m of System Sand over The Advanced Enviro))Septic pipes. When the spacing between System O)) length (E_{cc}) is up to 0.9 m, imported sand could be added between System O)) length instead of using System Sand (refer to Appendix 2).
- Level lengthwise the surface of sand which will receive the Advanced Enviro))Septic pipes.

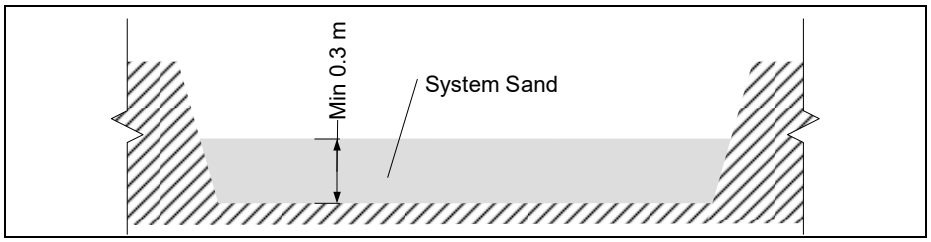

Figure 48. Cross-section of the System Sand layer (without imported sand)

Installing the Advanced Enviro))Septic pipes

- Be sure that the surface of System Sand over System O)) Contact Area corresponds with the dimensions prescribed in the plan and that it is level the full length in the direction of the pipes.
- Arrange the pipes on the surface keeping in mind the number of rows needed, the number of pipes per row and the center to center spacing (E_{CC}), lateral extension distance (E_L) and end extension distance (E_E).
- The seam side of the geotextile fabric that covers the pipes must be upwards. The 250 mm wide white membrane (bio-Accelerator) must be situated at the bottom of the pipe.
- Assemble the Advanced Enviro))Septic pipes using the couplings provided.
- Level the rows of Advanced Enviro))Septic pipe from one end to the other.

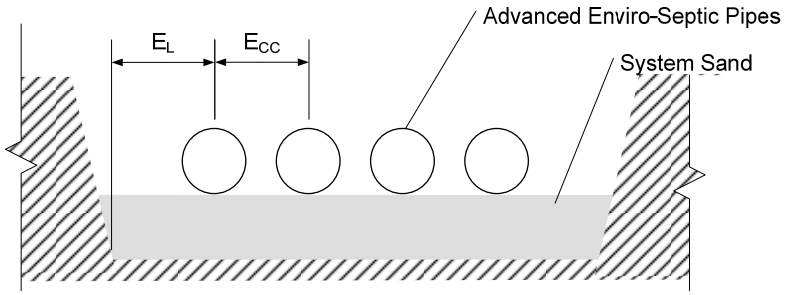

Figure 49. Cross-section of Advanced Enviro))Septic pipes on the System Sand (without imported sand)

Installing the Couplings

Couplings are used to join the Advanced Enviro))Septic pipes and create rows. To put them in place the installer must:

Figure 50. Coupling installation

- Pull back the geotextile membrane at the ends of the two pipes to be connected.
- Place the two ends one or two centimetres apart making sure that the seam is on top of the pipes and that the two white membranes are at the bottom.
- Install the coupling on the two Advanced Enviro))Septic pipes to be joined, being careful to insert the ridges of the couplings in the channels of the pipes.
- Close the upper part of the coupling by inserting the locking tab into the corresponding opening.
- Replace the geotextile membranes over the coupling.
- Keep seams upward.

Figure 51. Replacing the membranes over the coupling

Installing the Offset Adapters

Offset Adapters are used to connect the PVC pipe to the Advanced Enviro))Septic pipes for both air and wastewater. An Offset Adapter must be installed at the end of each row. Generally, a single offset adapter is used at the beginning of the row while a piezovent is installed at the opposite end where the piezometer and aeration pipes (connected to the vent) are located.

To put the offset adapters in place, the installer must:

- Pull back the geotextile membranes at the end of the pipe.

- Push the offset adapter in place so that the locking tabs located on the inside of the adapter locks into the corrugations of Advanced Enviro))Septic pipe.
- In the case of the single offset adapter, the opening must be placed at the top position to facilitate the passage of air at all times.

Figure 52. Installation of the Single Offset Adapter

Figure 53. Installation of the piezovent

Row Spacers

While sand may be used to keep the pipes in place while covering, simple tools may also be constructed for this purpose. Here are two examples. One is made from rebar, the other from wood.

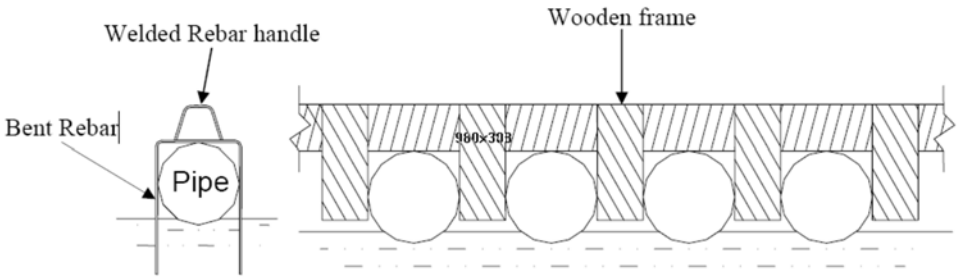

Figure 54. Use of the row spacer

Caution: Remove all tools used as row spacers before final covering.

Covering the Advanced Enviro))Septic pipes

Once the pipes are connected and the adapters properly in place, the installer must spread System Sand on the pipes to keep them from moving.

Figure 55. Covering the Advanced Enviro))Septic pipes

- First, add System Sand over the couplings to stabilize the rows.
- Next, progressively add System Sand along the length of the pipes up to their mid height.
- Push down the System Sand by walking on both sides of the Advanced Enviro))Septic pipes to fill gaps which may have been created under the pipes.

Figure 56. Filling the void around the Advanced Enviro))Septic pipes

- Completely cover the pipes with System Sand and add an extra layer of a minimum of 100 mm on top of the pipes. If the spacing between System O)) length (E_{cc}) is up to 0.9 m, an extra layer of a minimum of 100 mm of imported sand could be added on top of the pipe instead of using System Sand (refer to appendix 2).

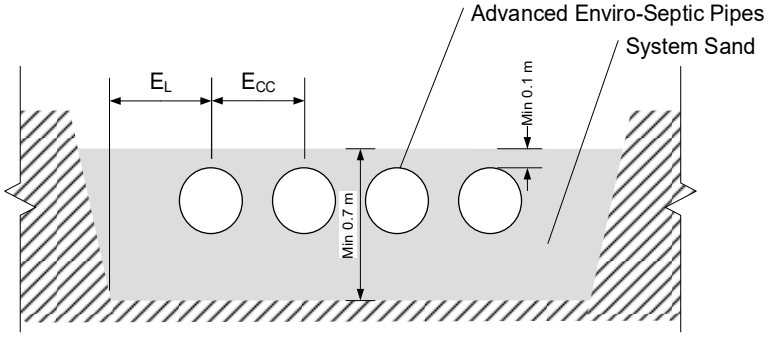

Figure 57. Cross-section of the installation

Piezometers

For each piezovent:

- Push the piezovent directly onto the Advanced Enviro))Septic pipe
- Pull the geomembrane fabric back over the piezovent
- Connect the piezovents together by cutting 100 mm PVC pipe to measure

For each piezometer:

- Connect each piezometer to opening designed for this purpose
- The piezometer is made of PVC pipe 100 mm in diameter. It needs to be as long as needed in order to be above the final fill or embankment (usually between 55 to 85 cm or 22 to 34 in).
- Add a green cap part of System O)) kit on the extremity of each piezometer.

Vent

- Install the vent on the aeration manifold (max 300 m of Advanced Enviro))Septic pipe per vent)
- Allow sufficient height (min 1.2 m) to avoid the vent opening being covered with snow during winter.
- Be sure that the ventilation pipes have a 1% slope in the direction of the Advanced Enviro))Septic pipes so that condensation can flow back to the system at all times.
- Make sure that there is a continuous air circulation between the entry vent located downstream of the Advanced Enviro))Septic pipes and the exit vent of the residence's plumbing located on the roof.
- The ventilation pipe can be moved away from the system to be hidden, for example hidden behind a tree like in the image above.

Figure 58.

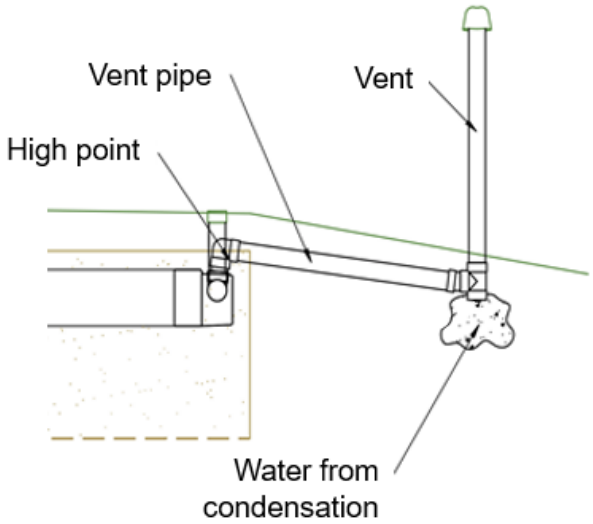

Figure 59. Aeration pipe and vent installation

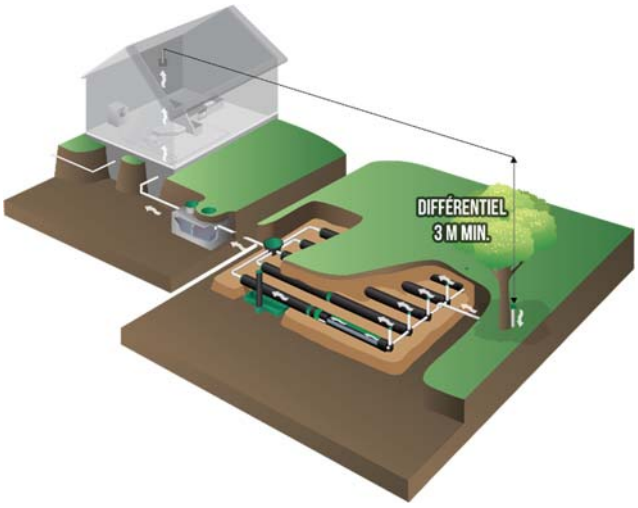

Figure 60. Air circulation

Native feed System:

- There must always be a height difference of 3 m between the two vents.

Pump Station Systems:

- First choice: install a bypass pipe connecting the pump station to System O)) header manifold using a 100 mm PVC pipe. Make sure to construct the bypass pipe with a high point in such a manner that only air but not water can travel back to the pump station.
- Second choice: install a second vent located on the distribution box or on System O)) header manifold. The 3 m difference between the entry and exit vents is still required.

Pump Station (optional)

If a pump station is required, it must be installed according to the manufacturer's recommendations. The installer must be careful to follow the designer's specifications when programming the pump cycles. The parameters to consider are:

- Minimum and Maximum volume per cycle.
- Maximum flow of the pump

Velocity Reducer

If a pump station is required to send the wastewater up to the D-Box, a velocity reducer must be used to slow down the flow and encourage an even distribution of wastewater through the equalizers. Install this device according to the plans, upstream from the D-Box.

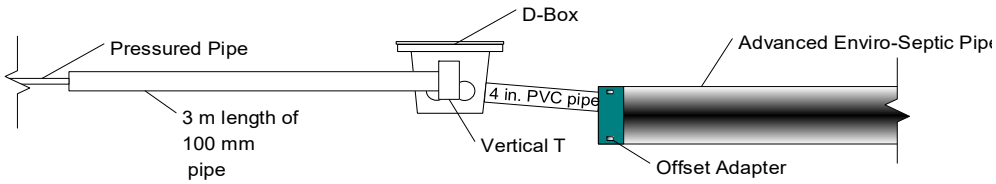

Figure 61

D-Box Installation

The majority of residential System O)) use a D-Box as a method of distributing the wastewater between the rows of pipes. The steps to install the distribution box are as follow:

- Create a stable horizontal base of compacted sand.
- Place the distribution box level on the sand surface.
- Correctly place the distribution box keeping in mind that the entry hole is higher than the exit holes. Whenever possible, make sure that the cover will be accessible from the surface for inspection purposes. Use raiser if needed.
- Keep a 1% slope between the exit hole of the septic tank and the entry hole of the distribution box.
- Cut out the plastic of the openings of the distribution box to be used according to the number of distribution pipes to be installed:
  - Cut part of the diameter of the opening with a knife.
  - Gently pull out the remaining part of the circle.
  - Do not try to push in the rubber circle as it may damage the gasket.
  - Repeat these steps for each opening to be used.
- Insert the 100 mm PVC pipes into the distribution box :
  - Insert the pipe approximately 25 mm into the distribution box
  - Twist the pipe to insert it easily
  - Insert the inlet pipe a little further and add a vertical tee in the center position.

Figure 62. Distribution box

Installation and Balancing of Distribution Box Equalizers

Equalizers are inserted into each of the 100 mm PVC pipes exiting the D-Box. They are used to improve the D-Box performance by equalizing the flow to each of The Advanced Enviro))Septic pipes.

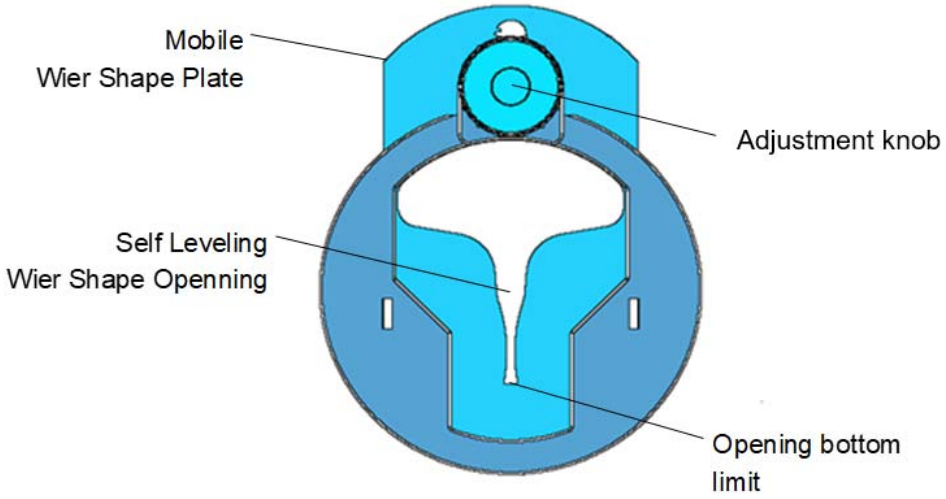

Figure 63. Equalizer

The equalizers must be installed and adjusted as follows:

1. Insert one equalizer unit into each D-Box outlet pipe with the adjustment knob positioned on top.
2. Rotate all adjustment knobs clockwise to the full UP position.

3. Add water into the D-Box until reaching the weir openings of the equalizers. Using the water as a level, observe which outlet sits lowest in the D-Box and do not adjust the equalizer fitted to that outlet. Rotate all remaining equalizer adjustment knobs counter-clockwise, moving the weir plate DOWN to match the level of the lowest Equalizer and the water line. Fine tune by slowly adding water to make sure all weir opening outlets are at the same level.

CAUTION: If a D-Box is out of level more than 9.5 mm (3/8”), re-level the D-Box and start again.

Feed, Distribution and Aeration Pipes

Use 100 mm PVC watertight pipes.

Place the bell opening of the pipes in the direction going up the slope.

Insert the 100 mm PVC pipes into the Advanced Enviro))Septic pipes. Use a minimum of 200 mm of pipe between the extremity of the Advanced Enviro))Septic pipe and the elbow or T of the header manifold.

Figure 64. Inlet Pipe sloped toward the System O))

Keep a minimum of 1% slope between the distribution box and the opening of the single offset adapter.

If the slope is steep, make sure the water will be slowed down before entering the pipe to avoid too much movement at the beginning of the row.

Final Backfill and Grading

Cover the Advanced Enviro))Septic pipes with a minimum of 300 mm (maximum 600 mm) of backfill permeable to air with no silt / clay.

Of this 300 mm, the first 100 mm on top of the pipes must be System Sand.

The backfill l is to be permeable top soil or sandy loam according to the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems.

When part of the system is above ground, put the lateral embankment at the required slope as indicated in the plan.

Leave a slight slope on top of the bed. The final grade must permit rainwater to flow toward the exterior perimeter of the system.

Erosion Control

Protect the top of the bed by creating a slight slope to permit water runoff. Plant grassy vegetation to prevent erosion.

Completing the Installation

Starting the System

Be sure that all the installation steps have been followed to the satisfaction of the designer or engineer in accordance with New Brunswick Technical Guidelines for On-site Sewage Disposal Systems and this manual.

Fill the septic tank with fresh water.

Visualize the aeration circuit to be sure that it is continuous between the entry vent located at the end of the Advanced Enviro))Septic pipes and the exit vent (min 3 m higher) generally located on the roof of the residence or building.

When pumps are installed, the Department of Public Safety (DPS) must be contacted for inspection of electrical components prior to covering the pump chamber assembly.

The system is now ready to be used!

Leaving the Site

If the finished grade or landscaping is to be done by others, upon leaving the site, place a stake or several stakes as needed, that mark the finished grade. Also leave a note to explain that vehicular traffic is not allowed on the system.

Administrative File

Fill out the Enviro-Quality form, add the sieve analysis representative of the system sand used and send everything to DBO Expert's local representative in the prepaid postage envelope.

Give the Owner's Manual to the new System O)) owners or inform them that they will be receiving one directly from DBO Expert' local representative upon receipt of the Enviro-Quality form.

Section P – Daily Use

Background

System O)) is a passive wastewater treatment attached growth technology. Properly installed, System O)) piping requires no particular action taken for daily use, intermittent use or after a prolonged absence.

Usage Directions

As with any septic system, attention should be paid to the nature of the wastewater to be treated. It is important that the users of the system follow the direction presented in the Owner's Manual. It provides a detailed list of things to do or not to do in and around the residence or building being served by the system. Not following the directions may lead to clogging or premature aging of the system. If this happens, actions can be taken to regenerate the biomat or to replace certain components if damage warrants it.

What to Do in Case of Problems

If, in the course of normal use of your treatment system, you notice any of the following:

- Presence of abnormal odour in the residence, around the septic system or emanating from sources of drinking water,
- Abnormally wet soil, presence of ponding or odours in the area of the septic tank or System O)),
- Back-up in the toilets or other sanitation devices in the home
- Presence of abnormally abundant vegetation on the surface or around the septic tank or System O)) installation
- Flooding of the land where System O)) is installed
- Erosion of the soil on or around System O))
- Alarm from the pump station, if such a device is part of your installation

Immediately contact your contractor or customer service. Please have your system's information on hand.

Section Q – Component Maintenance Program

Background

System O)) requires only minimal maintenance. In fact, it is just a periodic follow-up. This follow-up could eventually lead to certain maintenance operations.

Note, however, that the septic tank, the pump station, and the distribution device will need further maintenance depending on the directions of the manufacturer of these systems.

Locating the System

The following diagrams will help determine where the system has been installed. Refer to the original drawings for more details.

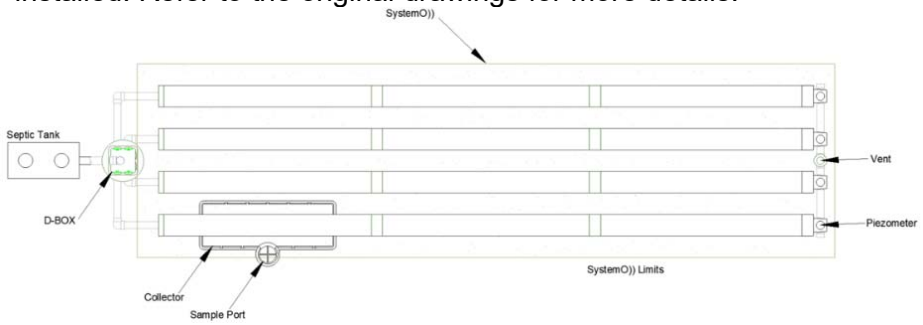

Figure 65. System O)) components installed below grade

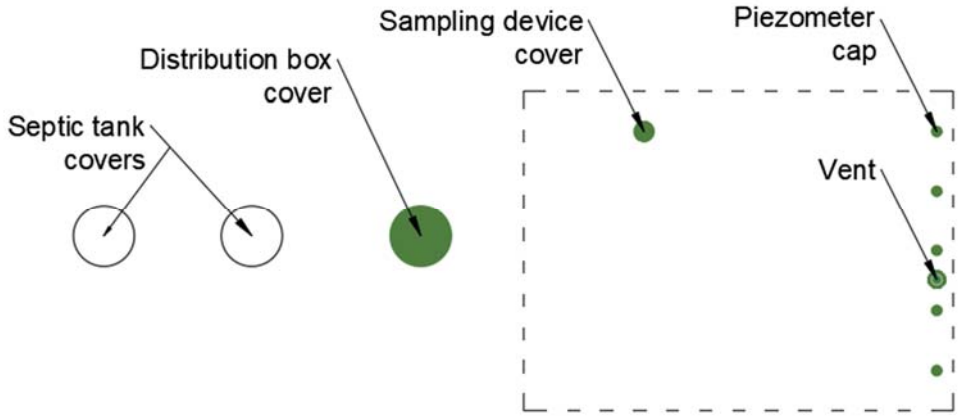

Figure 66. System O)) components visible above grade

Note: The positioning of the components may vary according to the configuration used. The broken lines represent the position of the septic tank, the D-Box and System O)). If a pump station is being used an additional cover will be visible above grade.

Septic Tank Maintenance

The Septic tank as part of System O)) must be pumped on a periodic basis. Generally, it must be inspected every 2 to 4 years to determine when to pump the contents, depending if it is used on a regular or occasional basis.

When pumping the septic tank, the liquid and the solids are to be removed completely from both compartments of the tank. The septic tank is then filled with fresh water.

At all times, the emptying of the septic tank must be done by a person with the proper training and pumping equipment.

It is the Owner's responsibility to have the septic tank pumped. This work must always be done by a qualified person. It can be very dangerous to open a septic tank without first taking the necessary precautions.

Note: The owner must always be sure that the septic tank covers are properly secured in place. A poorly installed cover is a safety hazard.

Septic Tank Effluent Filter

The Septic tank is equipped with an effluent filter. It must be maintained according to the inspection and maintenance procedure recommended by the manufacturer.

Please note that the effluent filter used must not hinder the free passage of air travelling through the system. The top of the effluent filter needs to be open.

Distribution Boxes and Equalizers

Under normal use, the D-Box does not require adjustment. The initial adjustment and the auto levelling (natural adjustment) capacity of the equalizers together maintain a good distribution of wastewater in the rows of Advanced Enviro))Septic pipes. System O)) maintenance provider will make any required adjustments.

If an adjustment is necessary the technician must do the following:

- Clear and remove the cover of the distribution box.
- Take the Equalizers out of the outlet pipes and wash them under running water to remove any accumulation of grease or slime.
- Remove any sludge that has accumulated on the bottom or sides of the distribution box.
- Put the Equalizers unit back into each D-Box outlet pipe with the adjustment knob positioned on top.
- Rotate all adjustment knobs clockwise to the full UP position.
- Add water into the D-Box until reaching the weir openings of the Equalizers. Using the water as a level, observe which outlet sits lowest in the D-Box and do not adjust the Equalizer fitted to that outlet. Rotate all remaining Equalizer knobs counter-clockwise, moving the weir plate DOWN to match the level of the lowest Equalizer. Fine tune by slowly adding water to make sure all weir opening outlets are at the same level.

CAUTION: If the D-Box is out of level more than 9.5 mm (3/8"), re-level the box and start again.

- Put the inside insulation (plastic D-Box) and the cover back on the D-Box being careful that it sits properly on all sides.
- Replace insulation or soil originally found on top or around the D-Box
- Make sure to return the site in its original condition.

Rows of Advanced Enviro))Septic pipes	Under normal use, the rows of Advanced Enviro))Septic pipes need no maintenance. It is normal to find a certain fluctuation of the water level in the pipes. However, if the water level is equal or higher than 230 mm, a System O)) rejuvenation may be needed. This procedure must be done by an authorized maintenance person (see Section U – System Rejuvenation and Expansion).
Sampling Device Maintenance	If the System O)) has a sampling device. A 200 mm diameter sample port with access just above grade will be located on one side of the system, near the extremity of the rows fed by wastewater coming from the septic tank. (see **Figure *37*** and **Figure *38***). The sampling device does not need maintenance. It is only necessary to make sure that the cover stays in place. For more information on the use of the sampling device, consult the Section R on the sampling procedure.
Piezometers	Other than making sure that the covers are in place, there is no maintenance to do on the piezometers.
Vent	The vent requires no maintenance. The owner must make sure that nothing hampers the air circulation. In the winter, the vent must be high enough so that the passage of air is not blocked by the snow. At all times, there must be a 3 m difference in height between the entry vent at the end of System O)) and the vent stack generally located on the roof of the building.
System Sand	With System O)), there is no maintenance necessary for the sand.
Pump Station or Low-Pressure Distribution System	In some cases, the constraints of the site or the wastewater distribution needs require the use of a pump station or a low-pressure distribution system. The Owner is then responsible for respecting the manufacturer's directions for maintenance of this equipment. A flow measuring device is an option on pumped systems.
Surface of the Fill on top of System O))	The surface of the fill on top of System O)) must be covered with grass. The finished grade must be slightly sloped so that rain water will run off the system. The grass must also be cut regularly. Any depressions / ground settlement that are produced with time should be with top soil filled to avoid water accumulation or erosion on top of the system.

Maintenance Summary Table

The following table shows a summary of the follow up to be done for each of System O)) components. Maintenance is to be conducted by an authorized person as defined in the regulation and authorized by DBO Expert as a maintenance provider for System O)).

Table 4. Summary of Maintenance for System O)) Components

Component	Function	Steps to Follow	Frequency	Responsibility
Septic Tank	Primary wastewater treatment	Periodic emptying	According to local regulations	Owner (work must be done by a qualified person)
Effluent filter	Retention of solids larger than the maximum opening of the filter.	Periodic cleaning	Twice a year	Owner
Distribution devices A) Distribution box Polylok and equalizers B) Low pressure distribution system	Distribute water from the septic tank to the rows of the System O))	A) According to the level of water in the piezometers.	A) As needed	A) Owner (it is preferable that this work be done by a qualified person)
		B) According to the water levels in the piezometers.	B) If necessary	B) By qualified person
Piezometers	Indicate the water level in the pipe rows	Water level measurement	Once or twice a year and as a preventive measure, before the septic tank is emptied.	Owner or Qualified person
Sampling device (if applicable)	Check the purifying performance and measure the level of water in the System O))	Optional	Optional	Owner or Qualified person
Vent	Allow air to pass through the System O))	Check that the opening is not blocked	Twice a year	Owner
Pumping station (if applicable)	Water uplift to System O))	According to the supplier's specifications		

Section R – Method of Collecting and Evaluating Samples

Background

If the System O)) has a sampling device, it can be used to recover the treated water in order to analyze it. The following paragraphs describe how to sample the water in the system.

Materials

Here is a list of necessary materials for taking a sample of System O)) effluent via the sampling device access tube:

- Flashlight
- Cooler and sampling containers as provided by an accredited laboratory.
- Sampling container attached to a rod to lower the container to collect the sample.

Sampling Procedure

1. Remove the cover from the sample port of the sampling device.
2. Using the rod, lower the container below the inlet pipe at the bottom of the sample port.
3. When treated water has accumulated in the container, retrieve it and filter the treated water into the laboratory containers using a 0.25 mm sieve to remove the large particles of sediment which could have fallen off the walls of the sampling device.[5]
4. Put the container on ice and repeat Steps 2 and 3 until enough treated water has been collected to fill all the laboratory containers.
5. Place the analysis containers in the cooler to keep them cool.
6. Pour the unused liquid in the sample port.
7. Replace the covers and put a plastic tag on it. Be sure to leave the area in its initial condition.
8. Identify properly the laboratory containers and take note in the book of the date and time of the sampling.
9. Quickly take the samples to the laboratory as specified by their measurement protocol.

Visual and Olfactory Techniques to Evaluate the Effluent

If System O)) is functioning properly, the effluent taken from the sampler should be clear or slightly coloured (yellowish, brownish). Also, it should be relatively translucent. If it has any smell, it should not be strong.

Visual evaluation: Place the sample taken in a container with clear sides. Place the container on a white surface such as a sheet of paper. If the effluent has a dark color or is cloudy, it is a sign that the system might not be functioning normally.

[5] The sieve is used to obtain a representative result. It is actually less constraining than the sand that the treated water would have traveled through to get to the surface of the receiving soil had it not been intercepted by the collector of the sampling device.

Olfactory evaluation: Holding the open container in your hand, on a horizontal plane, make a slight circular movement making the water swirl inside the container. If a smell of ammonia (sharp bitter smell), of hydrogen sulphur (rotten egg smell) or any other strong smell is noticeable, it is a sign that the system may not be functioning normally.

If any of the potential problem signs are present, proceed to undertake a $CBOD_5$, a total suspended solid (TSS) and an E.-Coli. analysis.

Section S - Component Inspection Procedure

Background

Even though System O)) does not require any formal maintenance, an annual inspection is good practice to ensure the system is functioning properly. The following paragraphs show which components are to be verified.

Documentation

It is important to keep track of the inspections and maintenance provided. This is why a good follow-up involves compiling data about the state of the system at the time of inspection. Appendix 1 shows a form which can be used for this purpose.

Installation Diagram

It is important this diagram is prepared as part of the design permit requirements of the position of the equipment underground. This diagram should show the following elements as well as any other elements that could assist in the location and identification of the system components:

- Tank, sample port and D-Box covers;
- Pump station cover (if present);
- Direction of the Advanced Enviro))Septic pipes;
- Location and numbering of the piezometer openings;
- Vent.

Here is an example of a System O)) diagram.

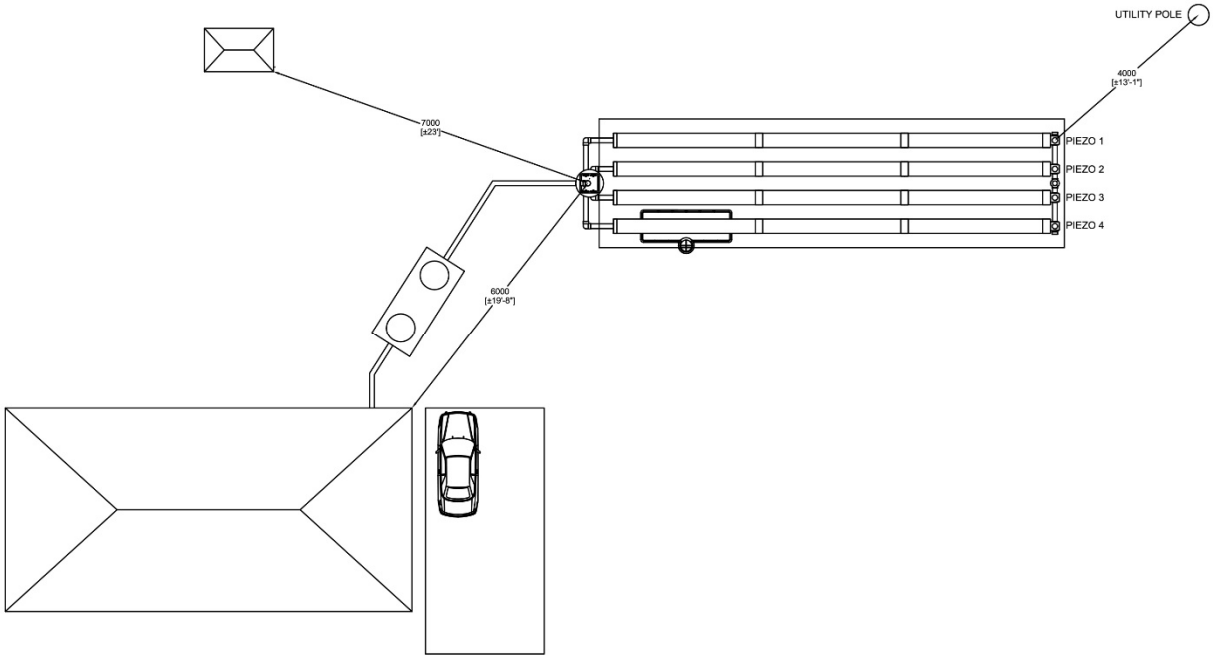

Figure 67.

Necessary Precautions

The septic tank and the pipes contain wastewater. Resurgent water may also be contaminated, so certain precautions must be taken. The person doing the inspection of a septic installation must be properly protected. Work clothing, glasses and protective gloves are to be worn. The use of disposable gloves is recommended. In order to avoid possible contamination, avoid direct contact with wastewater.

Septic Tank

The septic tank precedes the treatment system. It must be pumped periodically (Every 3 - 5 years. A record of emptying must be kept by the owner.

At the time of inspection;

- Verify that the covers of the septic tanks are in place, secure and in good condition.
- Verify that surface water run-off cannot enter the septic tank by the cover or any infiltration point.
- Verify that the soil above and around the septic tank is stable and not spongy which could indicate the presence of a leak.

Visual Inspection

At the time of inspection of the treatment system:

- Verify that the ground is stable above and around the treatment system and that it is grass covered.

- Verify that the lateral embankment has an acceptable slope (maximum 30%) to avoid eventual erosion problems.
- Determine if there are any forewarnings of a problematic situation such as spongy or soaked ground, presence of unwanted plants, presence of resurgence or soil erosion.

It is suggested to take pictures of the state of the installation at the time of inspection and keep them on file.

Measuring the Water in the Piezometers of the Advanced Enviro))Septic pipes

The measurement of the water level in the rows of pipes is done via the piezometers found at the end of System O)). This installation of these piezometers is an essential component to ensure that the system is functioning as intended.

Sequence in which to measure the water level

1- Remove the cover of the piezometer to be measured.
2- Slide a wooden stick or a meter stick into the piezometer so that its end is in the water that might be present at the bottom of the piezometer. Normally a wooden stick one meter long is sufficient. However, if your piezometers are deeper, use a longer stick. A piece of string attached to your measuring stick may also be used to lower and raise the stick from the piezometers.
3- Using a ruler (or directly on the meter stick), determine the water level in the pipe by the level of wet surface on the stick. When having difficulty reading it, put fine sand on the stick before putting it into the piezometer. The sand will be mostly gone from the area submerge in water and the reading will be easier.
4- Take note of the water level in the piezometer.
5- Replace the piezometer cover.
6- Wipe the wet area of the stick (or ruler) with a disposable cloth.
7- Repeat these steps for each piezometer.
8- Clean the stick or ruler and the gloves if reusable. Discard disposable gloves and cloths in a closed plastic bag.
9- Record the results obtained in the piezometers section of the follow-up form (see Appendix 2).

Other option: Instead of using a stick or meter stick, the reading can be taken using a plunging siphon. A plunging siphon is a small graduated tube used to remove a small quantity of liquid. The technician inserts the plunging siphon to the bottom of the piezometer, closes the top opening with his thumb, then removes the siphon from the piezometer to see the reading.

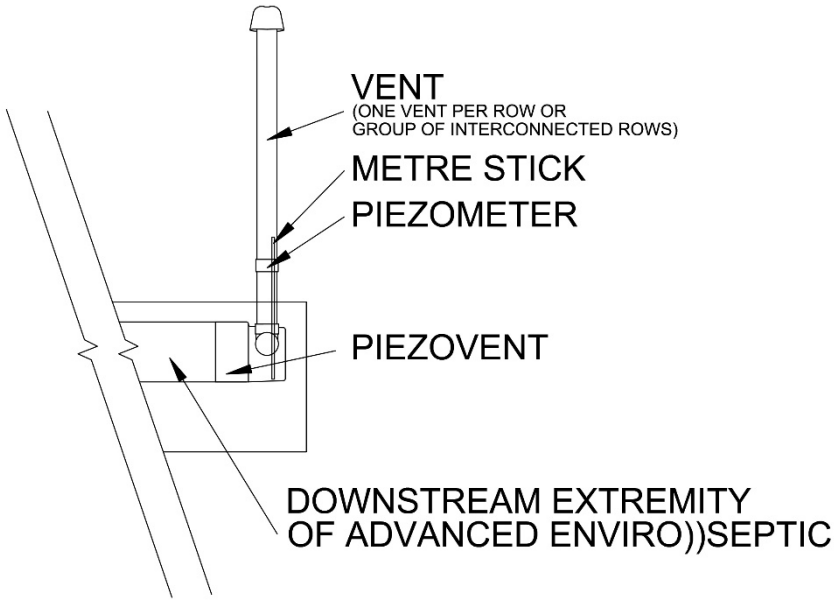

Figure 68

Adjustment of the Distribution Box Equalizers

If the measurement of water level in the piezometers shows a variation of more than 100 mm between the lowest and the highest piezometers at two consecutive measuring, the Equalizers in the D-Box must be adjusted. Proceed to do the adjustment following the directions given in Section O.

Measuring the Water level in the Other Piezometers

Local regulations may require the installation of one or more piezometers to measure the level of the groundwater. These piezometers can be installed in the center of the treatment system or in the area surrounding it.

If these piezometers exist, take the reading of the water level in them and record the results on the follow-up form.

Section T - Replacement or Repair of Components

Sign of a System not Functioning Normally

If System O)) presents any of the following conditions, it is not functioning as required:

- Abnormally wet soil, presence of ponding or odours in the area of the septic tank or System O))
- Back-up in the toilets or other sanitation devices in the home
- Presence of abnormally abundant vegetation on the surface or around the septic tank or System O)) installation
- Flooding of the soil where System O)) is installed
- Erosion of the soil on or around System O))
- Advanced Enviro))Septic pipes filled with water
- Alarm from the pump station if such a device is part of your installation

Possible Causes

Several elements may be the cause of a system malfunction. They can be grouped into three major categories.

- Hydraulic Overloading (leaking fixture in the house, infiltration water in tank, D-Box or wastewater fed pipes, possible over use of water)
- Organic Overloading
- Inadequate air circulation
- Inadequate maintenance of septic tank/ effluent filter
- Pollutant concentration higher than domestic wastewater

Each of these categories will be analyzed in detail in the paragraphs to follow.

Hydraulic Overloading

Possible Causes of Over Loading

There is too large a volume of wastewater discharging into the system.

The System Sand does not meet the specifications and the water movement through the sand is restricted.

Table *5*Table *5*. Hydraulic Over Loading shows the most foreseeable causes and their solutions.

Table 5. Hydraulic Over Loading

Problem	Possible Causes	Solutions
Volume of water use from the building is greater than the design flow	• The use of water in the building is not as expected. The number of occupants is greater than planned. The activities in the building are generating a larger wastewater volume than normal or than was expected.	• Take readings on the water meter to measure the water flow used in the building in order to show the client that his activities are generating too large a volume of wastewater for the system. • Ask the Owner to modify the activities or habits of the occupants so as to respect the system's capacity. • Increase the capacity of the installation.
	• The plumbing in the building is in poor condition and leaks are causing an increase in the normal flow.	• Repair the plumbing in order to avoid unwanted water entering the treatment system.
	• Unwanted water is seeping in to the system. To verify this condition, cut all known sources of water use in the residence and see if water continues to run into the septic tank. Here are a few examples of possible causes: • the exit of the building's drain pipes is connected to the treatment system. • the pipe for the swimming pool backwash is connected to the treatment system. • water runoff is getting into the septic tank via the cover or an unsealed joint. • The water from gutters or sump pump is being directed to the septic tank.	• Eliminate the unwanted water from the volume of wastewater to be treated. • Direct water from the downspouts to the ditch or rain gutter. • Direct water from the swimming pool to the ditch or have pumped by a hauler. • Raise the cover or seal the joints so that groundwater cannot enter the septic tank. • Direct this water to the drain pipe, ditch or away from the septic tank.
Unwanted water entering directly into the treatment system	• The treatment system is made up of sand and Advanced Enviro))Septic pipes. In certain conditions, it may be receiving water not coming from the septic tank. This water increases the hydraulic load imposed on the surface of the receiving soil. The infiltration capacity is overextended and water accumulates. Here are some examples of possible causes: • The system is not covered with top soil and grass. • There is a depression in the surface on top of the system where water accumulates and then infiltrates.	• Modifications must be made to redirect this water to the normal drainage ditches /swales . A drainage row is a possible solution. • Complete the covering making a slight slope towards the exterior of the system and cover with grass. • Fill the depression with dirt, leaving a slight slope toward the exterior of the system and cover with grass. • Provide a drainage trench/swale to intercept this water and direct it to a ditch.

	• The system is on a slope and streaming water or groundwater is infiltrating into it.	
Rise in the groundwater table	• The addition of treated water to the receiving soil causes an increase in the level of the groundwater table the size of which depends on the site. In certain conditions this increase in level may come up to the treatment system.	• Increase the surface of the system to diminish the hydraulic load of the receiving soil and thus reduce the increase in the groundwater table. • Reduce the volume of wastewater generated, as the evacuation capacity of the soil is less than the flow foreseen in the design.

Deficient air circuit

The aeration / vent piping is important to the proper functioning of System O)), as it permits the passage of air necessary to feed the bacteria responsible for the treatment of wastewater. If the air is cut off, the bacteria develop anaerobically creating a danger of clogging. Therefore, it is important to re-establish the vent flow if it is cut.

Table *6* shows the most foreseeable causes and their solutions.

Table 6. Deficient Aeration Circuit

Problem	Possible Causes	Solutions
The air is cut off	• There is no entry vent.	• All systems must have at least one entry vent per 300 m of pipes.
	• There is no exit vent or there is not 3 m of height difference between the entry and exit vents.	• All systems must have an exit vent. At best, it should be placed on the roof of the building and there must be a height difference between it and the entry vent of at least 3 m.
	• There is a pump station but no diversion pipe for air passage. • The slope of the aeration pipe is not toward System O)), so condensation accumulates and cuts off the air passage.	• A diversion pipe or high vent must be installed to ensure air passage. • The pipe must be adjusted correctly. This implicates having a 1% slope toward the Advanced Enviro))Septic pipes or a drainage point for the condensation.
	• A vent is obstructed (i.e. by snow).	• Vents must be kept clear to permit air passage.

High strength Wastewater

System O)) is designed to treat water of a domestic nature. If the wastewater entering the system is not what was foreseen, the bacterial development may be affected, thus decreasing the level of treatment or even increasing the danger of clogging.

Table *7* shows the most foreseeable causes and their solutions.

Table 7. Denatured wastewater

Problem	Possible causes	Solutions
The water is too saturated	• The septic tank contains a lot of grease or sludge. It hasn't been emptied recently so the usable volume is reduced and a lot of sediment is passing into the treatment system. • The activities of the occupants are not as expected (i.e. restaurant, food production, etc.) • The septic tank is very clean, but the Owner puts additives in his water so a lot of solid ends up in the treatment system. • There are a lot of non-assimilated elements in the septic tank. • A garbage disposal unit is used in the building.	• Have the septic tank emptied and explain to the Owner the importance of doing this regularly. • Speak to the Owner about this to discuss a change in activities or an upgrading of the treatment system. • Explain to the Owner why he should stop using these additives. • Determine and eliminate the source of the non-assimilated elements. • Ask the Owner to remove this equipment as it is damaging to the installation.
The water is loaded with chemicals	• Paint or other chemical products have been discharged into the treatment system. • The occupants use large quantities of caustic cleansers.	• Explain to the Owner the importance of not putting these products in his wastewater. • Recommend that the occupants use reduced phosphate cleansers and smaller quantities

Pump Station

For any problems related to the pump station refer to the manufacturer's instructions.

Replacement of One of the System Components

Certain precautions must be taken if one of the system components needs to be replaced. Please note that the replacement of a system component would likely need approval from the New Brunswick Department of Public Safety.

- Stop the flow of wastewater.
- Remove and properly dispose of contaminated liquid.
- Remove the component and replace it with an equivalent piece of equipment. If it is a section of Advanced Enviro))Septic pipe that needs replacing, make sure to replace the sand properly around it. If the sand is contaminated, dispose of it properly and replace it with new sand.

- Verify that the connections are watertight when required and that the necessary slopes are present.
- Re-cover using the required layers of materials and cover with grass.

For replacement of the pump station, verify with the manufacturer's directions.

Section U – Rejuvenation Process and Expansion

Introduction

This section covers procedures for rejuvenating failing systems and explains how to expand existing systems.

Definition: Failing System

System failures, almost without exception, are related to the conversion of bacteria from an aerobic to an anaerobic state. Flooding, improper venting, alteration or improper depth of soil, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to this condition.

It is normal to find a certain level of wastewater in the rows of Advanced Enviro))Septic pipes. It is also normal to notice a fluctuation in the water level with time. But, when the system has been misused, a large level of clogging may occur around the pipes.

An elevated level of wastewater for a long period may be a sign of clogging. Fortunately, System O)) has the ability to regenerate itself. In other words, it is possible to recreate practically the original conditions of the system.

When Should we Consider Rejuvenation

A rejuvenation process can be expected if the wastewater level in the piezometers is above 230 mm (9 inches), and the sand around the pipes is not saturated with water. If the sand is saturated with water, you must first re-establish hydraulic balance in the system. After that, once the effluent is drained from the sand, a rejuvenation process should be done if the water level does not go down in the rows of pipes.

Three Types of Rejuvenation

There are three rejuvenation processes possible.

1. The natural rejuvenation happens through reduction in use of the septic installation for a period of a few days or weeks (i.e. Period of absence for vacation). No intervention is required for this type of rejuvenation.
2. The forced rejuvenation consists of emptying the septic tank and removing the water from the rows of Advanced Enviro))Septic pipes at the same time. This form of rejuvenation is the most common and the easiest to do.

3. The forced rejuvenation and cleaning consists of emptying the septic tank and the removal of water and any inorganic materials which have accumulated in the pipes over a number of years. This type of rejuvenation requires a more important intervention. It is required in the case where the system has been subjected to abuse or after many years of use.

Precautions to be Taken

The forced rejuvenation process must be done by a qualified person.

Exceptionally, when doing a forced rejuvenation, the septic tank is not filled with clear water as in the case of a normal emptying. This process must be done at a time when the level of the groundwater table is low and there is no danger that a hydrostatic pressure force on the septic tank.

The fact of not filling the septic tank gives the system 2 or 3 days rest even though the occupants of the building are continuing their normal activities. Evidently, the tank can be filled with clear water if the rejuvenation process is done just before the occupants of the building leave for a prolonged period of absence.

Preventive measure when emptying the septic tank
It is recommended to verify the water level in the piezometers a few days before normal emptying of the septic tank (see measuring water levels). If the water level is too high, it is possible to use the emptying of the septic tank to do a forced rejuvenation process.

Rejuvenating Failing Systems

Failing systems need to be returned from an anaerobic to an aerobic state. Most systems can be put back on line and not require costly removal and replacement by using the following procedure.

1. Determine the problem causing system failure and repair.
2. Drain the system through the piezometers installed at the extremities of the rows of Advanced Enviro))Septic pipes or sections of rows of pipes. If the pipes need to be cleaned, pass a cleaning nozzle while pumping out the water and any dislodged debris. Under certain circumstances, this operation may require excavation at the ends of the rows of pipes. The ventilation pipes, piezometers and the offset adapters are then taken out for better access to the pipes and thus a more efficient cleaning.
3. If foreign matter has entered the system, flush the pipes.
4. Safeguard the open excavation.
5. Guarantee a passage of air through the system.
6. Allow all rows of pipes to dry for a minimum of 72 hours.
7. Re-assemble the system to its original design configuration.

System Expansion	System O)) are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections. Note: All system expansions need to be permitted by the local building department or considering authority regulation.
Re-usable Pipe	System O)) 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.

Closing Words

The information in this manual is subject to change without notice. Your suggestions and comments are welcome. Please contact us at:

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Appendix 1 – Worksheet

Bed Systems

Number of Advanced Enviro))Septic Pipes required ?			
1. From the New Brunswick Technical Guidelines, determine the daily sewage flow	_____	litres/day	***A***
2. Number of Advanced Enviro))Septic pipes required (***A***÷126, rounded up)	_____	pipes	***B***
Application Area			
3. Soil maximum hydraulic rate (see **Table 2)**	_____	L/m^2/d	***C***
4. Area required to evacuate treated effluent (***A***÷***C***)	_____	m^2	***D***
Design of the System O))			
5. Number of cells	_____		***E***
6. Number of rows	_____		***F***
7. Number of pipes per row (max. 10 pipes/row)	_____		***G***
8. Total number of pipes (must be greater or equal to ***B***) (***F*** x ***G)*** x ***E***)	_____		***H***
Spacings (see Table 1)			
9. Center to center spacing (E_{cc}) (min. 0.45 m)[6]	_____	m	***I***
10. Lateral spacing from the center of the last lateral row of pipe to the limit of System O)) (E_L) (min. 0.45 m)	_____	m	***J***
11. End extension distance from the end of a row of pipe to the limit of System O)) (E_E) (min. 0.30 m)	_____	m	***K***
12. Total length of System O)) (***G*** x 3.05) + (***K*** x 2)	_____	m long	***L***
13. Width of Application Area (***J*** x 2) + (***I*** x (***F*** - 1))	_____	m wide	***M***
14. Total surface area (must be greater or equal to ***D***) (***L*** x ***M***)	_____	m^2	***N***
System Sand			
15. Height of sand required under pipes	_____	m	***O***
16. Total height of system sand required(***O*** + 0.4)	_____	m	***P***
17. Volume occupied by pipes (***H*** multiplied by 0.22)	_____	m^3	***Q***
18. Volume of system sand, including pipes (***N*** multiplied by ***P***)	_____	m^3	***R***
19. Total volume of system sand required (***R*** – ***Q***)	_____	m^3	***S***

Number of 1 Hole Inlet Caps (***E*** x ***F***) _____
Number of Piezovents (***E*** x ***F)*** _____
Number of Equalizers (***E*** x ***F***)_____
Number of Coupling = (***F x (G-1)) x E*** _____

[6] Note: When the spacing between System O)) length (E_{cc}) is more than 0.9 m, imported sand could be added between System O)) length instead of using System Sand (see ***Figure 7***). There is no maximum spacing, but efforts should be taken to reduce the amount of imported sand required in order to minimize the cost of the project for the client.

This worksheet is designed to be a guide only. Final design calculations should be confirmed by the Project's Designer given site specific conditions not considered in this manual such as, but not limited to steep slopes or tall raised mounds.

Refer to the Installation Manual available from the authorized distributor

Example

Number of Advanced Enviro))Septic Pipes required ?			
1. From the New Brunswick Technical Guidelines, determine the daily sewage flow	3000	L/day	***A***
2. Number of Advanced Enviro))Septic pipes required (***A***÷126, rounded up)	3000 ÷ 126 = 24	pipes	***B***
Application Area			
3. Soil minimum hydraulic rate (see ***Table 2)***	75	L/d/m^2	***C***
4. Application Area Required (***A***÷***C***)	3000 ÷ 75 = 40	m^2	***D***
Design of the System O))			
5. Number of cells	1		***E***
6. Number of rows	4		***F***
7. Number of pipes per row (max. 10 pipes/row)	6		***G***
8. Total number of pipes (must be greater or equal to ***B***) (***F*** x ***G)*** x ***E***)	(4 x 6) x 1 = 24		***H***
Spacings (see Table 1)			
9. Center to center spacing (E_{cc}) (min. 0.45 m)[7]	0.45	m	***I***
10. Lateral spacing from the center of the last lateral row of pipe to the limit of System O)) (E_L) (min. 0.45 m)	0.45	m	***J***
11. End extension distance from the end of a row of pipe to the limit of System O)) (E_E) (min. 0.30 m)	0.30	m	***K***
12. Total length of System O)) (***G*** x 3.05) + (***K*** x 2)	(6 x 3.05) + (0.3 x 2) = 18.9	m	***L***
13. Width of Application Area (***J*** x 2) + (***I*** x (***F*** - 1))	(0.45 x 2) + (0.45 x (4-1)) = 2.25	m	***M***
14. Total surface area (must be greater or equal to ***D***) (***L*** x ***M***)	18.9 x 2.25 = 42.5	m^2	***N***
System Sand			
15. Height of sand required under pipes	0.3	m	***O***
16. Total height of system sand required (***O*** + 0.4)	0.3 + 0.4 = 0.7		***P***
17. Volume occupied by pipes (***H*** x 0.22)	24 x 0.22 = 5.28	m^3	***Q***
18. Volume of system sand, including pipes (***P*** x ***N***)	0.7 x 42.5 = 29.75	m^3	***R***
19. Total volume of system sand required (***R*** – ***Q***)	29.75 – 5.28 = 24.47	m^3	***S***

Number of 1 Hole Inlet Caps (***E*** x ***F***)	1 x 4 = 4
Number of Piezovents (***E*** x ***F***)	1 x 4 = 4
Number of Equalizers (***E*** x ***F***)	1 x 4 = 4
Number of Coupling = (***F x (G-1) x E)***	4 x (6-1) = 20

System in trenches

Number of Advanced Enviro))Septic Pipes required ?			
1. From the New Brunswick Technical Guidelines, determine the daily sewage flow	_____	litres/day	***A***
2. Number of Advanced Enviro))Septic pipes required (***A***÷126, rounded up)	_____	pipes	***B***
Application Area			
3. Soil maximum hydraulic rate (see ***Table 2***)	_____	$L/m^2/d$	***C***
4. Area required to evacuate treated effluent (***A***÷***C***)	_____	m^2	***D***
Design of the System O))			
5. Number of trenches	_____		***E***
6. Number of rows/trenches	_____		***F***
7. Number of pipes per row (max. 10 pipes/row)	_____		***G***
8. Total number of pipes (must be greater or equal to ***B***) (***F*** x ***G)*** x ***E***)	_____		***H***
Spacings (see *Table 3*)			
9. Lateral spacing from the center of the last lateral row of pipe to the limit of System O)) (E_L) (min. 0.45 m)	_____	m	***I***
10. End extension distance from the end of a row of pipe to the limit of System O)) (E_E) (min. 0.30 m)	_____	m	***J***
11. Width of trench (L_T) (2 x ***I***) (min. 0.6 m)	_____	m	***K***
12. Length of trench (***G*** x 3.05) + (2 x ***J***)	_____	m	***L***
13. Surface area of one trench (***L*** x ***K***)	_____	m^2	***M***
14. Total surface area (***M*** x ***E***)	_____	m^2	***N***
System Sand			
15. Height of sand required under pipes	_____	m	***O***
16. Total height of system sand required(***O*** + 0.4)	_____	m	***P***
17. Volume occupied by pipes (***H*** multiplied by 0.22)	_____	m^3	***Q***
18. Volume of system sand, including pipes (***N*** multiplied by ***P***)	_____	m^3	***R***
19. Total volume of system sand required (***R*** – ***Q***)	_____	m^3	***S***

Number of 1 Hole Inlet Caps (***E*** x ***F***) _____
Number of Piezovents (***E*** x ***F)*** _____
Number of Equalizers (***E*** x ***F***)_____
Number of Coupling = (***F x (G-1)) x E*** _____

Example – System in trenches

Number of Advanced Enviro))Septic Pipes required ?				
1.	From the New Brunswick Technical Guidelines, determine the daily sewage flow	3000	litres/day	***A***
2.	Number of Advanced Enviro))Septic pipes required (***A***÷126, rounded up)	24	pipes	***B***
Application Area				
3.	Soil maximum hydraulic rate (see ***Table 2***)	75	L/m^2/d	***C***
4.	Area required to evacuate treated effluent (***A***÷***C***)	3000 ÷ 75 = 40	m^2	***D***
Design of the System O))				
5.	Number of trenches	4		***E***
6.	Number of rows/trenches	1		***F***
7.	Number of pipes per row (max. 10 pipes/row)	6		***G***
8.	Total number of pipes (must be greater or equal to ***B***) (***F*** x ***G)*** x ***E***)	(1 x 6) x 4 = 24		***H***
	Spacings (see *Table 3*)			
9.	Lateral spacing from the center of the last lateral row of pipe to the limit of System O)) (E_L) (min. 0.45 m)	0.45	m	***I***
10.	End extension distance from the end of a row of pipe to the limit of System O)) (E_E) (min. 0.30 m)	0.3	m	***J***
11.	Width of trench (L_T) (2 x ***I***) (min. 0.6 m)	2 x 0.45 = 0.9	m	***K***
12.	Length of trench (***G*** x 3.05) + (2 x ***J***)	(6x3.05)+(2x 0.3) = 18.9	m	***L***
13.	Surface area of one trench (***L*** x ***K***)	18.9 x 0.9 = 17.01	m^2	***M***
14.	Total surface area (***M*** x ***E***)	17.01 x 4 = 68.04	m^2	***N***
System Sand				
15.	Height of sand required under pipes	0.3	m	***O***
16.	Total height of system sand required(***O*** + 0.4)	0.3 + 0.4 = 0.7	m	***P***
17.	Volume occupied by pipes (***H*** multiplied by 0.22)	24 x 0.22 = 5.28	m^3	***Q***
18.	Volume of system sand, including pipes (***N*** multiplied by ***P***)	68.04 x 0.7 = 47.63	m^3	***R***
19.	Total volume of system sand required (***R*** – ***Q***)	47.63 – 5.28 = 42.35	m^3	***S***
Number of 1 Hole Inlet Caps (***E*** x ***F***)		4 x 1 = 4		
Number of Piezovents (***E*** x ***F)***		4 x 1 = 4		
Number of Equalizers (***E*** x ***F***)		4 x 1 = 4		
Number of Coupling = ***F x (G-1)) x E***		1 x (6 -1) x 4 = 20		

Appendix 2 – System Follow-Up Form

Follow up Report – System O))

Coordinates:

Last name: _____ First name: _____

Address: _____

City: _____ Postal Code _____

Date of report: _____

Photo Taken:_____

Technician on Site: _____

Pipes:	☐ Traces of wastewater level fluctuation in the pipes ☐ Feed pipe slope problem		
Vegetation:	☐ System not covered with grass. ☐ Presence of unwanted plants / trees nearby		
Odour:	☐ At the entry vent	☐ At the exit vent	
Vent:	☐ No roof vent ☐ 3 m differential not respected		
Fill:	☐ Nonconforming slope. Too steep		
Back-up	☐ Visible Back-up		
Sampling:	☐ Cleaning of sampling device	☐ Sample taken	☐ N/A
Distribution:	☐ Adjustment of equalizers		

Flow meter or water meter: _____units: _____

Water level in the piezometers at the end of the rows of Advanced Enviro))Septic pipes (mm)

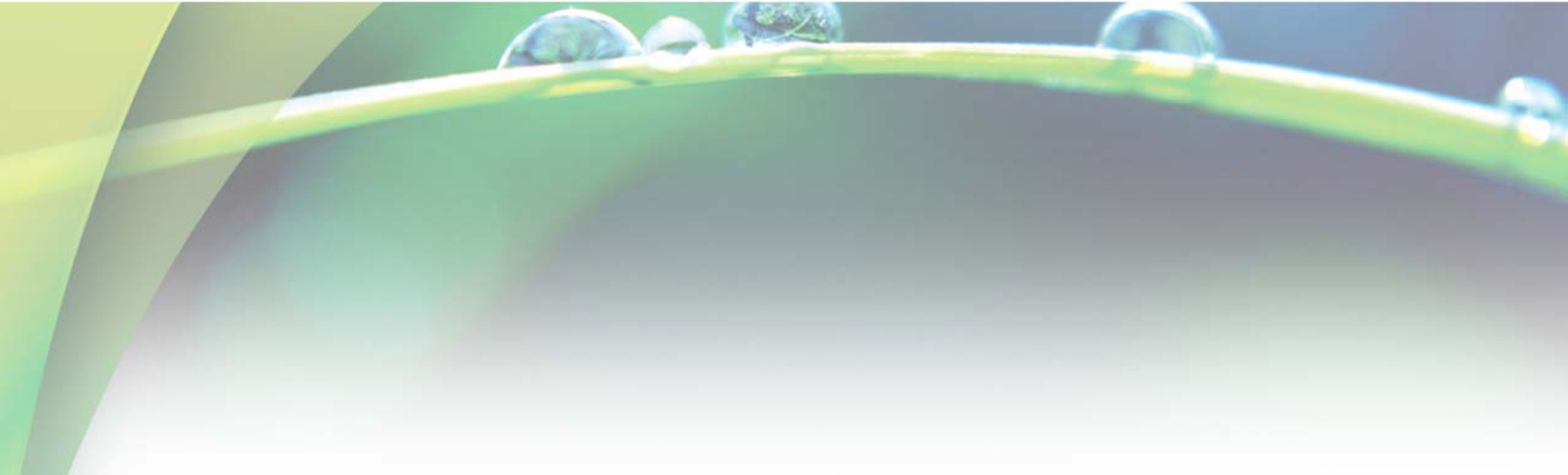
No 1	No 2	No 3	No 4	No 5
No 6	No 7	No 8	No 9	No 10
No 11	No 12	No 13	No 14	No 150
No 16	No 17	No 18	No 19	No 20

The technician must indicate on the diagram the position of the piezometers measured and the numbering used.

Water level in the other piezometers. For each piezometer:

No. _____
Bottom measurement of piezometer_____
Top measurement of piezometer_____

Installation diagram (1 square = 1 m):



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