System O)) ®

Designer & Installer Manual

Province of British Columbia

DBO EXPERT

FRP MOCOAT

DBO Expert & FRP Mocoat Fiberglass Ltd.

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A. Introduction and generalities

A.1. Context

This manual contains information about the design and installation practices of the System O)) advanced treatment technology for the province of British Columbia, in compliance with the Standard Practice Manual Version 3 (SPM V3).

A.2. Use of this Manual

This manual is for the exclusive use of designers and /or installers who are licensed or authorized to conduct this type of work in accordance with laws, regulations, code or bylaws issued by the appropriate authorities, or

It is the responsibility of the Authorized Designer and/or Installer to follow the Provincial laws and regulations that apply to the work being conducted.

In case of discrepancy with SPM V3, the latter prevails.

A.3. Definitions

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

Advanced Enviro-Septic Pipe	An Advanced Enviro-Septic pipe (AES) is a single unit of pipe, 3.05 m (10 ft) in length, with an outside diameter of 300 mm (12 in) and a total volume capacity of approximately 220 litres (48.4 IG). The set of membranes surrounding the pipe includes the Bio-Accelerator.
Area of Infiltrative Surface	The area of infiltrative surface means the area of interface receiving effluent from the distribution system
Centre to Centre Spacing	Centre to centre spacing is the horizontal distance from the centre of one System O)) row to the centre of the adjacent row. The abbreviation for this term is S_{cc}.
Daily Design Sewage Flow	Daily design sewage flow is the determined liters/day flow for sewage systems.
Differential Venting	Differential venting is a method of venting a System O)) utilizing high and low vents.
Distribution Box (D-box)	A distribution box is a device used to divide and/or control the septic tank effluent flow into the Advanced Enviro-Septic rows of 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.

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 System O)) contact area. The abbreviation for this term is S_e.
High and Low Vents	High and low vents are pipes used in differential venting.
Lateral Extension Distance	The lateral extension distance is the distance filled with system sand extending from the centre of the last lateral row to the side of the treatment system. The abbreviation for this term is S_L.
Low-Pressure Distribution System (LPDS)	A low-pressure distribution system (LPDS) is a way to homogeneously supply a Standard System O)) when a pump chamber is required. A LPDS completely replaces a D-Box as a distribution device. The Inject O)) is a type of LPDS.
Pressurized nested pipe (PNP)	A method for providing uniform distribution on day one, by nesting perforated distribution pipe throughout the entire length of each row of the System O)).
Row Length	The row length is the length of the Advanced Enviro-Septic pipes that are connected together with the couplings, including the S_E.
Bed/row width	The width includes the AES pipes, their S_{CC} and the lateral extension of system sand (S_L)
Sand media	Sand media is imported to the site to raise the system to achieve the required vertical separation (VS). This does not include the system sand which is part of the treatment system.
Shunt pipe	Also known as an air by-pass pipe, a shunt pipe is a pipe installed between the treatment system and the pumping station in order to re-establish the air circuit from the treatment system to the house vent.
System Sand	System sand is sand that has specific criteria and is used to surround the Advanced Enviro-Septic pipe.
Vertical Separation	The vertical separation (VS) means the depth of unsaturated soil including any sand media below the 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 percolation time greater than 50 min/cm.

A.4. Technical support

FRP Mocoat Fiberglass Ltd is DBO Expert's authorized distributor in Western Canada for the System O)) products. FRP provides the following product technical support with trained and qualified personnel:

1. Installer Training Sessions
2. Design and installation advice and guidance
3. Review of site-specific designs, drawings and specifications to support permit application process
4. Provide, as needed, site specific materials & parts listing
5. On site construction review as required by FRP authorized personnel

For site specific conditions not covered in this manual, the Authorized Designer, Planner, and/or Installer shall request additional technical support, special design specifications, and approvals from DBO Expert to satisfy the regulations and the site conditions

Any such DBO published special designs are to be considered as addendums or amendments to this manual and are to be considered as a new part or section of this manual.

B. Presentation of System O))

B.1. Background

System O)) is known as a Combined Treatment and Dispersal System (CTDS). System O)) treats a residential strength 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.

B.2. Components

System O)) is a combination of the AES pipes, specially designed accessories and a specific thickness of System Sand.

Figure 1. Typical System O)) Components

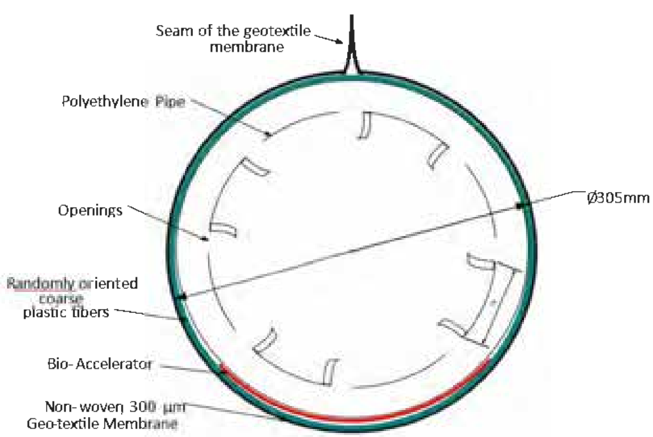


Figure 2. Pipe Cross-Section

Table 1. Components of a Treatment System

Standard 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 System O)) pipe rows by gravity or when using PNP.
Velocity Reducer	Always required when a pump station is used to lift water to a distribution box. Can be done with a minimum 3 m (10 ft) length 100 mm (4 in) 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, a Low-Pressure Distribution System (LPDS) or a Pressurized Nested Pipe (PNP).
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.
System O)) Rows	The System O)) rows are comprised of the 3.05 m (10 ft) lengths of Advanced Enviro-Septic pipes, adaptors and couplings.
Offset Adapter	An offset adapter is an end cap fitted with a 100 mm (4 in) offset opening at the 12 o'clock position.
Couplings	Used to connect two AES pipes together
End Cap	An end cap is a solid cap used to seal the end of an Advanced Enviro-Septic pipe. While they tend to be replaced by Piezovents, they still have specific uses.
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.
Sampling Device	The sampling device is used to retrieve samples of the treated effluent from the System O)). The sampling device is placed at the base of the System O)), below the system sand (at Point of Application). This Sampling Device is mandatory for every Type 2 or 3 system.
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 usually located at the end of the rows of Advanced Enviro-Septic pipe and the high vent (exit) is usually located on the roof of the building. Other configurations may be used when the roof vent is not viable.
Piezovents and piezometers	An end cap that acts as a multipurposed adapter for the piping of the aeration network and the piezometer at the far end of an Advanced Enviro-Septic row. Each row has its own Piezovent and therefore, piezometer. The piezometers are located at the end of each row and are used to monitor the system. They must be accessible at finish grade level.

B.3. Operating Principles

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

1. Warm effluent enters the AES pipe and is cooled to ground temperature.
2. Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.
3. Bio-Accelerator fabric filters additional solids from the effluent and develops a biomat which provided treatment and ensures effluent distribution along the entire length of the pipes.
4. A mat of coarse random fibers separates more suspended solids from the effluent.
5. Effluent passes into the geo-textile fabric and grows a protected bacterial surface.
6. 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.
7. Bacteria grows on the fibrous mat and geo-textile surfaces to create and break down sewage solids.
8. Bacterial efficiency is increased by the large air supply and fluctuating liquid levels which provide for optimum bacterial activity.

B.4. Treatment Chain

There are seven (7) main components in the System O)) chain of treatment. They are:

1. Standard septic tank (2-Compartment tank or Combination of tanks) in accordance with the SPM V3.
2. Effluent filter
3. Pump chamber (optional)
4. Distribution device
5. Advanced Enviro-Septic pipe
6. System sand.
7. Infiltration bed

Both figures below shows the general treatment chain of the System O)):

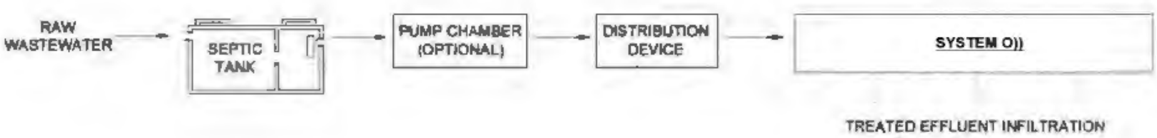


Figure 3. Simplified Treatment Chain

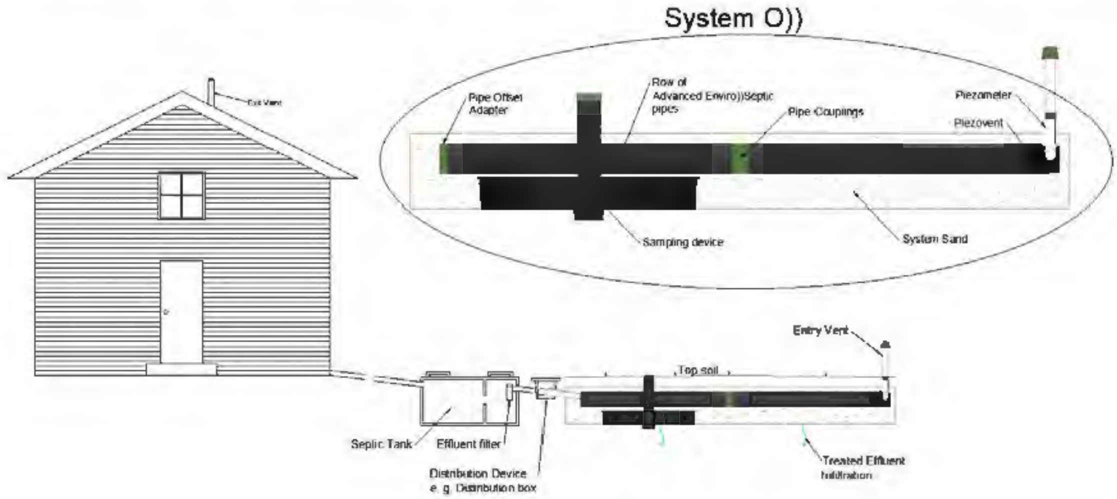


Figure 4. Illustrated Treatment Chain

B.5. Performance and Certifications

System O)) has done various third-party testing and can be adapted in multiple ways to allow for an optimal design. Depending on the desired Treatment Type, the Daily AES capacity, sand thickness and type of distribution can be adjusted.

Table 2. System O)) Performance and Certifications

Treatment Type*	Standard	Test Duration (Months)	Daily AES capacity (DC_{AES})	Sand thickness below AES pipes	Type of Distribution
2, 10/10	CAN/BNQ 3680-600	12	126 L/AES/day (27.7 IG/AES/day)	15 cm (6 in)	PNP
2, 10/10	NSF-40	6	113.6 L/AES/day (25 IG/AES/day)	15 cm (6 in)	Gravity
3	CAN/BNQ 3680-600	6	126 L/AES/day (27.7 IG/AES/day)	60 cm (24 in)	Gravity
3	CAN/BNQ 3680-600	6	126 L/AES/day (27.7 IG/AES/day)	30 cm (12 in)	PNP

*Note: While Type 2, 10/10 options have official BNQ and NSF certificates (see Table 3), Type 3 options are available through 6 Months of testing on the CAN/BNQ 3680-600 bench test.

Table 3. Certification listing

Standard	Model	Link
CAN/BNQ 3680-600	O-AES-BIV-15-SDSFP	en_2978ann230626_an.pdf
NSF-40	AES-CTD	Listing Category Search Page | NSF International

B.6. System O)) Profiles

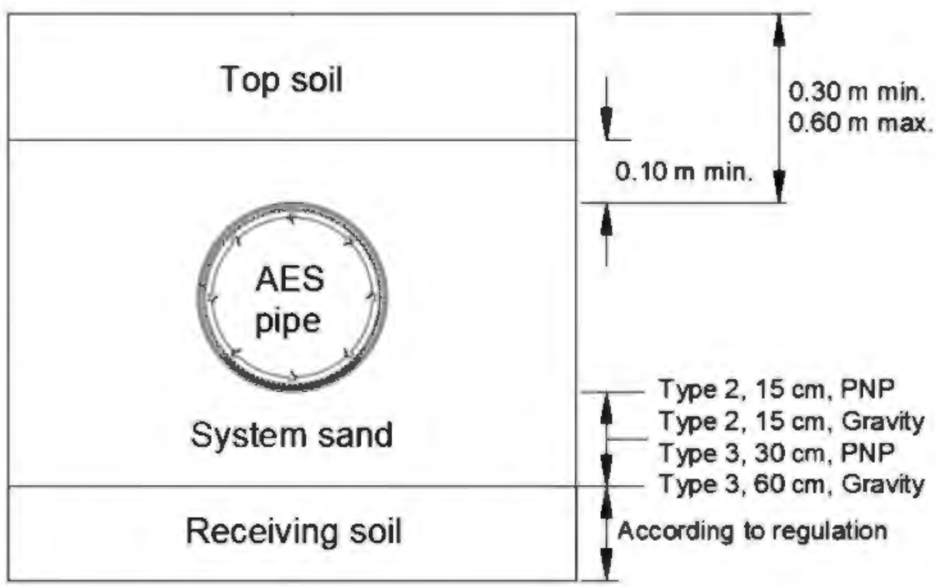


Figure 5. Basic profile of System O))

C. General System O)) concepts

C.1. Designing Steps

In this section, we will go over some general design criteria required to design a System O)). These criteria are required independently of the configuration but may vary depending on the System O)) configuration.

There are five main steps in sizing this system:

- Determine the required septic tank size.
- Determine the number of AES pipes required.
- Determine the thickness of system sand below the AES pipes.
- Determine the appropriate distribution device
- Determine the dimensions of the System O)) such as length, width and the total footprint and specifications of the bed required to properly infiltrate the treated effluent

Depending on the provincial regulations, additional specifications must be followed. Refer to Section D of this manual for British Columbia's specific regulation.

C.2. Sizing Criteria

This Section goes over general design criteria for System O)). Where local regulations provide specifications, refer to Section D instead.

Number of AES Pipes and Thickness of Sand

To determine the minimum number of AES pipes required for a System O)), divide DDF by the daily capacity of the AES pipe (DC_{AES}) as shown in Table 2.

$$N_{AES} = DDF/DC_{AES}$$

The minimum number of Advanced Enviro-Septic pipe obtained can be rounded up to a ¼ of a pipe, but it is often easier to round up to a whole number.

As each section of pipe is 3.05 m (10 ft) in length thus the total linear length of pipe is the number of pipes multiplied by the length.

Metric example:

For example, for a DDF of 1300 L/day and using a BNQ option: N_{AES} = 1300 / 126 = 10.3 AES.

Rounded up to a ¼ of a pipe, it gives a minimum of 10.5 AES required. The minimum length of pipe is: 10.5 pipes x 3.05 m = 32.03 m of pipe

Imperial example:

For example, for a DDF of 286 IG/day and using a BNQ option: N_{AES} = 286/ 27.7 = 10.3 AES.

Rounded up to a ¼ of a pipe, it gives a minimum of 10.5 AES required. The minimum length of pipe is: 10.5 pipes x 10 ft = 105 ft of pipe

It is easier for the installer if systems are designed in 3.05 m (10 ft) increments since Advanced Enviro-Septic pipes are 3.05 m (10 ft) in length. However, the pipe may be cut to the necessary length with a sharp knife.

Pipe spacings

Acronym	Description	Recommended horizontal spacing	
		(m)	(in)
s_{CC}	Centre to centre spacing from one row of pipes to the next.	0.45 - 1.10	18 - 43
s_L	Lateral extension distance from the centre of the last lateral row of pipes to the limit of the System O)).	0.45 - 0.6	18 - 24
s_E	End extension distance from the end of a row of pipes to the limit of System O)).	0.30 - 0.60	12- 24

Figure 6. System O)) spacings

Row length

The total length is calculated with the following formula:

$$\frac{3.05\ m}{AES\ pipe} \times \frac{AES\ pipe}{row} + \ 2(S_E)$$

There is no minimal length of a row of AES pipes, although at least 1 pipe per row is usually recommended. The maximal length is based on local regulations and sometimes varies depending on the type of distribution.

System width

The width of a bed is calculated with the following formula:

$$(\#row - 1)\ \times\ S_{CC} +\ 2(S_L)$$

The minimal width of a bed, using 1 row and the minimal recommended S_L, is therefore 0.9 m (36 in).

The maximal width of a bed is based on local regulations. However, a very wide bed may result in a higher chance of a rising water table without an appropriate Linear Loading Rate (LLR) or careful drainage consideration.

C.3. Sand Criteria

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

- 100 mm (4 in) above the pipes.
- 150 to 600 mm (6 to 24 in) below the pipes depending on Treatment Type.

For the side of the pipes:

- 150 mm (6 in).

The system sand can be natural sand, or filter sand that has been modified, and it must meet on of the two follow options:

System O)) Sand:

- Effective diameter (D_{10}) between 0.2 and 1 mm;
- Coefficient of Uniformity (Cu) ≤ 6;
- Less than 3% of material smaller than 80 µm; and
- Less than 20% of material larger than 2.5 mm.

These criteria can be established by entering the sieve analysis results in DBO Expert's System Sand Evaluation Excel Sheet.

System O)) Sand Acceptance	Value	Unit	Criteria	Acceptance	
D10 evaluated on the graph curve:	0,305	mm	0.20 ≤ D10 ≤ 1	OK	
D60 evaluated on the graph curve:	0,88	mm			
Cu (Uniformity coefficient):	2,89		≤ 6	OK	
Fine particles (< 0.08 mm) evaluated on the graph curve:	1,10	%	≤ 3 %	OK	Acceptable sample?
Large particles (> 2.5 mm) evaluated on the graph curve:	6	%	≤ 20 %	OK	
Sample compliant with the criteria of System O)) system sand?					OK

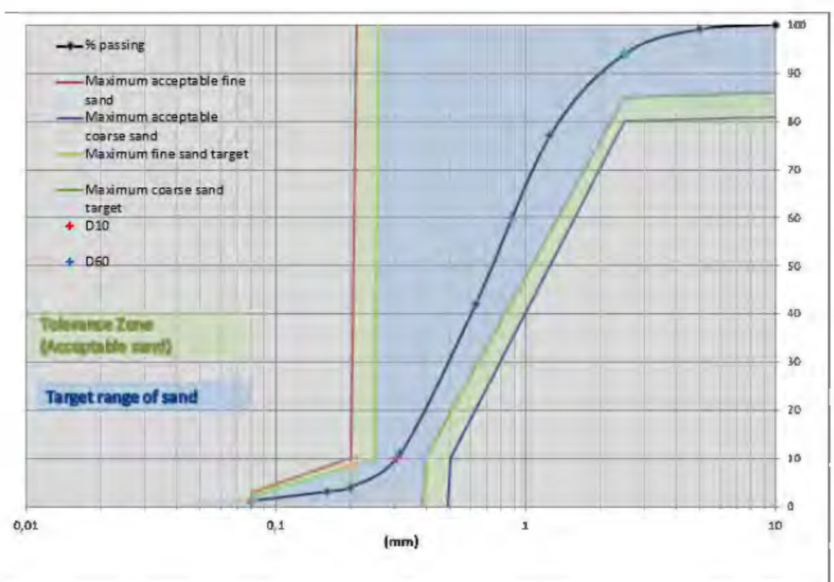


Figure 7. System O)) Sand Evaluation Excel Sheet

Adjusted ASTM C33 Sand:

This sand is identical to ASTM C33 Sand, but a maximum of 3% fine (sieve No. 200 (75 µm)) is accepted rather than 5%. Limiting the amount of fine to 3% is beneficial to the tenacity of a CTD.

Table 4. Adjusted ASTM C33 Sand Requirements for System O))

Sieve Size	Specification Percent Passing
3/8 in. (9.5 mm)	100%
No. 4 (4.75 mm)	95-100%
No. 8 (2.36 mm)	80-100%
No. 16 (1.18 mm)	50-85%
No. 30 (600 µm)	25-60%
No. 50 (300 µm)	5-30%
No. 100 (150 µm)	0-10%
No. 200 (75 µm)	0-3%

C.4. Flow Distribution Possibilities

Gravity

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

This solution allows for a 100% electricity free treatment system when possible.

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 (2 in) 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 or 2 in).

Figure 8. 7-hole D-Box with T in vertical position (left) and with internal insulation (right).

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

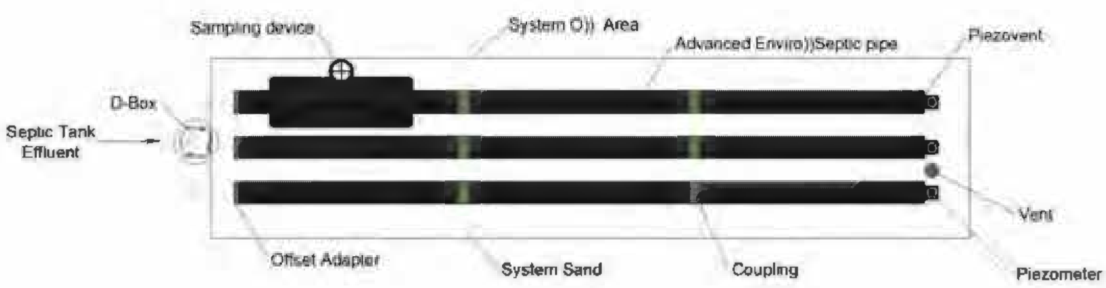


Figure 9. Basic system – Top view

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 Enviro-Septic pipe needs to be 1% and at least 50 mm (2 in).

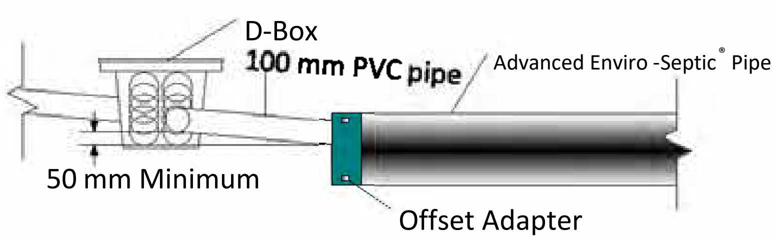


Figure 10. Side view – Basic system

Note: An Equalizer is limited to a maximum of 38 liters (8.4 IG) per minute in gravity systems.

Pressure to Gravity

If the AES pipes are above the septic tank outlet, a pumping station will be required to distribute the septic tank effluent to the rows of System O)). The first option is to pump the effluent directly into a D-box.

The advantage is that no special pumps are require and only basic calculations are required to lift water to the D-box.

Note: For each Equalizer, calculate a maximum of 75 liters (16.5 IG) per minute when water is pumped inside a Distribution box.

Note: The maximum dose per cycle should not exceed 40 L (8.8 IG) per AES pipe.

A Velocity Reduction Device must be used to reduce the velocity of the effluent entering the distribution box. Using a pump chamber also requires a particular attention to the air flow circuit with a requirement for a 100 mm (4 in) shunt pipe or the use of a differential vent directly on the System O)).

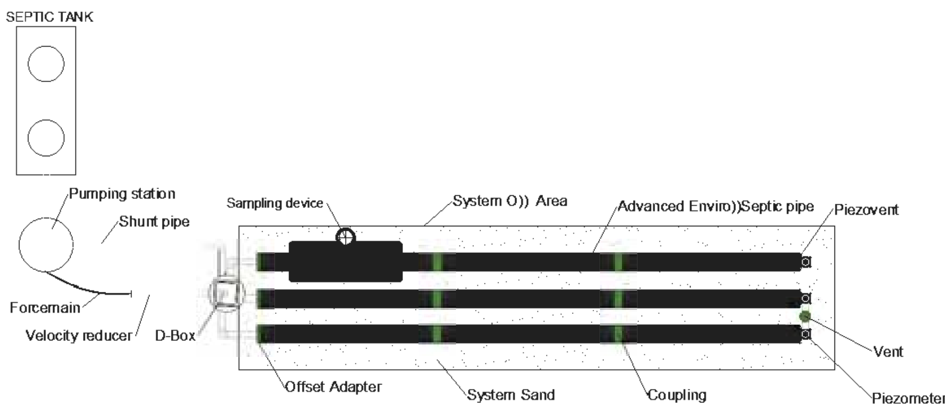


Figure 11. System O)) using a pump chamber

Low-Pressure Distribution

When pumping the effluent from the septic tank to the System O)) is required, a second option is a low-pressure distribution system (LPDS) to directly dose the effluent uniformly between the System O)) rows. The LPDS completely replaces the D-Box.

The advantage of this method is that no adjustment of equalizers are required and that it ensures better distribution between the rows of the System O)).

However, more complicated pump calculations are required, and a stronger pump might also be. DBO Expert is available to help with these calculations.

The Inject O)) is a low-pressure distribution device developed by DBO Expert. It consists of a Piezovent containing a perforated vertical pipe that creates a flow restriction, allowing for a pressure build up. The Inject O)) replaces the Offset Adapter and each row is connected to one another by the 50 mm (2 in) PVC distribution pipe, plus a 100 mm (4 in) PVC venting pipe. During a pumping cycle, once pressure has built up throughout each

Inject O)), the water shoots from the Inject O)) opening, hits the access cap and then flows into the Advanced Enviro-Septic pipes.

Figure 12 shows the Inject O)) and Figure 13 shows a top view of how the Inject O)) is used on a System O)).

Note: The maximum dose per cycle should not exceed 40 L (8.8 IG) per AES pipe.

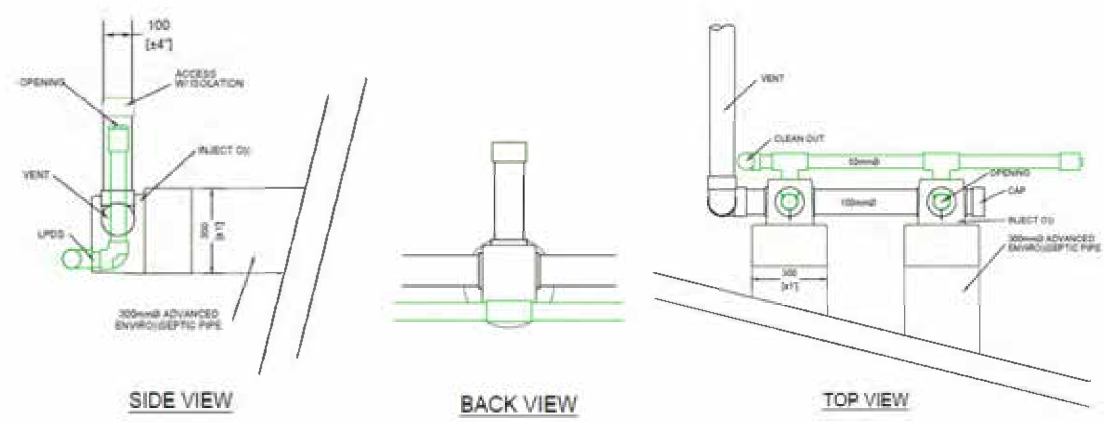


Figure 12. Inject O))

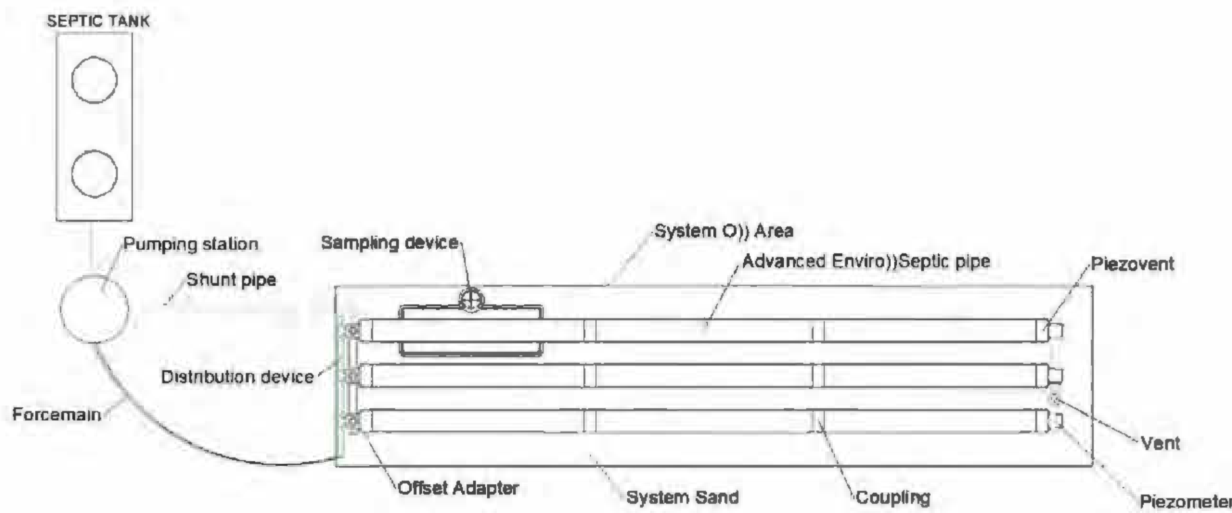


Figure 13. LPDS with a System O))

Pressurized Nested Pipe

A Pressurized Nested Pipe (PNP) consists of smaller PVC pipes inserted into each AES pipe row extending down their entire length. Orifices of specific sizes are pierced through the entire length of the PVC pipes.

Since the passage of water is restricted by the small diameter of the orifices, pressure is established in the supply pipe network. This pressure quickly equalizes causing the orifices, which are all the same diameter, to supply a uniform volume of water. This method is the most efficient to ensure a uniform distribution through the entire system on day one.

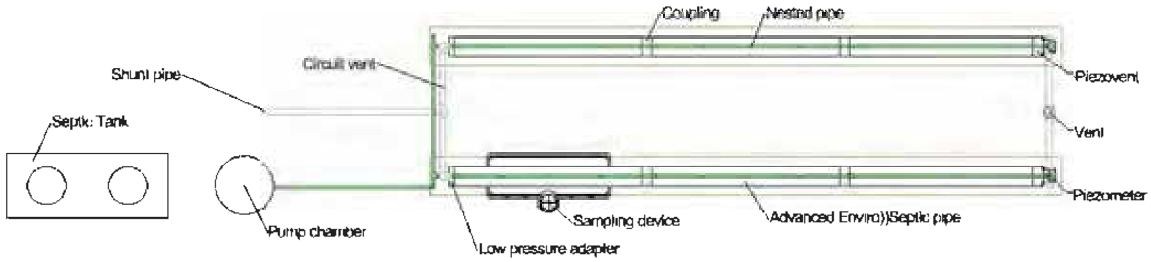


Figure 14. Top view - Flow distribution with a pressurized nested pipe

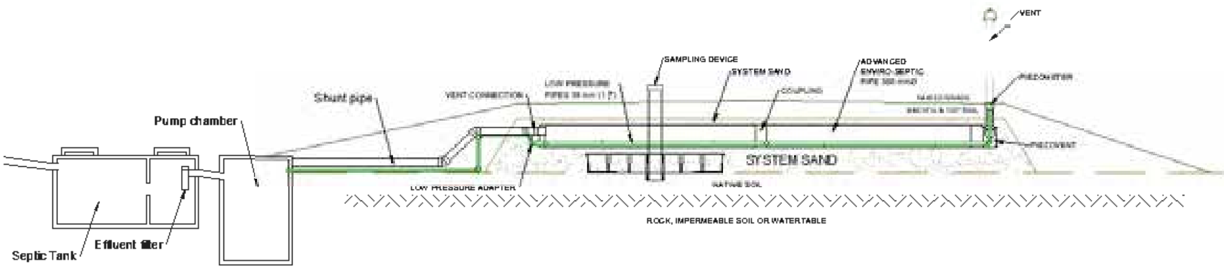


Figure 15. Side view – Flow distribution with a pressurized nested pipe

C.5. 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 the System O)).

The aeration circuit must be continuous between the entry and exit vent. The vent installed at the end of the rows of pipes (Piezovent side) acts as the entry point. The Piezovents allow to easily connect each row with an aeration pipe (vent manifold), as shown in the following figure.

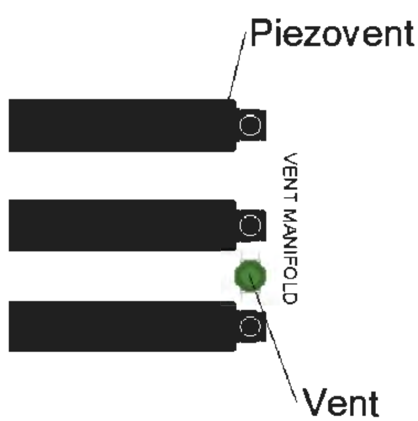


Figure 16. Venting connection

Design Standards

The entry vent (located at the end / piezometer side of the System O))) must meet the following standards:

- Must be a minimum of 100 mm (4 in) but high enough to rise above snow during winter - around 1.2 m (4 ft);
- Can be hidden among trees, located at fence post, etc.;

The entry vent must be at least 3 m (10 ft) lower than the exit vent.

All pipe used for venting should have a diameter of around 100 mm (4 in). While PVC is the most popular material, flexible pipes are also allowed. It is essential to ensure that there is no pipe sagging, which could allow water to build up and cause disruption of the air flow circuit.

For larger systems, ensure that there's a minimum of one entry vent per 300 linear meter (1000 ft) of AES pipe.

Vent Locations

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

Entry vent (Low) located downstream from the system, through the Piezovent installed at the end of each row.

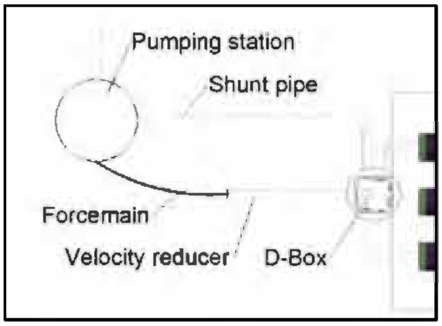
- The vent pipe is to be connected to the air manifold between two pipe rows or at the side of the last row.
- If the vent is located away from the System O)), use an open T-shaped fitting at the base of the aeration pipe to prevent condensation build up.

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

First choice is to use the building vent. If the use of the building vent is impossible, install an additional differential vent (see below Figure 18 as an example of a differential vent with a gravity-fed system)

On systems that use a pump chamber (pumping in D-Box, LPDS or PNP), special considerations need to be taken to ensure that the air flows efficiently through the system since the pump chamber interrupts the air flow between the System O)) and the septic tank. This leaves the designer with 2 options:

- Install a shunt pipe (also known as an air by-pass pipe) between the treatment system and the pumping station to re-establish the air circuit, as seen in Figure 17;
- Install an additional differential vent pipe, as seen in Figure 18.



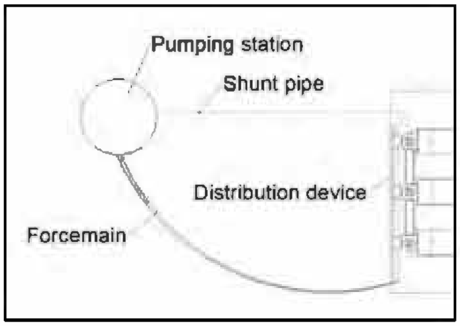


Figure 17. A. Pumping in D-Box / B. LPDS

Note: 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 a high vent in addition to the regular low vents in a system. High vents are connected close-to or to the distribution box (for gravity-fed systems) or in-between rows or at the extremity for LPDS and PNP systems. This arrangement enhances the circulation of air throughout the entire system. The high vent should be brought next to a gate, a building, or a tree as a good esthetical practice.

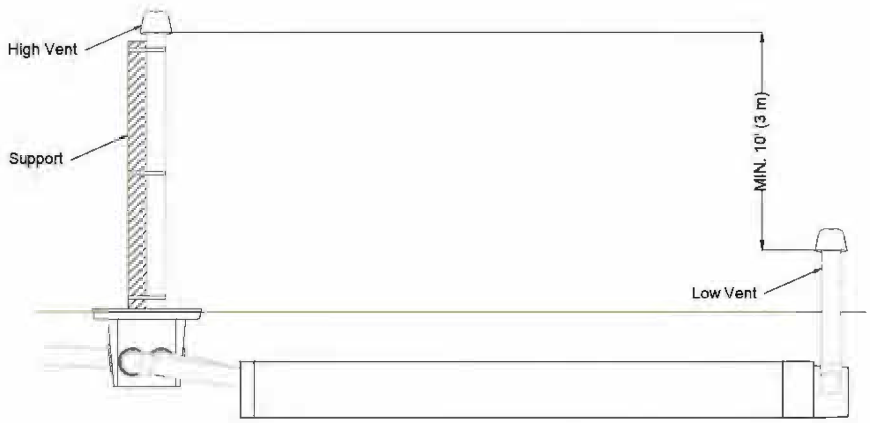


Figure 18. Example of Differential Venting for Gravity

C.6. Complementary Components

Sampling Device

The System O)) requires the installation of an effluent sampling device. The following paragraphs describe the sampling device to be used.

The sampling device includes two major components:

- Collector
- Sample port

The collector consists of a thermoformed trough in which a collector pipe is installed. The pipe is then covered with a layer of system sand.

The collector is installed at the bottom of the system sand directly below a length of AES pipe. The collected treated effluent is routed towards the sample port. The sample port is used to take the treated effluent samples for analysis. See below for a picture of the sampling device.

Figure 19. Sampling device

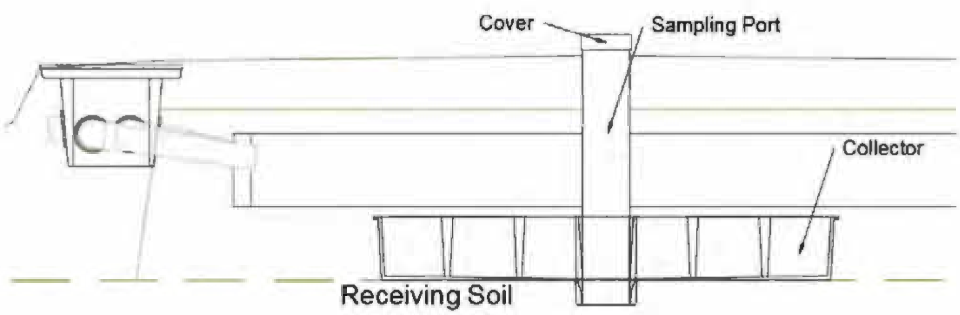


Figure 20. Position of the collector

The sample port should be located under an outside row as a standard practice. It should be centered below the first pipe of the row, meaning that the perimeter of the collector should be approximatively 570 mm (1.5-2 ft) from the Offset Adapter.

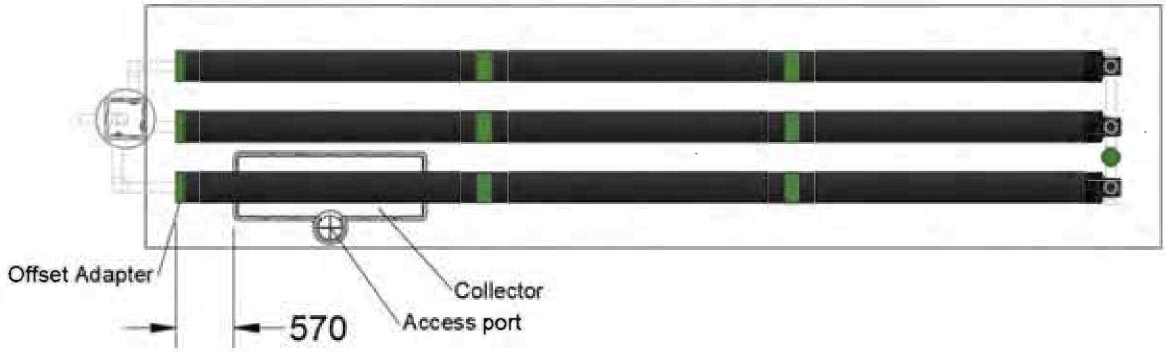


Figure 21. Localisation of the sample port

Piezometers

The piezometer allows the measuring of the water level in the pipes and is required at the end of each row. Figure 1 shows a piezometer installed at the end of a row of AES pipe.

The piezometer is to be capped at finish grade level. The watertight cap at the end of the piezometer needs to always be on, except during follow-up or maintenance of the system.

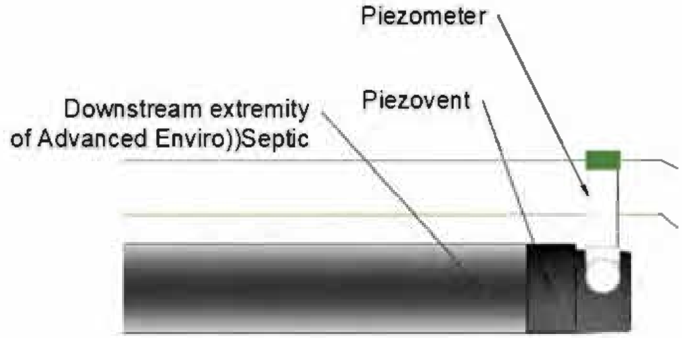


Figure 22. Piezometer design

C.7. Special Shapes

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

Curved Bed

Curved shapes work well around objects, setbacks, and slopes.

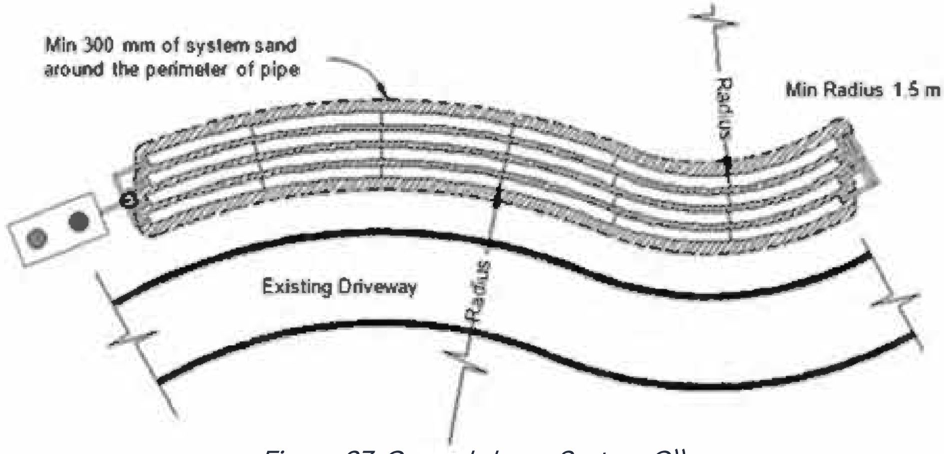


Figure 23. Curved shape System O))

Angled Shapes

Angular shapes can include one or more angles. Rows are angled by bending pipes. The shortest acceptable curve radius for System O)) is obtained by bending a 3.05 m (10 ft) pipe length at a right angle.

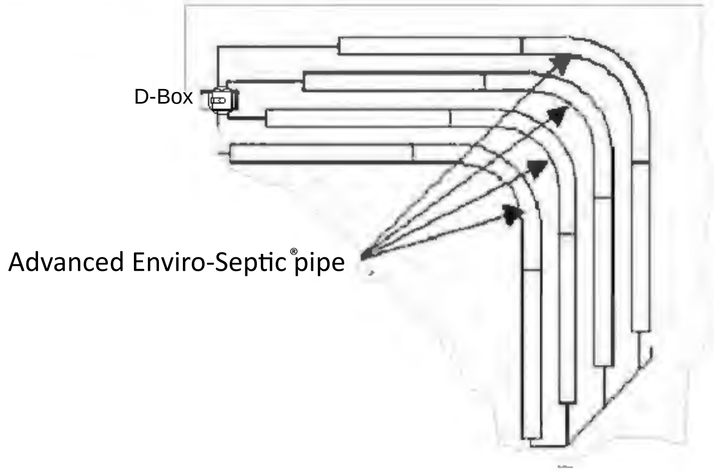


Figure 24. Angled shape System O))

Trapezoid Shape

The following system uses a trapezoid Shape to get around an obstacle or to adapt to a slope.

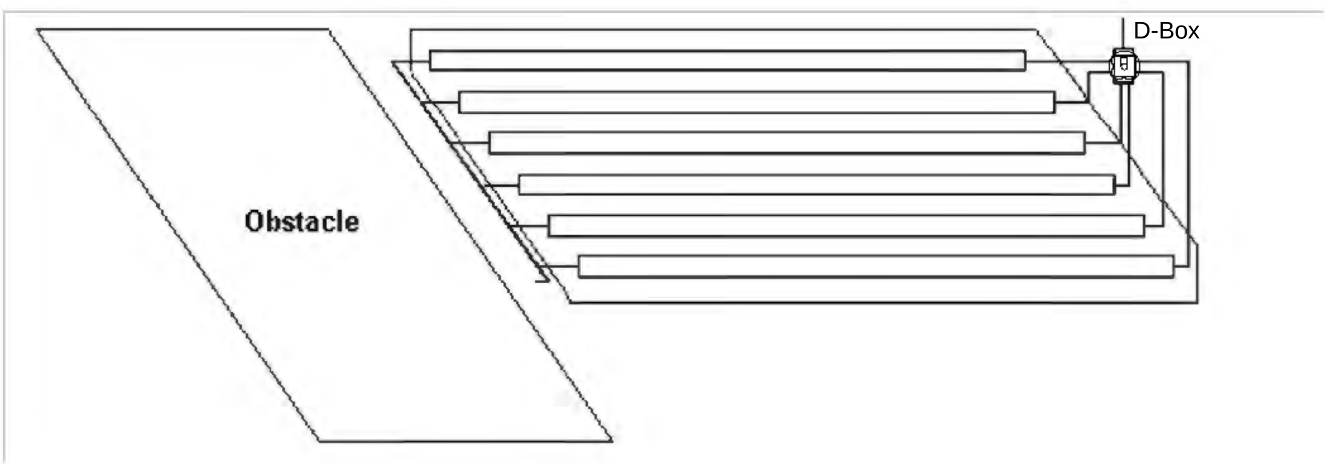


Figure 25. Trapezoid shape System O))

C.8. Commercial systems

The same design rules can be applied to commercial systems.

For commercial usage with high strength wastewater, please, contact your distributor as multiple options are available, such as adjusting loading rates to accommodate the additional organic loads and BOD_5 concentrations or adding pre-treatment components.

D. British Columbia Design Specificities

This section contains guidance towards the appropriate section of the SPM V3, additional information that applies to System O)) and ways different parameters impact others.

As multiple parameters are intertwined, this section has no specific order and may contain repetition throughout its subsections.

D.1. Type of treatment

System O)) provides certified Type 2, 10/10 treatment, as well as third-party 6 Month report for Type 3 treatment.

The type of treatment required depends on a variety of factors, such as available area, vertical separation and soil type.

For example, choosing a Type 3 treatment has multiple advantages over a Type 2 as it allows for a reduced vertical separation and a significantly higher Hydraulic Loading Rate (HLR). However, a Type 3 System O)) requires four times the thickness of system sand below the AES pipes if using gravity distribution, or two times if using PNP distribution.

Refer to Section III-4 for guidelines to selecting a system for a site, including the type of treatment.

Refer to Section III-4.2 for details about the effluent quality associated with each type of treatment.

D.2. Daily Design Flow

Refer to Section II-5.1, p. II-20.

D.3. Septic tank

Refer to Section II-6.4, p. II-44.

D.4. Vertical Separation

Refer to Section II-5.3.

Vertical Separation (VS) is the height of unsaturated aerated soil from the infiltration surface to the limiting layer at the dispersal area. For a System O)), the infiltration surface, also called Point of Application, is at the bottom of the required depth of System Sand to achieve the desired treatment (refer to Table 2 of this manual for Type of Treatment based on System Sand thickness and distribution method). For example, for a Type 2 Pressurized Nested Pipe, the Point of Application is after the 15 cm of System Sand below the AES pipes.

Depending on the design, a System O)) can be completely buried, shallow, at grade or raised.

D.5. Type of distribution

Refer to Section II-5.2, p. II-22.

The type of distribution used has a significant impact on two parameters

- The HLR to use for the Sand Layer, if used (Table II-24)
- The minimal Vertical Separation (Section II-5.3, p. II-25)

Uniform overtime

Uniform overtime distribution, in the context of a System O)), refers to any discussed distribution method that delivers water solely at the beginning of a row. While these methods may not provide uniform distribution on day one, a 2004 testing conducted on a 18.3 m long row demonstrates that once the biomat is established, the distribution is uniform with less than 20% variation over the entire length.

The following methods are attributed to a uniform overtime distribution:

- Gravity
- Pump to gravity
- Low-pressure distribution system (LPDS)

D.6. Gravity

While it is the simplest method, the SPM V3 limits its usage:

- Table II-14 requires from 90 to 150 cm (3 to 5 ft) of minimum vertical separation in native soil depending on the type of soil and treatment, with the possibility of having up to 10 cm (4 in) of Mound Sand or Clean Coarse Sand fill as a blinding layer being part of the vertical separation.
- A maximum length of 18.3 m (60 ft) per row if allowed.

Note that a butterfly configuration can be considered to counter the 18.3 m (60 ft) limit per row, as shown below:

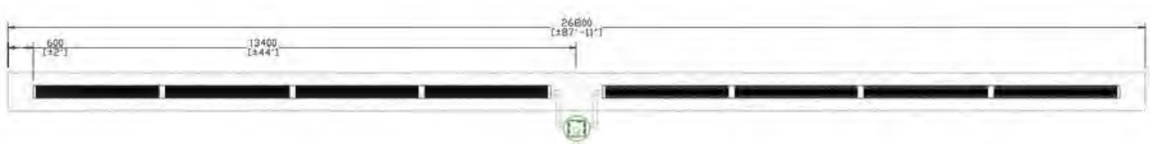


Figure 26. Example of a butterfly configuration with System O))

D.7. Pressure to Gravity and Low-Pressure Distribution

These methods are the same as the regular gravity in terms of regulation. Therefore, refer to the section above.

Uniform

Using a uniform distribution directly unlocks new possibilities for restrictive vertical separation in native soil (Tables II-15, II-16 and II-17).

As a reminder, Gravity, Pump to gravity and Low-pressure distribution system (LPDS) may not be considered as uniform distribution methods.

D.8. Pressurized Nested Pipe (PNP)

To be considered a uniform distribution, the PNP system should comply with Table II-43. Here are some important specifications:

1. Minimum of 60 cm (2 ft) of residual pressure for 4.8 mm (3/16 in) or larger orifices;
2. Minimum of 150 cm (5 ft) of residual pressure for orifices smaller than 4.8 mm (3/16 in);
3. Maximum of 0.56 m^2 (6 ft^2) of infiltration surface per orifice.
4. Minimum orifice diameter of 3.2 mm (1/8 in)
5. Orifice shield for downward-facing orifices
    - As the AES pipes also act as an infiltration chamber, upward-facing orifices don't require orifice shields.

Note that because of the maximum of 0.56 m^2 (6 ft^2) of infiltration surface per orifice:

- As a rule of thumb, the number of orifices per row is:

  $$Number\ of\ orifice\ per\ row = (Number\ of\ pipes\ per\ row\ \times\ 4) + 1$$

  As the number of pipes per row gets bigger, the S_E spacing will need to be reduced for the first and last orifice to properly cover 0.56 m^2 (6 ft^2). For example, at 6 pipes per row, the maximum S_E for 25 orifices to cover the entire surface of the row is 225 mm (9 in).

  The figure below shows examples of orifices with a coverage of 0.56 m^2 (6 ft^2), illustrated as 0.75 m x 0.75 m (2.5 x 2.5 ft) squares.

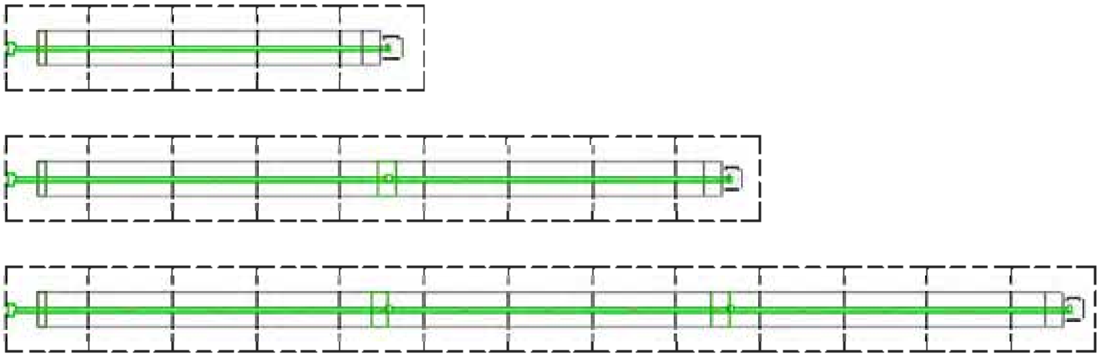


Figure 27. Orifice coverage (1 square = 0.56 m^2)

- A uniform distribution limits the maximum centre-to-centre spacing (S_{CC}). As illustrated in the figure below, when using uniform distribution, the maximum S_{CC} and S_L, respectively, should be 750 mm (2.5 ft) and 375 mm (15 in). Otherwise, the 0.56 m^2 (6 ft^2) per orifice criteria is not met.

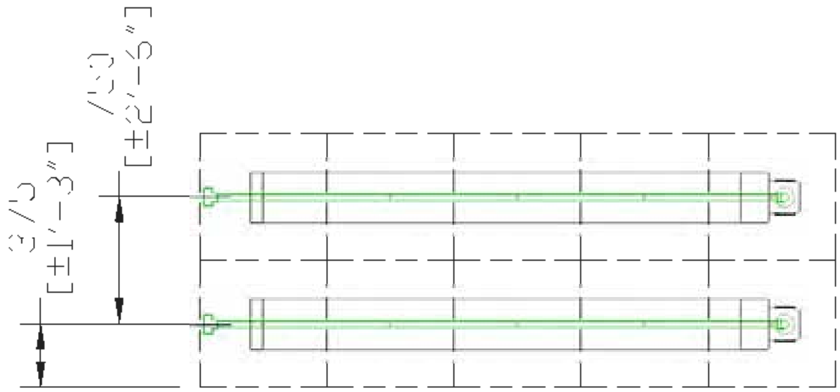


Figure 28. Maximum spacing for uniform dosing

D.9. Type of dosing

The type of dosing influences multiple parameters, such as vertical separation, doses per day, and the type of HLR to use in presence of a sand layer. The SPM V3 mentions three types of dosing:

- Demand Dosing
- Timed dosing
- Micro-dosing

As a reminder, and according to Section II-5.2.1, these types of dosing are only applicable to uniform distribution, meaning the PNP systems complying with Table II-43. Pumping to a d-box or using a low-pressure distribution device (LPDS) may not be considered as uniformed distribution methods.

Micro-dosing

Micro-dosing can be useful as it provides a lot of advantages compared to the other types of dosing. For example, it allows for the lowest possible vertical separation of 55 cm as seen in Table II-16, and in some cases might help with reducing the total footprint by allowing the use of Type 2 or Type 3 HLR for the sand media (Table II-24). It also allows for the use of Sand filter coarse sand as sand media.

D.10. Area of Infiltrative Surface (AIS) and Basal Area

Refer to Table II-22 and II-23 (page II-36) for the maximum allowable HLR based on the soil type or percolation rate.

Seepage Bed

If the System O)) has a non-uniform distribution or less than 30 cm (12 in) of sand media below the point of application, the basal area is determined as for a seepage bed, meaning the effective basal area only includes the area directly under the dispersal bed, and no lateral spreading is allowed.

In this situation, the AIS must be obtained by homogenously spacing the AES pipes over the surface. The AIS is determined by using the lowest HLR between the native soil and the sand media (if used).

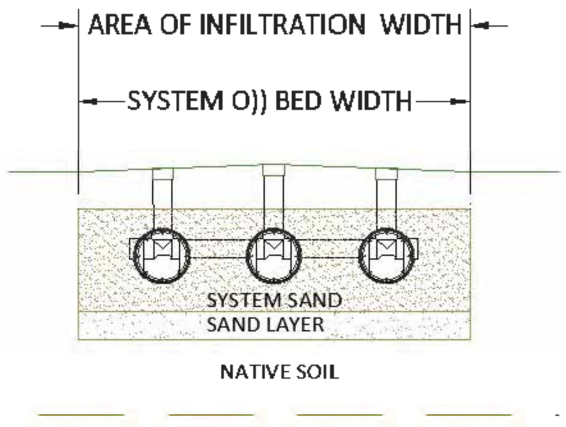


Figure 29. System O)) as Seepage Bed

Sand Mound

If the System O)) has a uniform distribution and 30 cm (12 in) or more of sand media is used below the point of application of the System O)), the basal area is determined as for Sand mounds, meaning II-6.15.2.1 applies. This allows for the inclusion of more area than the one directly below the dispersal bed. This includes a combination of, depending on the slope: the area directly downslope from the dispersal bed, the area where the depth of sand media exceeds 15 cm, or the area within a 3h:1v slope of the dispersal bed.

To determine the AIS, two specific HLR must be used: one for the sand media, one for the native soil. The system is therefore divided into two portions: the System O)) acting as the dispersal bed over a sand media, and the native soil. This may result in a small System O)) over a bigger basal area, as shown in Figure 30. However, if the sand media HLR is smaller than the native soil's, the sand media HLR must be used as the most constraining, as in a raised seepage bed.

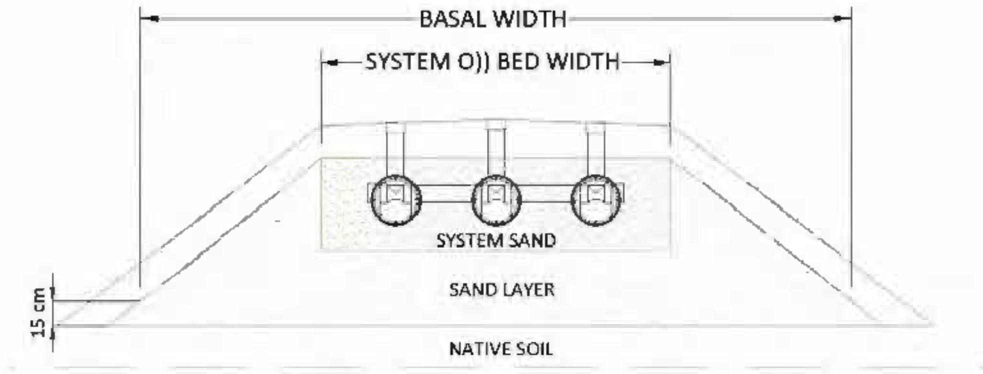


Figure 30. System O)) as Sand Mound

When the dosing method complies with micro-dosing criteria, a Type 2 or 3 sand media HLR can be used. If micro-dosing is not obtained, two options are possible for the design of the dispersal bed and basal area:

1. As a seepage bed, select the lowest HLR (sand media or native)
2. Select Type 1 HLR for Sand media and the appropriate HLR for the native soil.
    a. This method still allows for the advantages of II-6.15.2.1 for the basal area.

Sand Media

For the sand media HLR, refer to Table II-24 (page II-37).

Note that when using sand media, micro-dosing often results in a smaller area, as otherwise, a Type 1 HLR for the sand media is required instead of a Type 2. This is however only significant if the Type 1 sand media HLR is smaller than the Type 2 native soil HLR.

For example, if using Mound Sand over a native soil with a KFS of 600 mm/day (24 in/day), the Type 1 sand media HLR would be 40 L/m^2/day (0.81 IG/ft^2/day) while the Type 2 basal HLR would be 50 L/m^2/day (1.02 IG/ft^2/day). This means that not using micro-dosing results in a dispersal bed bigger than what the basal area would've required. By using micro-dosing with this same scenario, the sand media HLR becomes 65 L/m^2/day (1.32 IG/ft^2/day) and therefore results in a dispersal bed that will not make the system bigger than required by the native soil.

D.11. Bed dimensions

Width

Refer to Table II-37, II-38 and II-51.

When System O)) is designed as Seepage Beds or Sand Mounds, the maximum width allowed by the SPM V3 is 3 m (10 ft).

While the recommended minimum S_L for beds is 0.45 m (1.5 ft), a trench width of 0.6 m (2 ft) is acceptable. This complies with Table II-37 for slopes greater than 15%.

Length

Refer to Section II-5.6 (page II-38).

The total length of the system depends on the amount of AES pipe, the chosen configuration, and the contour length requirement based on the Linear Loading Rate (LLR).

D.12. Linear Loading Rate

Refer to Table II-26, 27 and 28 for the Linear Loading Rate (LLR) to use based on the type of distribution, soil and the slope.

The LLR is a parameter that aims at optimizing the evacuation of the infiltrated effluent. Without proper evacuation, a rising water table could occur and reduce the depth of unsaturated aerated soil under the bed.

The minimum system contour length is determined by dividing the DDF by the LLR.

When the required contour length is longer than the number of AES pipes required for the treatment, five options are possible:

1. Review the configuration to prioritize longer rows of pipes rather than multiple ones;
2. Add more AES pipes to reach the required length;
3. Add spacings between some of – or all – the AES pipes (see Figure 31);
4. Refer to III-5.6.7 (page III-82) for different approaches when length is constrained;
5. A combination of multiple options above.

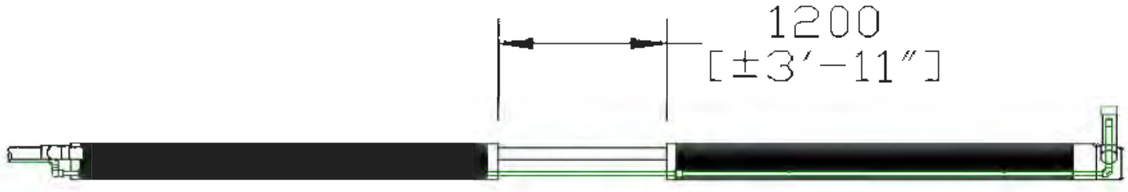


Figure 31. Pipe separation for longer length

Note: When using PNP distribution, the theorical maximum separation is 1500 mm (5 ft) because of the 0.56 m^2 (750 x 750 mm) / 6 ft^2 (2.5 x 2.5 ft) per orifice criteria. However, a more realistic maximum separation, and depending on the actual position of the orifices, would be 1200 mm (4 ft).

D.13. Sloped systems

Follow specifications applicable to trenches (Section II-6.6)), seepage beds (Section II-6.7 and 6.8) or sand mounds (Section II-6.15); whichever is applicable to the design.

For slopes greater than 15%, limit the system to the narrowest width possible: one row per trench. While the recommended minimum S_L for beds is 0.45 m (1.5 ft), a trench width of 0.6 m (2 ft) is acceptable to comply with Table II-37 for slopes greater than 15%.

D.14. Raised systems

System O)) may be installed at shallow depth, at grade or above grade, as specified in Section II-6.8. However, SPM V3 requires uniform distribution for an infiltrative surface above grade. If more than 30 cm (12 in) of sand media is added below the Point of Application, than follow Section 6-15 for Sand mounds.

D.15. Infiltration chambers

Where permitted in the SPM V3, AES pipes can also be used as infiltration chambers.

D.16. Horizontal Separation

Refer to Section II-5.4

E. Installation

E.1. Overview and Preparation

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 septic tank / pump station may be installed after the System O)).

Steps to Follow

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

- Excavate the area and scarify the surface of the receiving soil.
- If required, install sand media.
- Install the sampling device.
- Install the system sand on the System O)) 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.
- Install the Distribution device (D-Box, LPDS/Inject O)) or Nested pipes)
- Cover the Advanced Enviro-Septic pipes with system Sand exposing the ends.
- Install the feed, and ventilation piping.
- Cover the system sand with clean top soil (no silt or impermeable soil) permeable to air.

The installation of the septic tank should be done following the manufacturer's recommendations and local regulation. Installation of a pump station should be done according to the supplier's manual.

List of Typical Materials

System O))

- Advanced Enviro-Septic pipes
- Couplings
- Offset adapters
- Piezovents (Double adapters)
- Distribution system (i.e.; D-box with equalizers, LPDS, PNP)
- Piezometer End Caps
- Sampling device
- PVC pipes, 100 mm (4 in)
- PVC 90° elbows, 100 mm (4 in)
- PVC Tees, 100 mm (4 in)
- System sand that meets specifications
- Air permeable top soil with no silt or clay for final fill
- Pump station, manifold, and other accessories (optional)

Planning the Installation

Find the optimal order of steps for the installation:

- According to site constraints.
- Considering the movement of machinery.

Calculating the different elevations:

- 1% slope between:
  - the exit from the septic tank and the distribution box (gravity feed) or pump chamber
  - the distribution box and the entry to the furthest pipe
- 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)

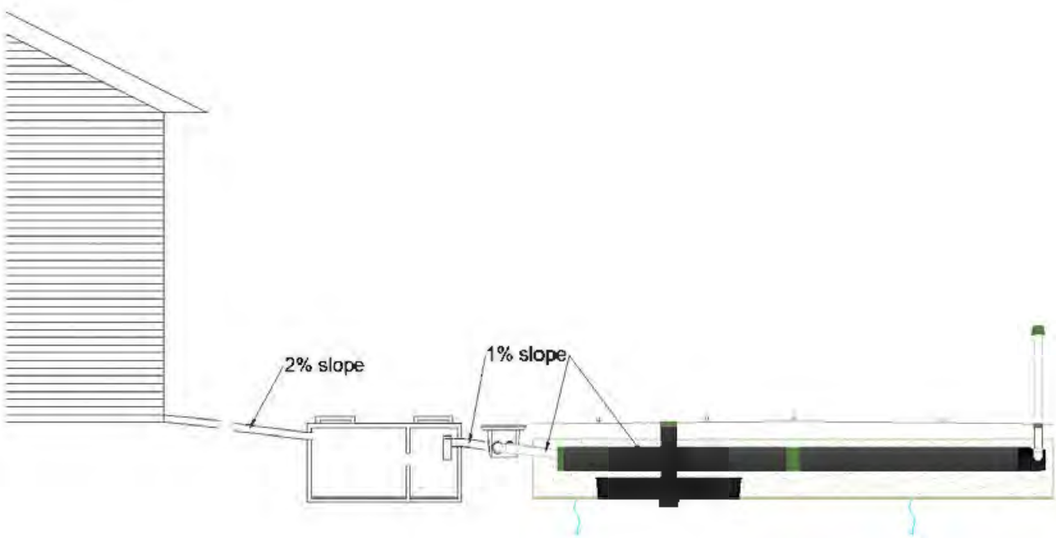


Figure 32. Elevations required between elements

Preparation of the Installation Site

- Outline the surface to be excavated.
- Excavate the layer of soil required according to whether the installation will be raised, at grade, shallow or in-ground.
- Scarify the surface of the receiving soil where the system sand (or sand media 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 sand media (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 ground that is saturated with water or in the presence of frost.

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.

E.2. Sampling Device Installation

The sampling device is to be installed on the surface of the scarified receiving soil. Its installation is done in four steps:

- Install the collector tray
- Install the sample port
- Add system sand as required
- Cut the sample port to grade (after the final backfilling of the system

The following paragraphs detail the steps for the installation of the sampling device.

Step 1 – Installing the tray

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

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

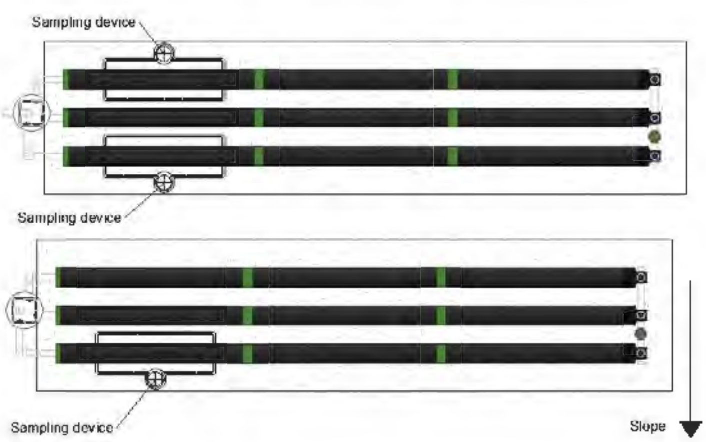


Figure 33. Sampling device localisation

Figure 34. tray installation

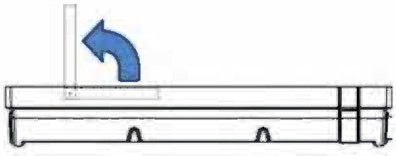
Step 2 – Installing the Well

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

Figure 35. Sampling well installation

Step 3 – Filling the tray

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



- Complete the installation of the sampling device as shown below.

Figure 36. Final installation of the sampling device

E.3. 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 sand media if required.
- Add the appropriate layer of system sand.
- Level lengthwise the surface of sand which will receive the Advanced Enviro-Septic pipes.

Installing the Advanced Enviro-Septic Pipes

- Be sure that the surface of system sand over the System O)) 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 centre to centre spacing (S_{CC}), lateral extension distance (S_L) and end extension distance (S_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.

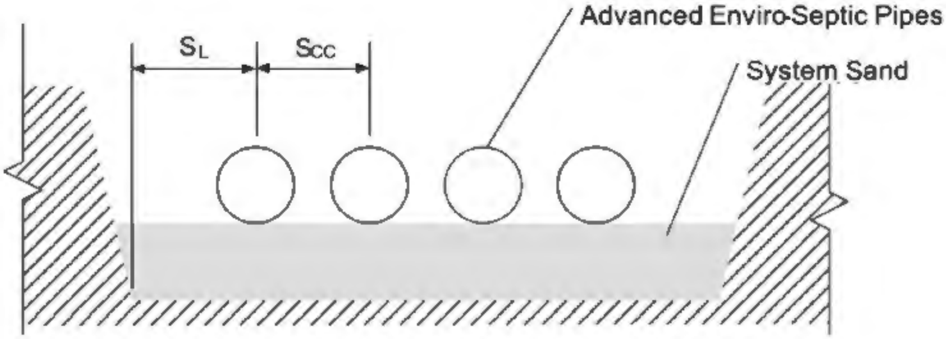


Figure 37. Installation of the AES pipes

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 38. Installation of the couplings

- 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 39. Replacing the geotextile over the couplings

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 40. Covering the AES 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 41. 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 (4 in) on top of the pipes.

E.4. Adapters

To put adapters in place, the installer must pull back both geotextiles (the black membrane and the bio-accelerator) at the end of the pipe, insert the adapters, and place back both geotextiles over the adapters.

A Piezovent is installed at the end of each row. The bell end will easily slide over the Advanced Enviro-Septic pipe. The Piezovent includes three 100 mm (4 in) holes allowing for the insertion of a piezometer (top hole) and the connection to the other rows (side holes). A 2-Hole Adapter may also still be used. In this case, the venting circuit is connected to the top hole, while the piezometer in connected to the bottom one.

Figure 42. Piezovent (left) and 2-Hole Adapter (right)

For the adapter at the beginning of each row, refer to the appropriate subsection below.

Gravity-fed

Offset Adapters are used to connect the PVC pipe coming from the D-box to the Advanced Enviro-Septic pipes for both air and wastewater. An Offset Adapter must be installed at the beginning of each row.

- Make sure to push the adapter in place so that the locking tabs located on the inside of the adapter locks into the corrugations of the Enviro-Septic pipe.
- The opening must be placed at the top position to facilitate the passage of air at all times.

Figure 43. Installation of the Single Offset Adapter

Low-pressure Standard

The Inject O)) is a low-pressure distribution system built inside a Piezovent. It is installed the same way as a Piezovent. See Section 0 for more details.

Pressurized nested pipe (PNP)

A PNP requires adapters similar to a gravity-fed systems but containing an additional smaller opening at its lower point. It is installed the same way as a one-hole adapter.

The distribution device must be installed simultaneously to the adapters for Pressurized nested pipe.

E.5. Plumbing components

Piezometers

The piezometer is made of PVC pipe 100 mm (4 in) in diameter. It needs to be as long as needed in order to be above the final fill or embankment (usually around 35 cm or 14 inches). It is inserted directly in the upper opening of the Piezovent.

Vent

Each Piezovent need to be connected one to another by their side-holes with 100 mm (4 in) PVC pipes.

There are two options to install the entry vent:

- Option 1: between two rows
- Option 2: at either extremity of an extremity row

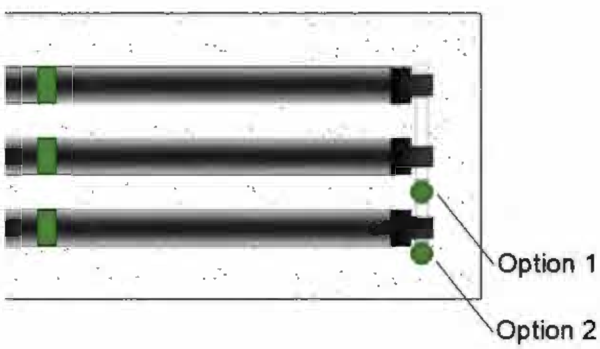


Figure 44. Options to install the entry vent

Figure 45 shows an example with 4 Piezovents connected, each with a piezometer, and a part of the vent at the left side extremity (Option 2).

Figure 45. Entry vent on an extremity row

Make sure that there is a continuous air circulation between the entry vent located downstream of the System O)) and the exit vent of the residence's plumbing located on the roof. If not possible, a differential vent should be installed at the other end of the System O)).

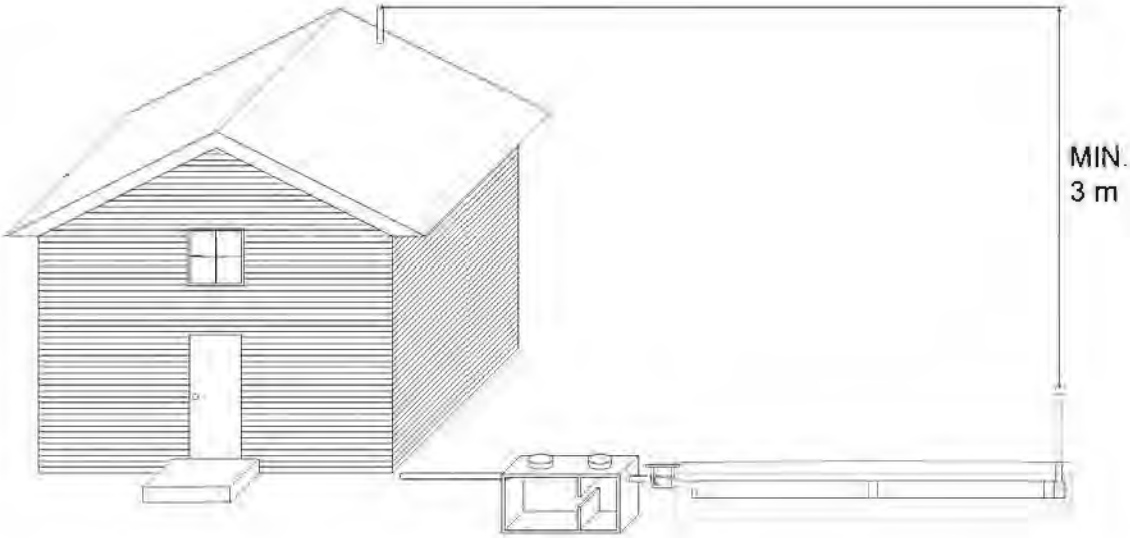


Figure 46. Minimum height difference between the two vents

There must always be a height difference of 3 m (10 ft) between the two vents.

Pump chamber Systems:

When using a pump chamber, the natural air circuit going from the System O)) to the septic tank to the house vent is disrupted. To ensure a functioning air circuit, all pumped System O)) must use a derivation air pipe or have a differential vent as an exit vent.

- Derivation air pipe: install a bypass pipe connecting the pump station to the System O)) header manifold using a 100 mm (4 in) 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.
- Differential vent: install a second vent located on the distribution box or on supply-side vent circuit. The 3 m (10 ft) difference between the entry and exit vents is still required.

E.6. Final Backfill and Grading

Cover the Advanced Enviro-Septic pipes with a minimum of 300 mm (12 in) but a maximum of 600 mm (24 in) of backfill permeable to air with no silt or impermeable soil. Of this 300 mm (12 in), the first 100 mm (4 in) on top of the pipes must be system sand.

The top soil is to be permeable top soil according to the SPM V3

When part of the system is raised, 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.

E.7. Distribution Device Installation

D-Box Installation

The majority of Standard 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 a riser 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 (4 in) PVC pipes into the distribution box :
  - Insert the pipe approximately 25 mm (1 in) 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 centre position.

Installation and Balancing of Distribution Box Equalizers™

Equalizers™ are inserted into each of the 100 mm (4 in) PVC pipes exiting the D-Box. They are used to improve the D-Box performance by equalizing the flow to each of the Enviro-Septic Pipes.

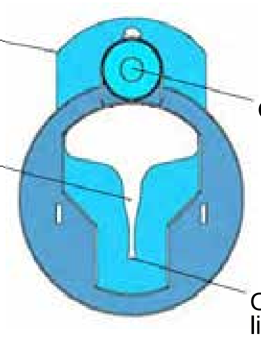


Figure 47. Equalizer

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 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 (4 in) PVC water tight pipes. Place the bell opening of the pipes in the direction of the slope.

Insert the 100 mm (4 in) PVC pipes into the Advanced Enviro-Septic pipes. Use a minimum of 200 mm (8 in) of pipe between the extremity of the Advanced Enviro-Septic pipe and the elbow or T of the header manifold.

Figure 48. Inlet Pipe sloped toward Advanced Enviro-Septic

- 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.
- Where frost is a concern, add insulation around the D-Box and over the feeding pipes as shown on the following figure.

Figure 49. Insulation around a distribution box

Pumping 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.

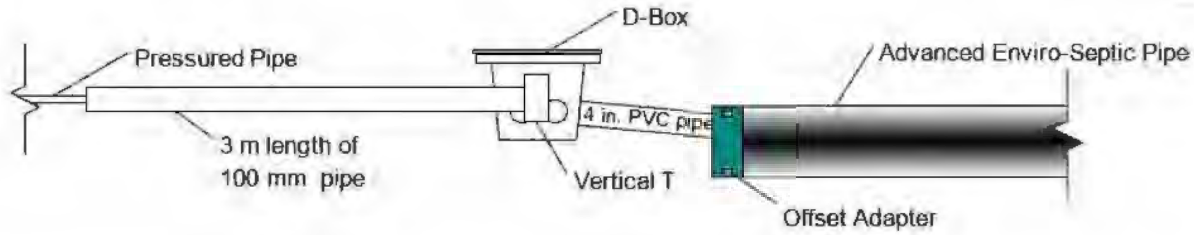


Figure 50. Velocity reducer

Low-Pressure Distribution System / Inject O)) Installation

An Inject O)) consists of a Piezovent containing a perforated vertical pipe that creates a flow restriction, allowing a homogenous distribution between each row. Each Inject O)) comes with a 100 mm (4 in) chimney and an insulated cap.

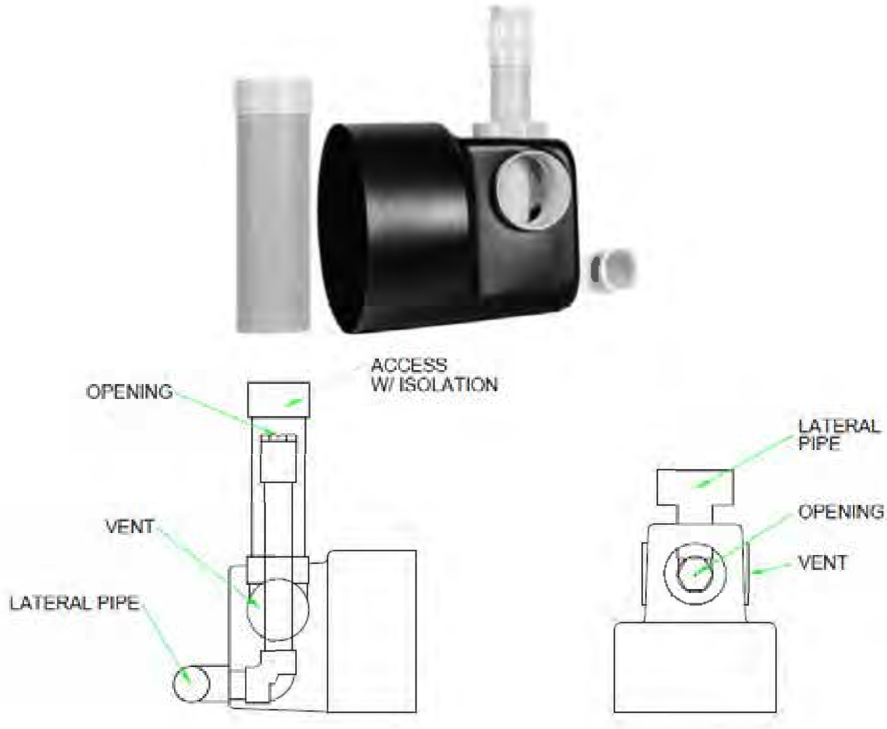


Figure 51. Inject O))

The Inject O)) is installed the same way as a Piezovent. A 100 mm (4 in) PVC pipe must connect all rows to ensure a homogenous venting between each row. This circuit must continue as an air derivation pipe or be connected to a differential vent.

Each Inject O)) are also connected by a 50 mm (2 in) PVC pipe, creating the low-pressure distribution (or lateral) circuit. This circuit ends on one side with a coupling used to connect the force main coming from the pump chamber, and on the other side with a capped purge. This purge acts as a clean out and should be accessible above ground.

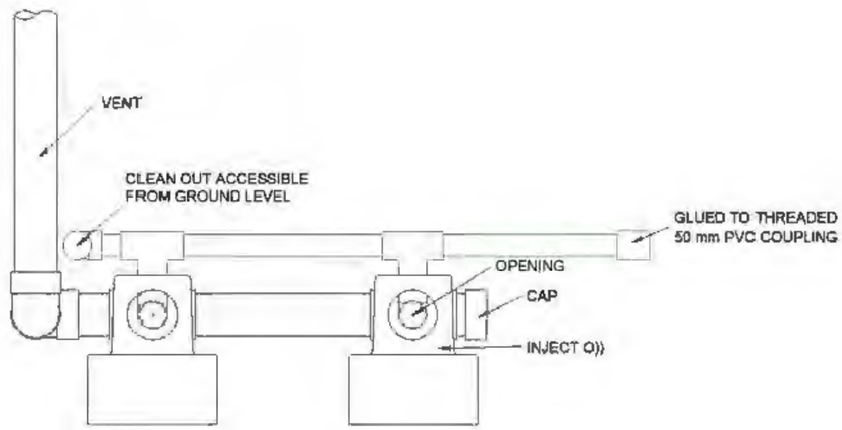


Figure 52. Inject O))

Pressurized Nested Pipe Installation

When installing a pressurized nested pipe System O)), the piping, cutting, piercing and glueing of the components are the installer's responsibility. It is recommended that the piping is pre-pierced before starting to assemble to system.

The Nested pipe components are installed simultaneously with the adapters.

The following components are suggested, and illustrated in Figure 53:

	Component	Quantity
A	Perforated Nested Pipes	One per AES pipe
B	Supply-side purge*	One per system
C	Force main connecting kit	One per system
D	Row entry	One per row
E	Row purge*	One per row
F	Centre-to-centre	Number of row minus 1

* All cleanouts or purges must be constructed with 45 elbows or sweeps.

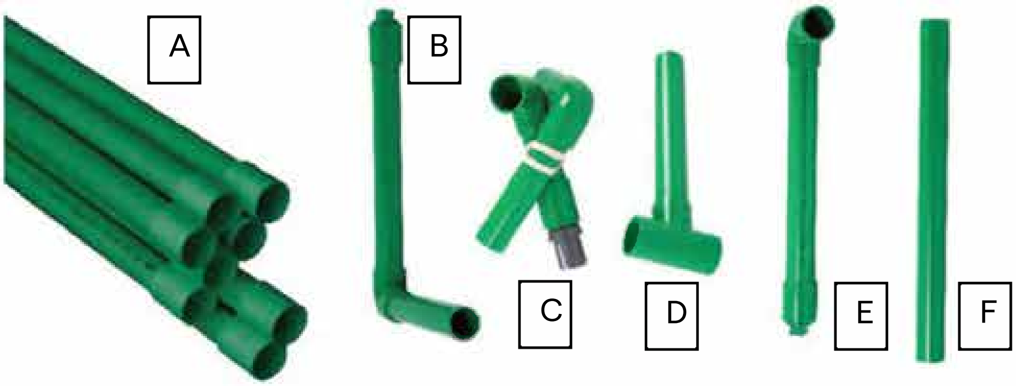


Figure 53. Distribution Device - Nested Pipe

Installation sequence

It is extremely important to glue every component together with PVC glue.

1. For each row, glue together the appropriate amount of perforated nested pipes (one nested pipe per AES pipe)

> Note: It is recommended that the last perforated pipe of each row have their openings facing down. The other openings can be face up. Provide for an orifice shield when required.

2. Slide the joined nested pipes inside the row of AES pipes

3. From the supply side, pass the Row entry (D) through the small hole of the 2-hole adapter
4. Glue the Row entry (D) to the perforated pipe, while making sure the openings are facing down.
5. Insert the 2-hole adapter on the AES pipe.

6. From the end side, insert the Piezovent while simultaneously gluing the Row purge (E) to the end of the perforated pipe. The Row purge should pass through the top hole of the Piezovent.

7. From each side, connect each row together:
    a. Supply side: Use the Centre-to-centre components (F) for the low-pressure circuit and 100 mm (4 in) PVC pipes for the air circuit
    b. End side: Use 100 mm (4 in) PVC pipes for the air circuit


8. Add the piezometers over each Piezovent
9. From the supply side, connect the Supply-side purge (B) and the Force main connecting kit (C) to the low-pressure circuit.

To complete the installation, do not forget to:

1. Connect the Force main connecting kit (C) to the force main
2. Complete the air circuit
    a. Short entry vent at the end side
    b. Air deviation circuit or differential vent at the supply side

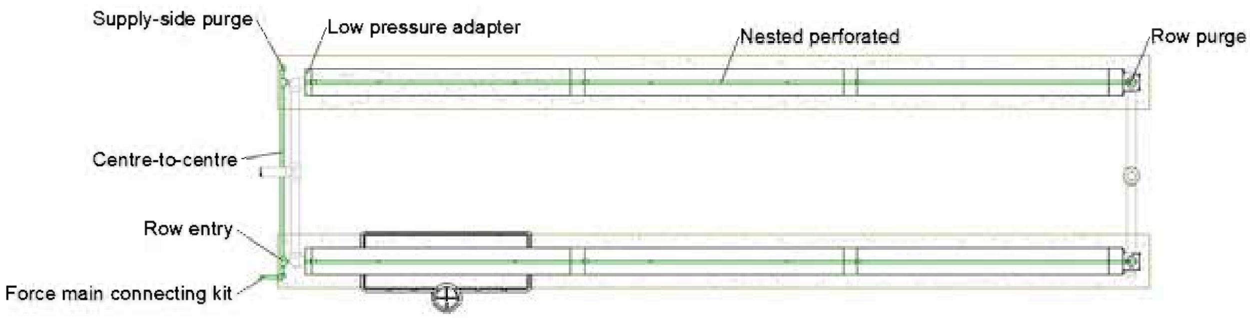


Figure 54. Components – Top view – Pressurized nested pipe

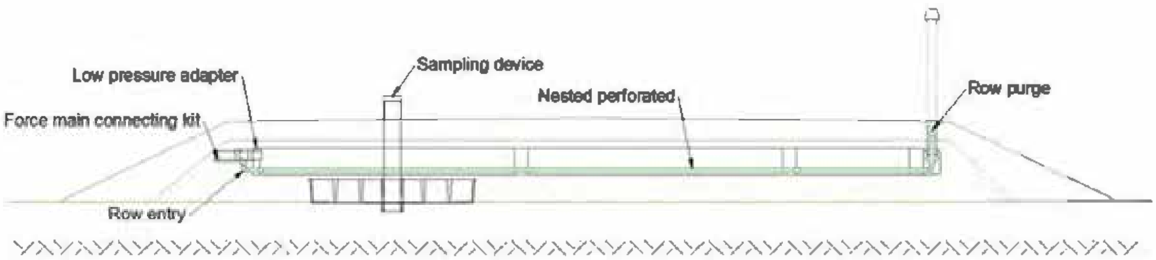


Figure 55. Components – Side view – Pressurized nested pipe