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Van Wert County's Enviro-Septic® Experimental Program- The First Two Years

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Background

On January 28, 2008 the Director of Health granted experimental concurrence allowing permitting and installation of 25 household sewage treatment systems utilizing Enviro-Septic® treatment and absorption components in Van Wert County. The main element of this system is the Enviro-Septic® pipe manufactured by Presby Environmental, Inc. This specially-designed pipe is said to provide secondary treatment of septic tank effluent in a passive manner before the effluent is dispersed into the soil.

The experimental concurrence approval allowing use of this system in Van Wert County includes several special conditions. First, all absorption systems are sized according to the sizing specifications found in the previously established Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems (Indiana Manual). Second, each system is monitored closely by the Van Wert County Health Department after it is placed into operation. Finally, because of the experimental nature of this program, the Director's approval also allows for the use of perimeter drains as close as four feet measured horizontally from the outside edge of the soil absorption area.

As of this writing, 15 Enviro-Septic® sewage treatment systems have been installed in Van Wert County. All of these systems are now receiving wastewater, as the last of these 15 systems was placed into operation on March 18, 2010. One more system is currently under permit, with additional systems expected to be permitted and installed during 2010.



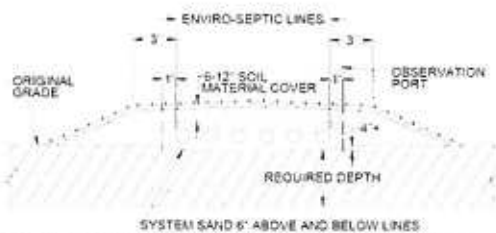
Typical Enviro-Septic® absorption field installation in Van Wert County.

System Design

All Enviro-Septic® systems installed in Van Wert County are installed according to the specifications set forth in the Indiana Manual. The single significant exception to this statement is that the horizontal spacing between the soil absorption bed and perimeter drain is reduced from ten feet to four feet.

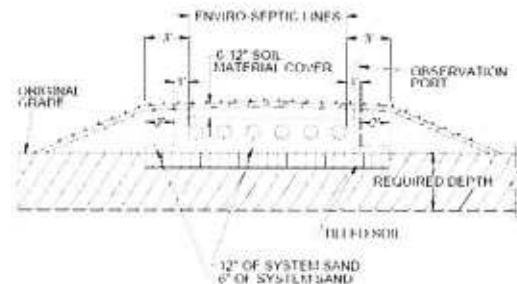
The Indiana Manual divides system installations into two basic categories. A system that is installed with its soil infiltrative surface four inches or more below original grade is categorized as a subsurface system. A system that is installed with its soil infiltrative surface less than four inches below original grade is called an elevated system. The main difference between installation of the two systems is that a subsurface system must have at least six inches of sand below the Enviro-Septic® pipe, while an elevated system must have at least twelve inches of sand below the pipe. Profile drawings of the two systems are shown below:

Subsurface Bed System



Source: Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems

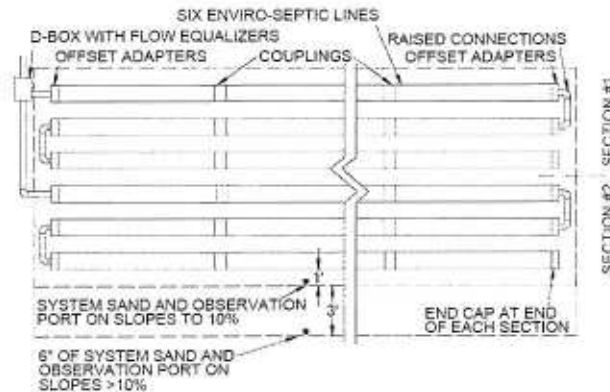
Elevated Bed System



Source: Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems

In either system, wastewater receives primary treatment in a conventional septic tank. Effluent is then either pumped or gravity fed to the absorption system, depending upon the elevation of the system and the topography of the property. Most Van Wert County installations contain three runs of Enviro-Septic® pipe. Each run of pipe is two feet shorter than the minimum required absorption area. The pipes are connected in series, so that septic tank effluent is always fed into the first pipe, and this pipe must fill up to the level of the outlet on the opposite end of the system before any effluent enters the second pipe. The configuration of the offset adapters that connect the multiple pipes allows air space to be maintained in the top of each pipe. A vent is installed on the end of the last pipe in the series so that air can be drawn through the entire system, facilitating aerobic digestion within the pipes. Below is a diagram showing the basic serial distribution concept as described above. The typical installation for a three-bedroom home in Van Wert County contains only three runs of pipe, and the bed is 13 feet wide by 92 feet long.

Basic Serial Distribution



Source: Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems

As mentioned previously, a perimeter drain is typically installed at a distance of four feet outside the absorption bed. This drain must be installed at least six inches below the elevation of the infiltrative surface, with the target elevation being at the depth of the glacial till or other soil layer that severely restricts vertical movement of water. The depth of an available drainage tile often dictates that the actual perimeter drain depth will be somewhere in between the minimum depth and the target depth.



Absorption bed with perimeter drain installed

Like other soil absorption systems currently in use in Ohio, sizing and location of each Enviro-Septic® system installed in Van Wert County are based on the results of a detailed site and soil evaluation. In Van Wert County, this evaluation must be conducted by a certified soil scientist. The sizing criteria found in the Indiana Manual are not completely consistent with those derived for other systems by using the Tyler loading rate table. Instead of calculating absorption system size using a specific soil loading rate and linear loading rate for each specific soil structure, texture and grade, the Indiana Manual divides soil textures and structures into six soil classes, labeled A through F. A sizing chart then provides dimensions for each soil class, based upon the number of bedrooms in the home. While the overall square footage of an Enviro-Septic® system as specified in the Indiana manual has been found to be equal to or greater than that of a conventional system sized using the Tyler table, the length of the Enviro-Septic® system is shorter than that of a conventional system sized based on the linear loading rates found in the Tyler table. The following comparison between absorption areas of the Enviro-Septic® system, a conventional septic tank

and soil absorption system, and a conventional soil absorption system preceded by a pretreatment unit is based on the results of a site and soil evaluation conducted on a Van Wert County property.

**Comparison of Absorption Areas of Conventional Trenches
With and Without Pre-Treatment**

Leaching Trenches or Sand Mound

	Septic Tank Effluent		Pre-Treated Effluent		Enviro-Septic®	
Soil Texture	c		c		c	
Soil Structure	sbk		sbk		sbk	
Soil Grade	2		2		2	
Slope	0-1%		0-1%		0-1%	
Infiltration Distance	14		14		14-Jan	
# of bedrooms	3	4	3	4	3	4
design flow (gal/day)	360	480	360	480	360	480
Soil Loading Rate (gal/day/sq. ft)	0.2		0.3		90	100
Linear Loading Rate (gal/day/ft)	2.5		2.5			
Soil Class (Enviro-Septic)					G	
Absorption area length (feet)	144	192	144	192	92	102
Absorption area width (feet)	12.5	12.5	8.333333	8.333333	13	16
Total absorption area (sq. ft.)	1800	2400	1200	1600	1196	1632

System Monitoring

As a condition of the Director's approval, each Enviro-Septic® sewage treatment system installed in Van Wert County is monitored closely by Health Department staff. At a minimum, each system is inspected monthly during its first winter of operation. Specifically, monthly inspections are conducted between the months of November and April. If there are any hydraulic loading problems to be found with this system, such problems should be evident during these "wet season" months. During the remainder of the year, each system is inspected quarterly. Additional visits are made to system sites to monitor moisture conditions within the system and attempt to collect perimeter drain effluent samples for testing. The frequency of these site visits is dictated by weather and soil moisture conditions. After the first year of operation of any given system, the inspection frequency for that system is set for the following year based on the probability of finding problems or being able to collect samples on that particular system site.

At the outset of the program, routine inspections were to include not only visual inspection of the perimeter drain and the system infiltrative surface through inspection and sampling ports, but also visual inspection of septic tank and dosing tank water levels and verification of proper dosing pump and high water alarm function. As the number of systems in operation has increased, however, the focus of these routine inspections has narrowed to the absorption system and perimeter drain. This is mainly due to the fact that only one member of the Health Department's two-person environmental health division is primarily responsible for all inspections and sampling relating to this program.



Water accumulated at infiltrative surface

According to the monitoring plan established by the Van Wert County Health Department in conjunction with Ohio Department of Health Sewage Treatment Systems staff, water samples are collected from Enviro-Septic® system perimeter drains when possible. Each set of samples is then submitted to a laboratory to be tested for E. Coli, fecal coliform bacteria, biochemical oxygen demand (BOD), total dissolved solids, total suspended solids, ammonia nitrogen, nitrate and nitrite nitrogen, and total phosphorous. If sufficient water is found in either of a system's infiltrative surface inspection ports when perimeter drain samples are collected, an additional sample is collected from the infiltrative surface inspection port and analyzed for E. Coli and fecal coliform bacteria. During the 2008-2009 sampling period all bacteriological testing was performed by Alloway Laboratory in Lima, while all other testing was performed by the Ohio EPA laboratory in Reynoldsburg. During the current sampling period, all testing is being performed by Alloway Laboratory in Lima. Laboratory testing has been made possible by financial support from the Van Wert County Board of Health, Ohio Department of Health and the Van Wert County Foundation.

Observations

Post-installation site visits are divided into two categories. The required monthly or quarterly visual inspection and evaluation of performance of each system is referred to as a routine inspection. Any site visit which may occur between routine inspections in order to collect samples, monitor the response of a system to unusual conditions, or investigate problems with a system is referred to as an additional site visit. Since the beginning of the program, the Van Wert County Health Department has logged 87 routine inspections and 95 additional site visits.

Due to the lack of conformity with linear loading practices commonly accepted in Ohio, hydraulic loading is a concern associated with the use of the Enviro-Septic® system. As of this writing, no surfacing of liquid or bleeding of liquid from the toe of any system has been observed. Each system is installed with an infiltrative surface inspection port at each end of the system. Of the 15 systems currently in operation, some standing water has been observed in at least one infiltrative surface inspection port of 7 systems on at least one occasion. Only one system has been found to have standing water in both inspection ports. Water levels within the systems are normally at their highest just after major precipitation or melting events, and decrease as the soil dries out. It is worth noting that linear loading may be less of a factor in the Van Wert County installations than it would be in other locations due to the relative lack of slope on most sites where the system has been installed.



Water flowing from perimeter drain at sampling port

The use of artificial drainage around a soil absorption system is a cause for concern due to the possibility of migration of contaminants through the soil from the absorption system to the perimeter drain. Some have even suggested that a soil absorption system surrounded by a perimeter drain is no different than a discharging sewage treatment system. Perimeter drains of Enviro-Septic® systems in Van Wert County are routinely monitored for flow as soon as possible after major precipitation and melting events, as these are the only times that water has been found flowing through most of these artificial drains. Of the 15 systems currently in operation, flowing water has been visually observed in the perimeter drain sampling port of four systems. Evidence of previous perimeter drain flow has

been found in most if not all systems, but the repeated inability to find water flowing through these perimeter drains suggests that they rarely carry water away from the systems for a significant period of time.

With a couple of exceptions which occurred during the 2008-2009 monitoring period, water samples are collected from flowing curtain drains by collecting water as it flows out of the drain tile, as opposed to being collected from water lying in the "sump" at the bottom of a sampling port. Samples collected from water found standing in infiltrative surface inspection ports are dipped out with as little disturbance of the soil surface as possible. Results of analysis of all samples collected as of this writing are provided below.

It is easy to see that there is a high degree of variability in the E. Coli and fecal coliform testing results. This high variability, coupled with the fact that samples collected inside the absorption system sometimes produce lower bacteria counts than those collected from the perimeter drain sampling ports, seems to indicate that some additional sources of bacteria are influencing the counts found in the perimeter drain samples. It is hoped that additional sampling will help to explain what is happening with regard to E. Coli and fecal coliform levels found in perimeter drain effluent. Also, lower suspended solids readings during the second year of operation may indicate that the initial higher readings were due to particles being easily washed down through the recently backfilled cover material above the drain trenches.

Finally, the owner of one system out of the 15 systems currently in operation has experienced problems with sewer gas inside the home, and significantly fluctuating toilet bowl water levels. Much attention was initially directed at the Enviro-Septic system as a potential cause of this problem. The theory was that the additional air drawn through the home's plumbing vent system as a result of the venting of the Enviro-Septic system had created a vacuum which emptied drain traps inside the home and lowered water levels in toilet bowls. An investigation ensued, and isolation of the absorption system's venting system from the home's plumbing vent system did not solve the problem inside the home. Eventually, the plumber was able to pinpoint two separate mistakes made in the home's plumbing vent system which seemed to be the source of the sewer gas problem. Fluctuating toilet bowl water levels have been noted once since the drain repairs were made. The cause of this fluctuation is not clear.

2008-2009 Enviro-Septic® Testing Results

Parameters

Date Collected	Site Name	E. Coli (per 100 mL)	Fecal Coliform (per 100 mL)	BOD ₅ (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorous (mg/L)
3/9/2009	Pancake	<100	<100	2.7	826	31	0.94	15	0.409
3/9/2009	McOmber	<100	<100	<2.0	342	<5	0.115	13.2	0.07
3/9/2009	Amstutz	180	5100	<2.0	740	12	0.289	8.77	0.058
4/13/2009	Pancake	<20	4800	lab accident	286	214	0.097	3.44	0.341
4/13/2009	Amstutz (IP)	<20	<20						
4/13/2009	Amstutz (SP)	50	1700	lab accident	472	112	<0.05	0.1	0.01
4/13/2009	McOmber	<20	1200	lab accident	342	11	<0.05	11.9	0.01
4/20/2009	Pancake	<20	250	2	364	31	<0.05	7.27	0.449
4/20/2009	McOmber	<20	<20	<2.0	386	11	<0.05	12.5	0.066
4/20/2009	Amstutz (IP)	<20	<20						
4/20/2009	Amstutz (SP)	<20	100	<2.0	648	21	<0.05	9.11	0.017
5/14/2009	Pancake	<10	33						
5/14/2009	McOmber	180	620						
5/14/2009	Amstutz (IP)	<10	<20						
5/14/2009	Amstutz (SP)	187	1300						
5/14/2009	Miller	380	280						
6/11/2009	Pancake	41	1300						
6/11/2009	McOmber	98	>20,000						
6/11/2009	Amstutz (IP)	<10	33						
6/11/2009	Amstutz (SP)	<10	<20						

Note: IP=infiltrative surface inspection port
 SP=curtain drain sampling port
 All other samples collected from SP unless otherwise noted.

2009-2010 Enviro-Septic® Testing Results

Parameters

Date Collected	Site Name	E. Coli (per 100 mL)	Fecal Coliform (per 100 mL)	BOD ₅ (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorous (mg/L)
12/9/2009	Pancake	1720	67	<10	615	16	0.21	24	0.39
12/9/2009	McOmber	37	1600	<10	442	11	<0.20	20.8	0.45
12/9/2009	Decker	63	1400	<10	340	6.4	<20	5.93	0.12
12/9/2009	Amstutz	20	130	<10	1010	17	<20	19.3	0.17
3/15/2010	Amstutz	31	<20	<10	1030	12	<20	13.2	0.24
3/15/2010	Amstutz (IP)	<10	<20						
3/15/2010	Side (IP)	<10	50						
3/15/2010	Decker	610	1600	<10	954	<4.0	0.62	8.28	0.09
3/15/2010	McOmber	<10	<20	<10	475	<4.0	<20	19.9	0.24
3/15/2010	Wright (IP)	<10	60						

Note: IP=infiltrative surface inspection port
 SP=curtain drain sampling port
 All other samples collected from SP unless otherwise noted.

Conclusion

The observations outlined here appear to indicate that the Enviro-Septic® sewage treatment systems currently operating in Van Wert County are working well. This is evidenced in large part by an overall lack of serious hydraulic loading concerns. Although there is some debate among interested parties as to how much treatment occurs in the Enviro-Septic pipe as opposed to the sand surrounding the pipe, limited testing results suggest that the effluent is very clean by the time it reaches the soil infiltrative surface. Contractors who have worked with the system appreciate the system's simplicity and ease of installation and maintenance.

For more information on the use of this system in Van Wert County, contact Jason Menchhofer of the Van Wert County Health Department at 419-238-0808, extension 108, or jmenchhofer@vanwertcountyhealth.org.

References

E. Jerry Tyler and Laura Kramer Kuns. Development and Use of a Wastewater Hydraulic Linear and Infiltration Loading Rate Table. 2000 NOWRA Conference Proceedings. Grand Rapids, MI

Presby Environmental, Inc. Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems, October 2005 Edition with March 2007 Revisions.