John Elias Baldacci
Governor

Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor
11 State House Station
Augusta, ME 04333-0011

Brenda M. Harvey,
Commissioner

Dora Anne Mills, MD, MPH
Public Health Director
Maine CDC Director

December 19, 2006

RING Industrial Group
Attn.: Theo B. Terry III, R.S.
65 Industrial Park
Oakland, TN 38060

Subject: Product Registration, RING Industrial Group EZflow Systems

Dear Mr. Terry:

The Division of Environmental Health has completed a review of a registration application for your company's product. This information was submitted pursuant to Section 1802 of the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules (Rules), for code registration, for use in Maine.

Product Description

The RING Industrial Group EZflow Systems consist of 803H/ 803H GEO, 904H/ 904H GEO, 1201P/1201P GEO, 1202H/1202H GEO and 1203H/1203H GEO models. In general terms, the EZflow Systems consist of a four inch diameter perforated plastic pipe set off-center in a bundle of aggregate. The aggregate consists of roughly rectangular expanded polystyrene beads approximately one inch long and one-half inch thick, with convoluted surfaces. The aggregate is retained around the pipe in a cylindrical configuration by plastic netting. Those models with a GEO designation also have a layer of nonwoven geotextile fabric integrated into the upper third of the aggregate cylinder to prevent migration of fines into the void spaces. Models 400CD, 700CD, and 1000CD are prefabricated curtain drains, and are included in this action.

Claim

You have provided copies of three of 31 approvals for this product from other jurisdictions. According to the information you provided, the RING Industrial Group EZflow Systems function as an equivalent to a conventional stone and pipe disposal area, with somewhat great size efficiency. The EZflow Systems are available in five foot and ten foot long units. You propose the following size rating for the various models:

Model	Height	Configuration	
		Cluster	Trench
803H/ 803H GEO	8"	3.25sq ft per linear ft	4.0 sq ft per linear ft
904H/ 904H GEO	9"	4.9 sq ft per linear ft	6.0 sq ft per linear ft
1201P/1201P GEO	12"	N/A	4.0 sq ft per linear ft
1202H/1202H GEO	12"	5.36 sq ft per linear ft	6.0 sq ft per linear ft
1203H/1203H GEO	12"	6.4 sq ft per linear ft	7.0 sq ft per linear ft

Determination

On the basis of the information and sample product submitted, the Division has determined that the RING Industrial Group EZflow System is acceptable for use in the State of Maine, provided that it is installed, operated, and maintained in conformance with the manufacturer's directions.

In the event that the product fails to perform as claimed by the applicant, use of the product in Maine, including all installations approved pursuant to Chapter 18 of the Rules, shall cease. Use of the product shall not resume until the applicant and the Division have reached a mutually acceptable agreement for resolving the failure to perform as claimed.

Because installation and owner maintenance has a significant effect on the working order of onsite sewage disposal systems, including their components, the Division makes no representation or guarantee as to the efficiency and/or operation of RING Industrial Group EZflow Systems. Further, registration of this product for use in the State of Maine does not represent Division preference or recommendation for this product over similar or competing products.

You may freely reproduce and distribute this letter. If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen, Environmental Specialist IV
Wastewater and Plumbing Control Program
Division of Health Engineering
e-mail: james.jacobsen@state.me.us

/jaj

xc: Product File

John Elias Baldacci
Governor

Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor
11 State House Station
Augusta, ME 04333-0011

Brenda M. Harvey,
Commissioner

Dora Anne Mills, MD, MPH
Public Health Director
Maine CDC Director

December 6, 2006

RING Industrial Group
Attn.: Theo Terry, RS
65 Industrial Park
Oakland, TN 38060

Subject: Sizing Proposal, RING Industrial Group, EZflow products

Dear Mr. Terry:

Thank you for the opportunity to review the proposed sizing for various EZflow wastewater disposal products. Ref.: E-mail dated 12/04/06 and attached spreadsheet.

The Division finds that the proposed sizing for trench and cluster installations appears reasonable and prudent.

I look forward to working with you on the formal review for Maine product registration. Please contact me at (207) 287-5695 if you have any questions.

Sincerely,

James A. Jacobsen

James A. Jacobsen, Environmental Specialist IV
Subsurface Wastewater Program
Division of Environmental Health
e-mail: james.jacobsen@maine.gov

/jaj

xc: File

Device	Model	Height	Configuration	
			Cluster	Trench
EZflow	803H/ 803H GEO	8"	3.25sq ft per linear ft[d]	4.0 sq ft per linear ft[b]
EZflow	904H/ 904H GEO	9"	4.9 sq ft per linear ft[d]	6.0 sq ft per linear ft[c]
EZflow	1201P/1201P GEO	12"	N/A	4.0 sq ft per linear ft[a]
EZflow	1202H/1202H GEO	12"	5.36 sq ft per linear ft[d]	6.0 sq ft per linear ft[b]
EZflow	1203H/1203H GEO	12"	6.4 sq ft per linear ft[d]	7.0 sq ft per linear ft[c]

[a] 2.5' center to center
[b] 4.0' center to center
[c] 6.0' center to center
[d] Maximum burial depth of two foot unless approved otherwise by manufacturer

RING

INDUSTRIAL GROUP

MAINE

Request for Approval

of EZ *flow* Systems

December 05, 2006

3 copies

gave Two to Jim Jacobsen

12/6/06

LM

December 4, 2006

James A. Jacobsen, ES IV
Department of Health and Human Services
Division of Environmental Health
Subsurface Wastewater Program
286 Water Street
Augusta, ME 04333

Dear Mr. Jacobsen,

I very much appreciated the opportunity to meet with you and Russell Martin on Thursday, November 30th. The chance to meet with you in person and discuss our products was most helpful. It has allowed me to better prepare the information you need for acting on our request for approval.

Based on the information we discussed on the 30th I have put together the additional information in support of our request for approval. In addition to **EZ***flow* branded products: 1201P, 1201P GEO, 1202H, 1202H GEO, 1203H, 1203H GEO that I included in my initial request I would like to add the following **EZ***flow* branded products: 0803H, 0803H GEO, 0904H and 0904H GEO. I do not know if an approval is needed but if it is I would also like to request approval of our **EZ***flow* branded curtain drain products: 0400, 0700 and 1000.

I have included drawings of these four additional drainfield products for your file. I have also requested that samples of 1201P and 1201P GEO be sent to you. Since you do not have a lot of room to store samples I'm having special 18 inch lengths made up for you rather than the usual 5 or 10 foot lengths. This may delay you getting these samples for about a week.

Also per your request I included samples of some Installation Manuals. Once I received word that our products have been approved I will have a draft manual that is written just for the state of Maine sent to you for your review and approval.

Here is the sizing chart that I developed following our meeting on November 30th. Please let me know if this is acceptable.

Device	Model	Height	Configuration	
			Cluster	Trench
EZflow	803H/ 803H GEO	8"	3.25sq ft per linear ft[d]	4.0 sq ft per linear ft[b]
EZflow	904H/ 904H GEO	9"	4.9 sq ft per linear ft[d]	6.0 sq ft per linear ft[c]
EZflow	1201P/1201P GEO	12"	N/A	4.0 sq ft per linear ft[a]
EZflow	1202H/1202H GEO	12"	5.36 sq ft per linear ft[d]	6.0 sq ft per linear ft[b]
EZflow	1203H/1203H GEO	12"	6.4 sq ft per linear ft[d]	7.0 sq ft per linear ft[c]

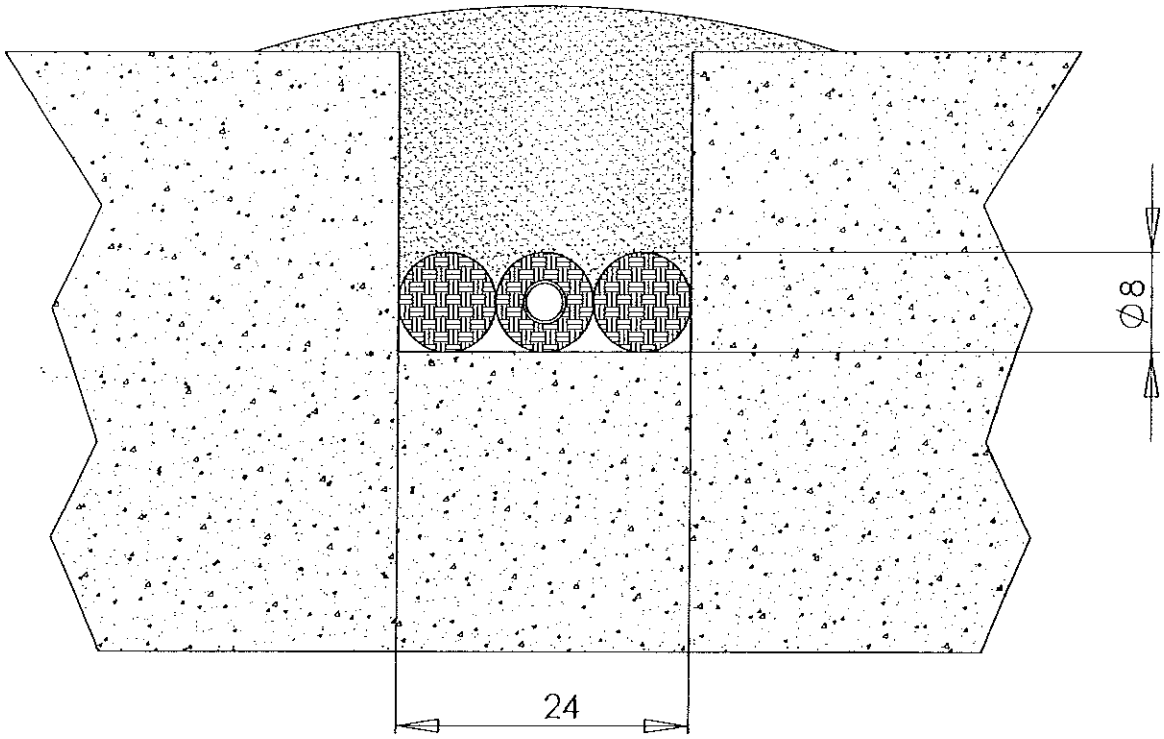
[a] 2.5' center to center
[b] 4.0' center to center
[c] 6.0' center to center
[d] Maximum burial depth of two foot unless approved otherwise by manufacturer

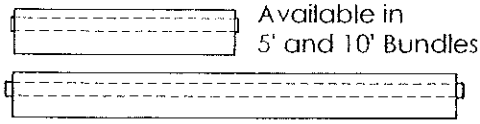
I hope that this packet will provide all the information you need to approve our products. If not, I would be happy to answer any questions that might come up so feel free to give me a call at 502-649-9841.

Sincerely,

Theo B. Terry, III, RS
Manager of Technology

Enclosures





Available in
5' and 10' Bundles

EPS Aggregate
Drainage System

UNITS: INCHES

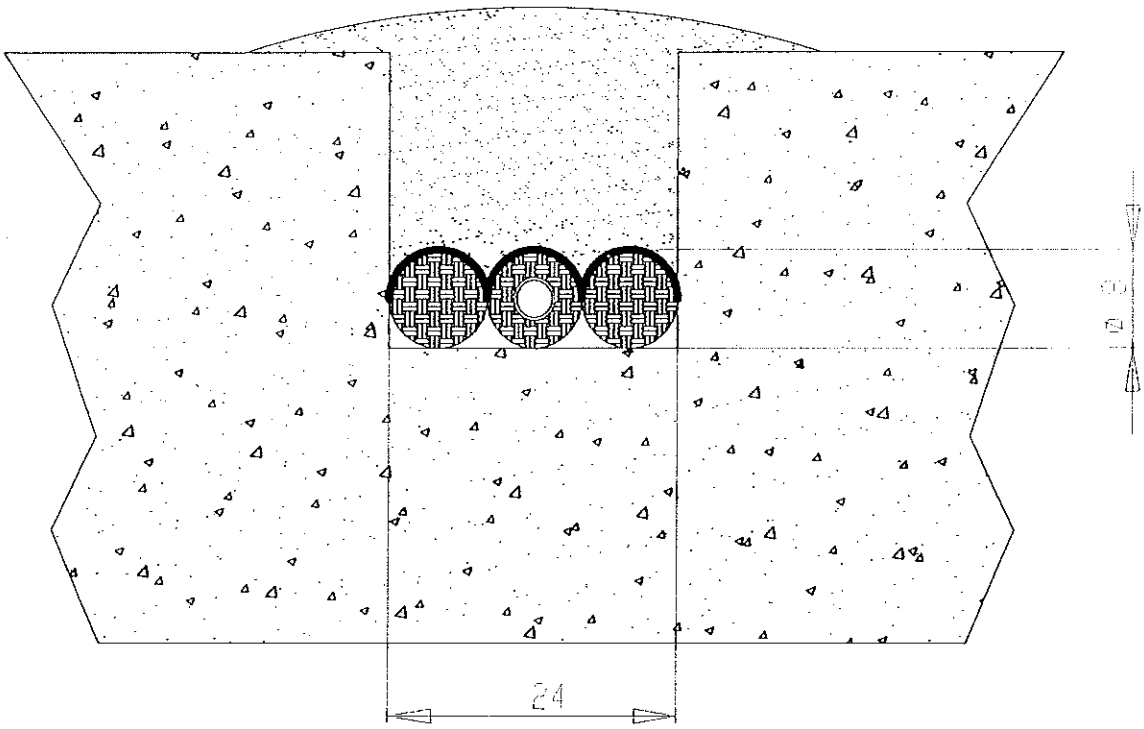
Last Edited:
07/17/2006

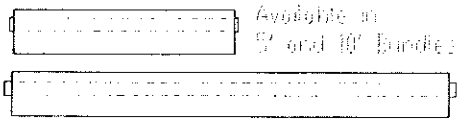
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

0803H





Available in
5' and 10' Bundles

EPS Aggregate
Drainage System

UNITS: INCHES

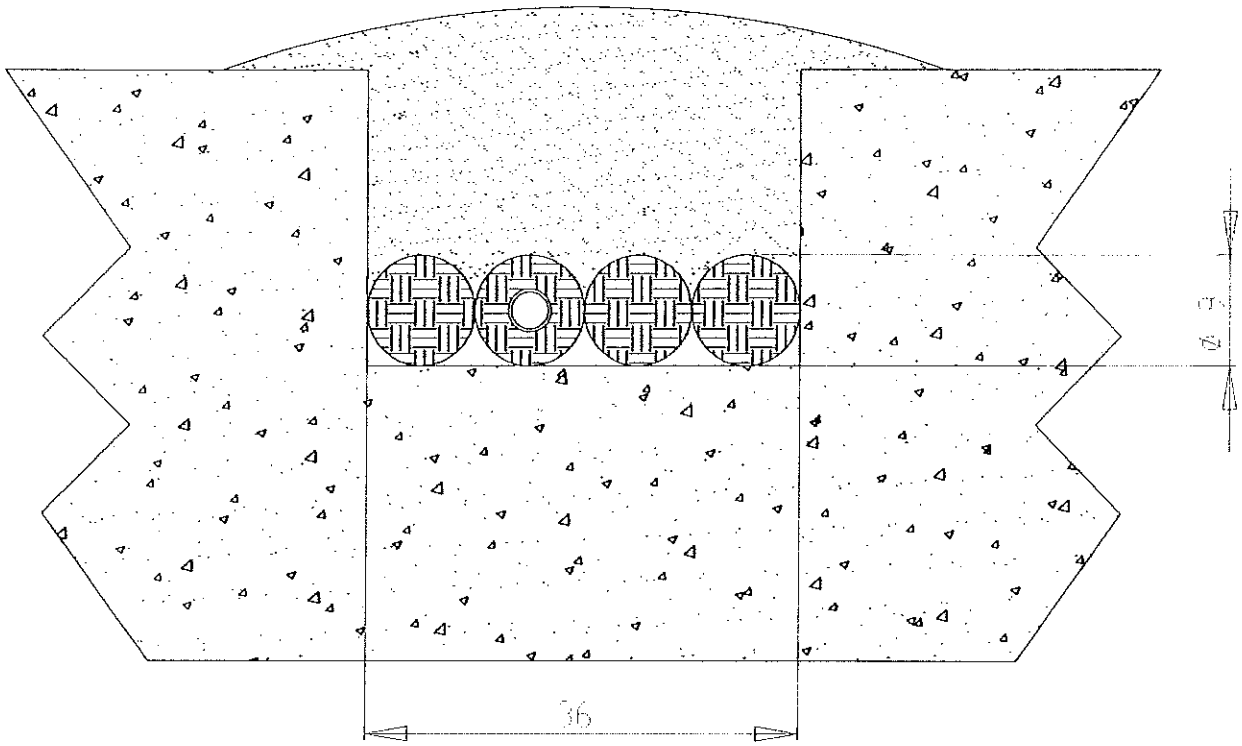
Last Edited
07/17/2006

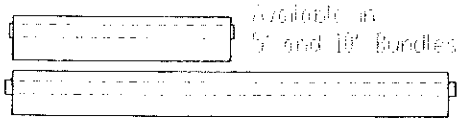
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

0803H GEO





Available in
5' and 10' Bundles

EPC Aggregate
Drainage System

UNITS: INCHES

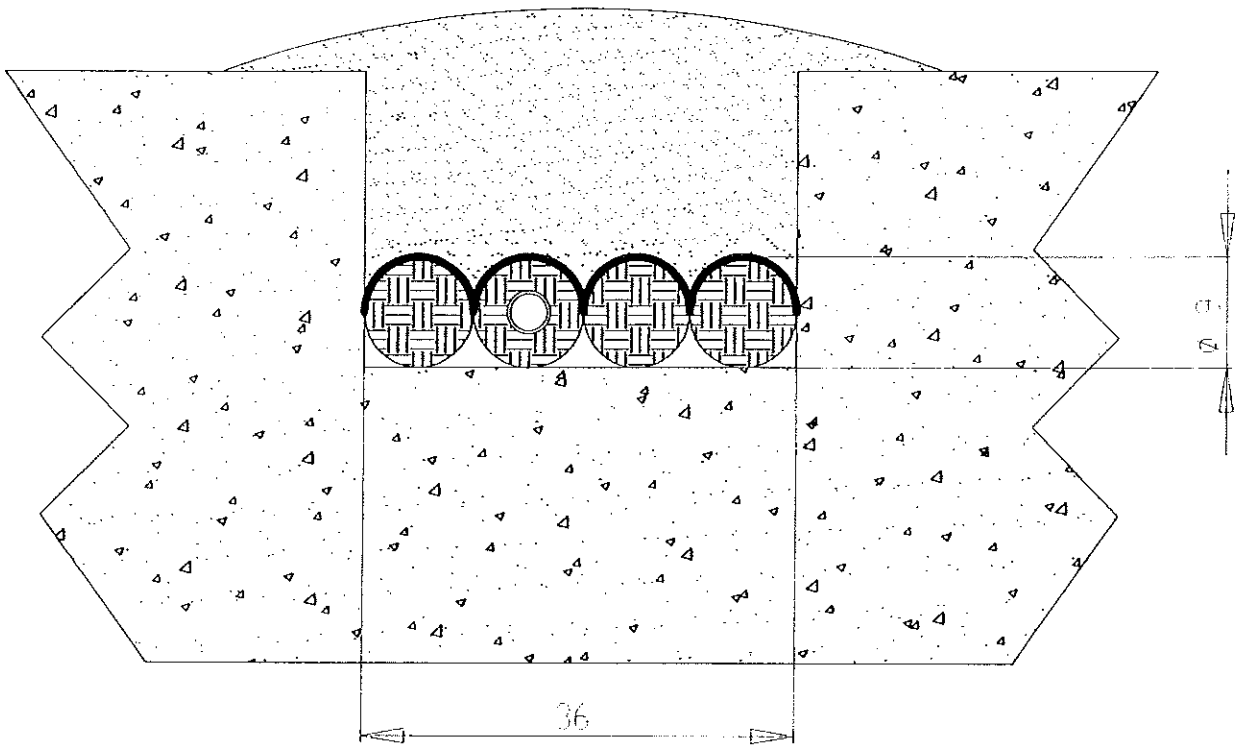
Last Edited:
07/17/2006

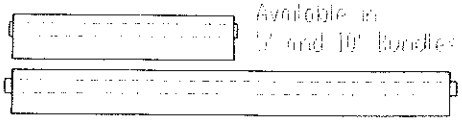
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

0904H





Available in
5' and 10' Bundles

EZflow Aggregate Drainage System

UNITS: INCHES

Last Edited: 07/17/2006

Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

0904H GEO

MAINE. EZ DOES IT.™

RING INDUSTRIAL GROUP, LP®

Installation Instructions for EZflow® Systems in Maine

EZflow
RING INDUSTRIAL

PERFORMANCE. EZ DOES IT™

Maine

The Maine Department of Health and Human Services, Division of Environmental Health has approved the use of RING Industrial Group, LP® **EZ*flow*®** products **1201-P-GEO and 1202H-GEO** pursuant to Sec. 1802 Maine Subsurface Waste Water Disposal Rules, 10-144 CMR 21 (8-1-05), provided that it is installed, operated, and maintained in conformance with the manufacturer's directions.

These products, in general terms, consist of a four inch diameter perforated plastic pipe set off-center in a bundle of aggregate. The aggregate consists of roughly rectangular expanded polystyrene beads approximately one inch long and one-half inch thick, with convoluted surfaces. The aggregate is retained around the pipe in a cylindrical configuration by plastic netting. The GEO layer of nonwoven geotextile fabric is integrated into the upper third of the aggregate cylinder to prevent migration of fines into the void spaces.

EZ*flow* Materials and Equipment needed
- **EZ*flow*** Bundles
- **EZ*flow*** Internal Pipe Couplers
- **EZ*flow*** Versa Couplers

Installation Instructions
The instructions for installation of **EZ*flow*** products are given below. This product must be installed in accordance with the appropriate state regulations and codes.

In cases where linear footage required is not in multiples of 10, installer may (a) modify the product to needed length and refasten netting to the pipe or, (b) use an additional 10 feet of product to exceed the required trench length.

1. After the site evaluator has determined sizing, configuration, and layout for the **EZ*flow*** systems, stake or mark with paint the location of trenches and lines. Be careful to set correct tank, invert pipe, header line or distribution box and trench bottom elevations before installation of pipe bundles.

2. Excavation shall be carried out in a manner that will avoid unnecessary compaction of both sidewalls and bottom area. Heavy equipment, especially rubber tired vehicles such as front-end loaders, shall not be driven over the exposed bottom of the disposal field. Excavation should be carried out, when possible, by a back-hoe operating from outside the perimeter of the previously excavated portions of the disposal fields.

3. The drainfield is to be a level or serial distribution type of modification of either, depending on site characteristics.

4. The bottom of each disposal field shall be installed at the elevation specified on the permit. It shall be maintained to a level grade no greater than 2 inches within 100 feet. Note: The bottom of a disposal field serves as the final stage of the distribution network.

5. Disposal fields, whether part of a single system or two or more discrete systems, shall be separated by a minimum of 5', as measured along the contour, or one half the width of the widest adjacent disposal fields; whichever is greater.

6. Excavate trench to approved depth and width according to diagrams on following page, with a minimum cover of 6".

7. Remove the plastic **EZ*flow*** stretch wrap and banding prior to placing bundles in the trench(es). Remove any plastic wrap in the trench before system is covered.

8. Place **EZ*flow*** bundle(s) in the specified **EZ*flow*** configuration as defined by the site evaluator. The top and center-most bundles containing pipe are joined end to end with an internal pipe coupler. For any 1202H-GEO system, aggregate bundles should be butted against the other aggregate-only bundles and do not require any type of connection.

9. The top of each GEO cylinder contains a filter fabric pre-manufactured between the netting and aggregate. The fabric is inserted to prevent soil intrusion. The installer shall make sure that the cylinder is positioned upward so that fabric is on top and is in contact with the fabric contained in the adjacent cylinder before backfilling.

10. Header or lead lines from distribution box or device will be connected to the top or center-most pipe bundle in each trench or inserted into the pipe.

11. **EZ*flow*** bundles are flexible and can fit in curved trenches as may be necessary to avoid trees, boulders, or other obstacles.

(Continued Page 5)

EZ*flow* 1201-P-GEO for Trench Systems

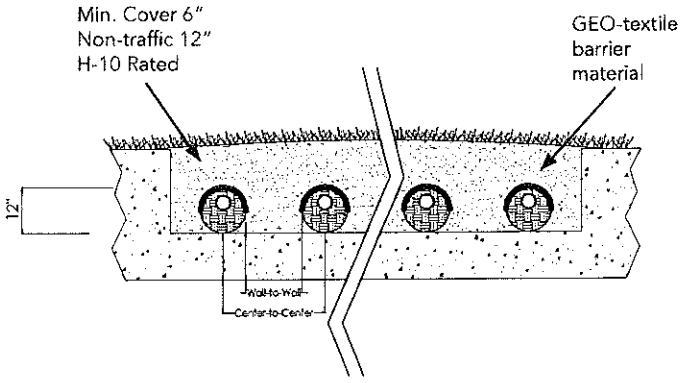
Model	Height	Configuration	
		Cluster	Trench
1201-P-GEO	12"	N/A	4.0 sq ft per linear ft

	Number of Bedrooms						
	Soil Profile	2	3	4	5	6	Each Additional Bedroom
		180 GPD	270 GPD	360 GPD	450 GPD	540 GPD	
Soil Profile	1	185	277	369	461	554	92
	2	149	223	297	371	446	74
	3	149	223	297	371	446	74
	4	117	176	234	293	351	59
	5	117	176	234	293	351	59
	6	117	176	234	293	351	59
	7	149	223	297	371	446	74
	8	185	277	369	461	554	92
	9	225	338	450	563	675	113

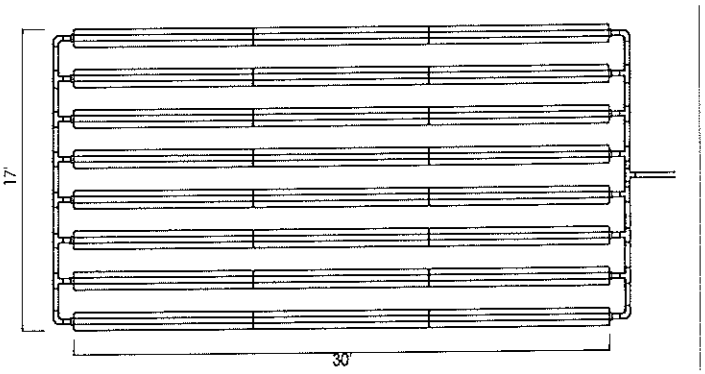
Table 1: Minimum Trench Footage of EZ*flow* 1201-P-GEO (Units in Feet) (For Residential Use)

Original Ground Slope	Soil Profile		
	4, 5 and 6	2, 3 and 7	1, 8, and 9
	C-C / W-W	C-C / W-W	C-C / W-W
0 to 10%	21 / 9	27 / 15	33 / 21
11 to 15%	24 / 12	30 / 18	33 / 21
16 to 20%	27 / 15	33 / 21	33 / 21

Table 2: Minimum Trench Spacing of EZ*flow* 1201-P-GEO (Units in Inches) (Expressed: Center-to-Center / Wall-to-Wall)



Cross Section 4 Row



Top View - 240' 8 Rows

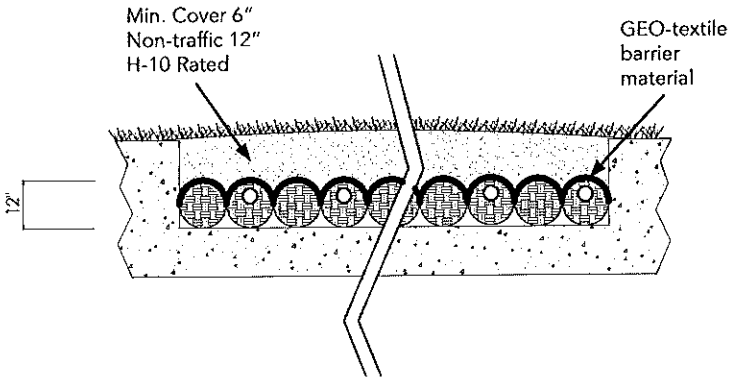
Note: Visit RingIndustrial.com for CAD drawings.

EZ*flow* 1202-GEO-SEP for Cluster Systems

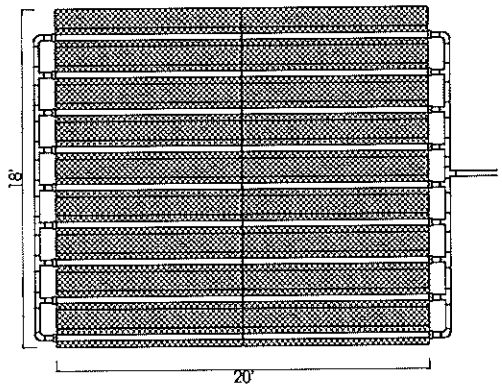
Model	Height	Configuration	
		Cluster	Trench
1202H-GEO	12"	5.36 sq ft per linear ft	6.0 sq ft per linear ft

	Number of Bedrooms						
Soil Profile	Soil Profile	2	3	4	5	6	Each Additional Bedroom
		180 GPD	270 GPD	360 GPD	450 GPD	540 GPD	
	1	138	207	275	344	413	69
	2	111	166	222	277	332	55
	3	111	166	222	277	332	55
	4	87	131	175	218	262	44
	5	87	131	175	218	262	44
	6	87	131	175	218	262	44
	7	111	166	222	277	332	55
	8	138	207	275	344	413	69
	9	168	252	336	420	504	84

Table 1: Minimum Cluster Footage of EZ*flow* 1202H-GEO (Units in Feet) (For Residential Use)



Cross Section
3 Sets of 1202H-GEO



Top View - 180' 9 Rows
18 Sets of 1202H-GEO

Note: Visit RingIndustrial.com for CAD drawings.

12. No part of a system may be backfilled until it has been inspected and approved. If any part is covered before being inspected and approved, it shall be uncovered at the discretion of the plumbing inspector and at the expense and risk of the owner.

13. The installer of the system shall make certain that the construction and installation are performed without adversely affecting the capacity of the soil or backfill material to adequately absorb or treat the septic tank effluent. Backfill shall meet the requirements of Sec. 804.0. Soil within 6" of EPS bundles shall be loosely placed and not compacted.

14. Final grading shall be completed in such a manner that surface water will not collect over the disposal field. Immediately after completion of final grading, the fill material surface shall be stabilized by mulching and seeding, sodding, to establish a good vegetative cover to prevent erosion.

Repeat steps 1 through 14 for each required trench.

The area of the drainfield shall not be used for vehicular traffic, parking, or underground utilities, to include water lines. Doziers, trucks, and other heavy vehicles shall not be allowed to run over the septic tank, field lines or other parts of the system.

Sod or seed the drainfield area to control erosion, as may be required by Permit or local policy.

Maintenance

It is the property owner's responsibility to maintain the system in a safe and sanitary manner.

EZ*flow* Inspection

As required by state or local regulations, be sure to obtain proper installation inspection and authorization from the plumbing inspector prior to covering the system.

Septic tank, header pipe or D box, trench bottom, grade, depth, and cover shall be in accordance with state rules and regulations unless otherwise specified.

The top of each GEO cylinder contains a filter fabric pre-manufactured between the netting and aggregate. The fabric is inserted to prevent soil intrusion. The installer shall make sure that the cylinder is positioned upward so that fabric is on top and is in contact with the fabric contained in the adjacent cylinder before backfilling.

RING INDUSTRIAL GROUP®, LP
LIMITED WARRANTY

RING Industrial Group ("RING") hereby extends the following LIMITED WARRANTY to the original purchaser of a new **EZ*flow*®** drainfield system installed by an authorized installer. The **EZ*flow*** drainfield system is warranted to be free from defects in material and workmanship under normal use, subject to the terms and conditions herein.

WARRANTY ELIGIBILITY:

This Limited Warranty shall extend to the original homeowner and to each subsequent owner of the home during the term of this Limited Warranty. This Limited Warranty covers the performance of the **EZ*flow*** drainfield system only when properly installed in accordance with RING's design specifications, installation instructions, and any applicable state rules or regulations by an authorized installer for use with domestic strength effluent.

OWNER'S OBLIGATIONS AND MAINTENANCE

1. The homeowner must retain proof that septic tank solids (digested sludge) have been properly removed once every thirty-six (36) months.
2. The homeowner must not landscape over the **EZ*flow*** drainfield system with trees or shrubbery nor erect any structures or place heavy items over the drainfield.
3. Homeowner must retain Limited Warranty signed by an authorized drainfield system installer and a properly issued Operation Permit.

WHAT IS WARRANTED AND FOR HOW LONG:

The **EZ*flow*** prefabricated drainfield system is warranted for ONE (1) YEAR from the date of installation to be free from defects in material or workmanship. During the warranty period, RING shall, at its option, repair or replace any defective system components at no charge for labor or materials. REPAIR OR REPLACEMENT OF THE DEFECTIVE PRODUCT IS THE EXCLUSIVE REMEDY UNDER THIS LIMITED WARRANTY. Any replacement or repair parts are warranted for the remainder of the warranty period or ninety (90) days, whichever is longer. Under this Limited Warranty, RING will provide only for replacement and installation of defective **EZ*flow*** drainfield system parts. The homeowner shall be responsible for any other costs, including but not limited to, re-sodding and any permits required for installation.

WHAT IS NOT COVERED BY THIS LIMITED WARRANTY:

1. The septic tank, filters, effluent distribution box(es) or other system components.
2. Improper design or installation, including but not limited to repairs/replacements necessitated due to improper or inaccurate soils analysis, the use of incorrect appliction rates or inadequate sizing criteria.
3. Landscaping or re-sodding costs.
4. Repair work performed without RING authorization.
5. Damage caused by unauthorized or improper attachment, alterations or modifications, including but not limited to use of geotextiles or plastic pipe.
6. Damage caused by flood, earthquake or other natural disaster.
7. Damage or failure due to improper maintenance or inadequate maintenance.
8. Failure due to excessive water usage, improper grease disposal or other excessive or improper use.
9. Failure caused by placing structures or plant material over the drainfield or by stresses or vehicular traffic greater than that prescribed in the installation or operation instructions.

NOTICE OF WARRANTY CLAIM:

To obtain warranty service under this Limited Warranty, the homeowner must notify RING within ninety (90) days after discovery of any defect. Upon notification, RING will issue an authorization number for investigation, repair, or replacement service. Notify RING Industrial Group, LP®, 30 Industrial Park, Oakland, TN 38060, or call Toll Free 1-800-649-0253. RING will not pay for any costs, repairs, or replacements without prior authorization.

DISCLAIMER OF AND LIMITATION ON WARRANTIES:

OTHER THAN THE EXCLUSIVE WARRANTY SPECIFICALLY SET FORTH HEREIN, NO OTHER EXPRESS OR IMPLIED WARRANTIES HAVE BEEN MADE OR WILL BE MADE BY OR ON BEHALF OF RING. RING HEREBY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND DO NOT INCLUDE INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, LOSS OF USE, INCONVENIENCE, OR LOSS OR DAMAGE TO PERSONAL PROPERTY, WHETHER DIRECT OR INDIRECT, WHETHER ARISING IN CONTRACT OR IN TORT.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. FEDERAL OR STATE LAW MAY GIVE YOU CERTAIN OTHER RIGHTS THAT ARE NOT CONTAINED HEREIN. SEE ADDENDUM

EZflow
RING INDUSTRIAL

Ring Industrial Group
30 Industrial Park
Oakland, TN 38060

PERFORMANCE. EZ DOES IT™

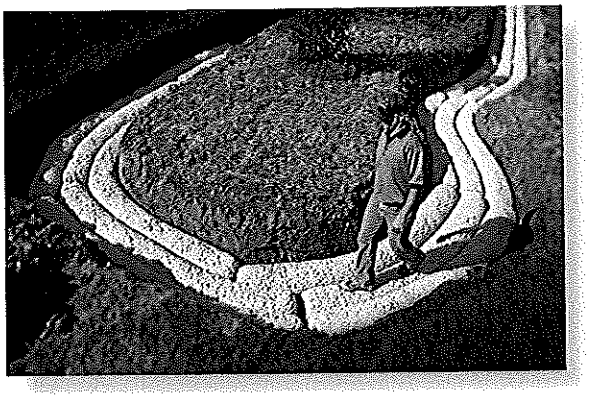
P: 1-800-649-0253
F: 1-866-279-9203
RingIndustrial.com

RING INDUSTRIAL GROUP, LP®

At A Glance

MISSION STATEMENT

We aspire to REINVENT the gravel drainage business.

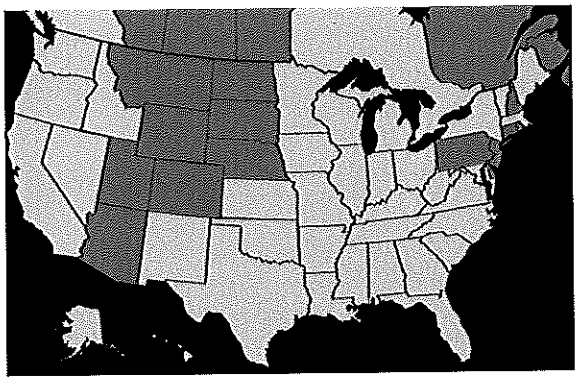


COMPANY PROFILE

Ring Industrial Group's **EZ*flow*®** Drainage Systems are the leading geosynthetic aggregate pipe systems for drainage applications. Manufactured from recycled polystyrene, **EZ*flow*'s** patented design affords consumers maximum system life and performance, lower system costs, and an environmentally friendly alternative.

EZ*flow* is engineered to make installers' jobs easier. **EZ*flow*** is the benchmark of performance, ease of installation, and value in the drainfield industry.

NUMBER OF STATE APPROVALS: 36



Legend: Light Blue = Approvals; Dark Blue = Pending

ESTIMATED NUMBER OF TOTAL IN-GROUND INSTALLATIONS:

300,000+

PLANT LOCATIONS

Brevard, NC	St. Augustine, FL
Monticello, Il	McDonough, GA
Portland, OR	Garner, NC
Duncanville, TX	Oakland, TN (Corporate HQ)

NUMBER OF EMPLOYEES: 200

RING CORPORATE FAMILY

Ring Industrial Group has been a member of the Ring Corporate Family since 2000. As manufacturer of the innovative **EZ*flow*** drainage products, it sets the benchmark with performance, flexibility, and reliability.

Other members of the Ring Corporate Family are:

Ring Container Technologies -- The leading manufacturer of blow-molded containers with plants in 17 U.S. locations, as well as one in England. Their containers are used for coffee creamer, oils, dressings and sauces, and many others.

Rapac -- The nation's largest reprocessor and manufacturer of expanded polystyrene products. These products are used by FedEx, UPS, Mailbox Etc., and EPS molders across the country. There are three RAPAC plants in the United States.

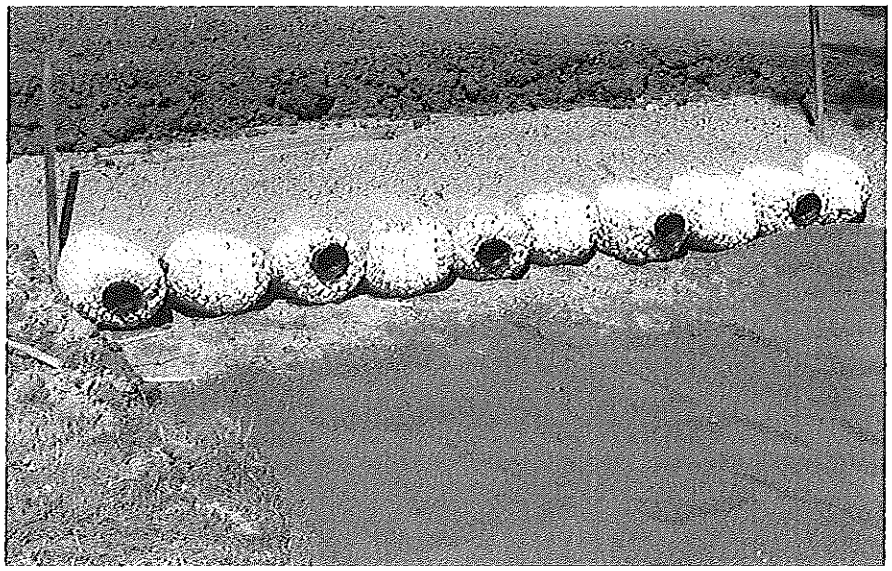
Maine
EZ Selection Guide
3 bedroom, soil profile 3

Do you need a SMALL SYSTEM FOOTPRINT?

Definitely →

1202 Cluster

5.36 sq ft per linear ft

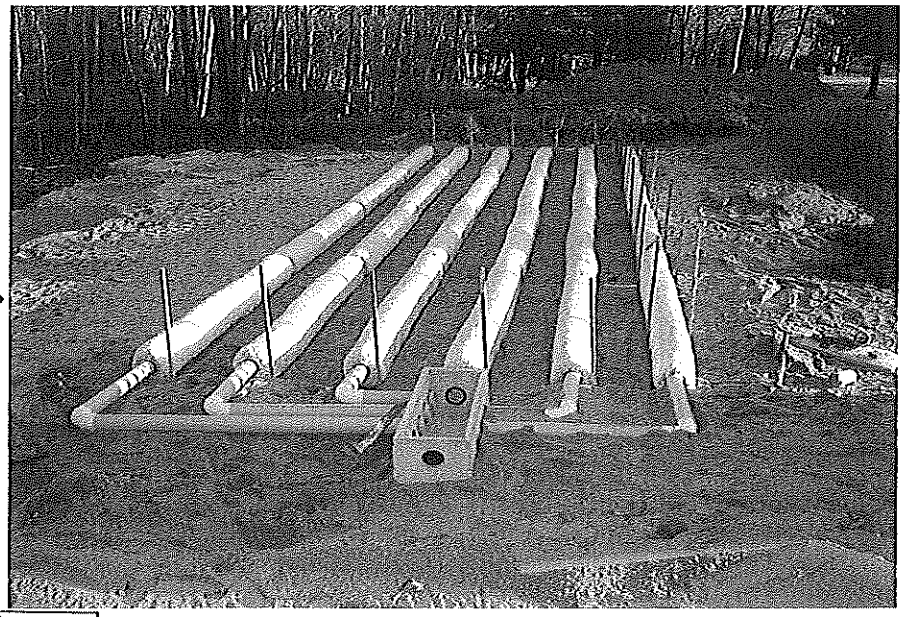


18' x 20'

NO

Do you need the most AFFORDABLE system?

YES →



1201 Trench

4.0 sq ft per linear ft

NO

Do you want the most EFFECTIVE system?
(lots of sidewall)

YES →

April 2009

TECHNICAL REPORT

TECHNICAL REPORT 3001 AUGUST 2005

WASTEWATER STORAGE VOLUME REQUIREMENTS

EZflow® systems are designed to deliver effluent into the soil.

INTRODUCTION

Of the many issues surrounding drainfield design criteria, surge and/or storage volume, in the opinion of many onsite leaders, is of least importance. Nevertheless, some have attempted to make this issue one of major importance. This report will separate drainfield facts from myths regarding the importance of wastewater storage volume.

DRAINFIELD FUNCTION

The underlying purpose of any drainfield is to create a subsurface interface with the soil in order to transfer wastewater for treatment and dispersal. In the design of drainfield systems, three variables are used to determine trench sizing: (1) effective soil interface area of the trench or product, (2) long term acceptance rate of the soil, and (3) estimated daily flows. Of these three, the estimated daily flow typically has the greatest safety factor applied (2.3 to 3.6 times the total daily flow ...EPA Manual 2002). The key to drainfield performance lies in the effective soil interface area created by lining the trench with gravel aggregate or by utilizing an engineered product and its ability to transmit wastewater.

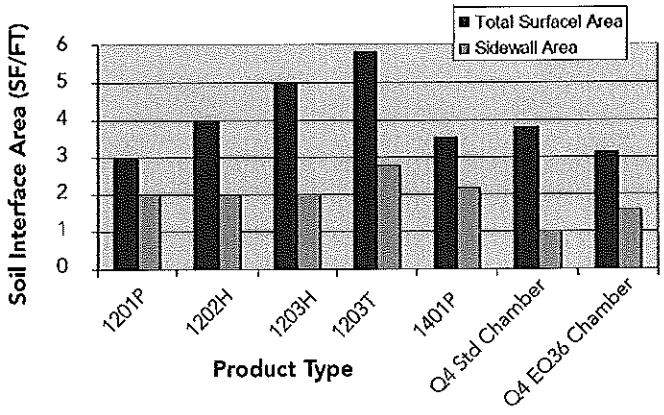
SOIL INTERFACE AREA

The amount of flow out of a system is directly related to the soil interface area of the system. The greater the soil interface area, the greater the outflow capability of the system. As a component of onsite wastewater systems, drainfields are not designed to store, at length, volumes of wastewater; instead they are designed to move volumes of wastewater from septic tanks into the soil. Storage volume becomes irrelevant if a system cannot deliver effluent to the soil. Any system designed primarily around storage volume rather than infiltrative area will eventually fail. **EZflow** systems are designed to deliver effluent into the soil. As shown in Figure 1, **EZflow** systems maximize soil interface area per linear trench foot.

WHY IS SOIL INTERFACE AREA IMPORTANT?

- Increased soil interface area enhances outflow capability of the system.
- Reduces organic loading per unit area of soil.
- Facilitates treatment of effluent.
- Increases system life.

Figure 1: Soil Interface Area Comparison



TOTAL STORAGE VOLUME

Two factors must be considered in determining the sizing of an onsite wastewater trench: (1) the outflow capability of the drainfield and (2) the static volume of the drainfield. Static volume provides a temporary buffer during peak flow conditions. An example of a peak condition could be the simultaneous use of two or more high volume appliances such as a dishwasher and washing machine. EPA estimates that under these conditions, outflows can approach 15 to 20 gallons per minute. Considering the needs of a typical household on laundry day (a common peak condition), there is a need for additional static volume of 200 gallons, resulting from five loads of laundry.

The dynamic volume, or outflow capacity of the drainfield directly impacts its effectiveness. If the daily inflow of effluent surpasses the outflow capability of the system for a prolonged period of time, the system will fail regardless of the amount of static volume. Consider the analogy of North Carolina State Professor Emeritus, Dr. Bob Rubin, "Trench systems are like bathtubs, once the drain is completely clogged, the size of the tub does not matter. It's going to overflow." The outflow capability is dictated by the soil interface area, therefore to increase the efficiency of the drainfield, the dynamic volume should be maximized, not the static volume.

Total Volume = Static Volume + Outflow Capacity

While it has been claimed that all drainfield products must provide equivalent storage volume as the gravel standard, this logic does not seem to hold up. Many systems, such

TECHNICAL REPORT

TECHNICAL REPORT 3002 APRIL 2006

MASKING IS A MYTH

EZ*flow*® products have superior flow at the trench bottom due to its lack of fines and compaction.

INTRODUCTION

Over the last 10 to 20 years, many members of the onsite community have pronounced masking as an important issue for drainfield development and performance. They have stated that masking, or the concept that gravel (or other solid objects) embeds itself within an infiltrative surface zone, will reduce the physical infiltrative surface area that is accessible for effluent infiltration. It has even been said that the amount of masking is directly proportional to the amount of media in contact with the soil area – meaning that the more contact material makes with the soil, the less effluent will infiltrate the soil. **These assumptions, however, are simply misleading.**

Research data clearly shows that **EZ*flow*** products and the **EZ*flow*** aggregate do NOT restrict flow at the trench bottom. To the contrary, the flow at the bottom of an **EZ*flow*** system is **enhanced** due to:

- a design that leads to unobstructed flow due to lack of fines
- a higher pressure head caused by volume displacement due to the aggregate.

Outlined in this report is a technical evaluation and comment to the application of the concept of masking regarding **EZ*flow*** brand drainfield products.

RESEARCH

Reduction of flow at the trench bottom is a function of both the length and the conductivity of the resistance layers at the trench bottom. This work was developed and published by Dr. Kevin White and Dr. Larry West in their juried article titled, ***"In-ground Dispersal of Wastewater Effluent: The Science of Getting Water into the Ground"***, which was published in ***Small Flows Quarterly, Spring 2003, Volume 4, No. 2.***

In addition, research by Dr. William Jana of the University of Memphis, due for publication in 2006, demonstrates the depth of submergence of a solid object into a surface layer does indeed influence the flow past the object. However, the amount of resistance to flow and corresponding flow reduction is dependent on the amount of volume displacement in the soil. Simply stated, it is an issue of displacement of soils or within a soil layer rather than "masking" or "embedment" of the infiltrative surface of the trench that is the issue.

Figure 1: SOIL DISPLACEMENT

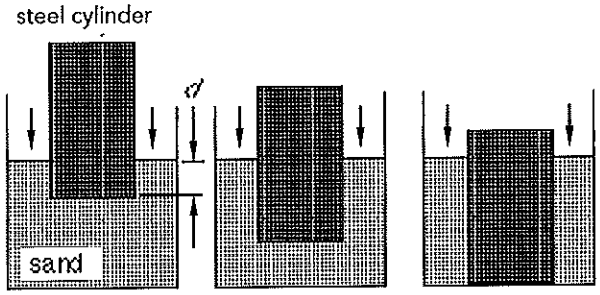


Figure 1: The volume of flow rate through a saturated layer is reduced proportionally to the volume of soil that is displaced within the layer -- not due to:

- the percent surface area that is "masked" by a solid object.
- a cylinder embedded into the soil.

LEGACY REPORT

2226*

Reissued August 1, 2008

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

The Subcommittee on Evaluation has reviewed the data submitted for compliance with the *Standard Building Code©*, the *Standard Plumbing Code©*, the *Florida Building Code - Building*, the *International Private Sewage Disposal Code*, and the *International One and Two Family Dwelling Code* and submits to the Building Official or other authority having jurisdiction the following report. The Subcommittee on Evaluation, and ICC-ES and its staff are not responsible for any errors or omissions to any documents, calculations, drawings, specifications, tests or summaries prepared and submitted by the design professional or preparer of record that are listed in the Substantiating Data Section of this report.

REPORT NO.: 2226*

EXPIRES: See the current EVALUATION REPORT INDEX

CATEGORY: FOUNDATION SYSTEMS

SUBMITTED BY:

RING INDUSTRIAL GROUP
EZ FLOW BRANDS
65 INDUSTRIAL PARK ROAD
OAKLAND, TENNESSEE 38060

1. PRODUCT TRADE NAME

1.1 EZflow 0701
1.2 EZflow 1001
1.3 EZflow 1201

2. SCOPE OF EVALUATION

Footing drain and septic tank drain lines

3. USES

Footing and foundation drainage and septic tank drain lines.

4. DESCRIPTION

4.1 EZflow 0701

The EZflow 0701 is a prefabricated drainage system designed to replace stone aggregated subsurface drains. It consists of a 3 inch (76 mm) diameter perforated corrugated plastic pipe surrounded by 2 inches (51 mm) of aggregate. The aggregate is an expanded polystyrene (EPS) and is held in place with a polyethylene or geo-textile netting. The aggregate is treated with calcium sterate. It is supplied in 5 foot (1.5 m) and 10 foot (3 m) long sections.

4.2 EZflow 1001

The EZflow 1001 is a prefabricated drainage system designed to replace stone aggregated subsurface drains. I consists of a 4 inch (102 mm) diameter perforated corrugated plastic pipe surrounded by 3 inches (76 mm) of aggregate. The aggregate is an expanded polystyrene and is held in place with a polyethylene or geo-textile netting. The aggregate is treated with calcium sterate. It is supplied in 5 foot (1.5 m) and 10 foot (3 m) long sections.

4.3 EZflow 1201

The EZflow 1201 is a prefabricated drainage system designed to replace stone aggregated subsurface drains. It consists of a 4 inch (102 mm) diameter perforated corrugated plastic pipe surrounded by 4 inches (102 mm) of aggregate. The aggregate is an expanded polysytrene and is held in place with a polyethylene or geo-textile netting. The aggregate is treated with calcium sterate. It is supplied in 5 foot (1.5 m) and 10 foot (3 m) long sections.

4.4 Septic Tank Drain Lines

EZflow 1001 and EZflow 1201 may be used for septic tank drain lines. When used as septic tank drain lines, one or more bundles of only EPS aggregate are placed in the trench with the drain lines.

5. INSTALLATION

5.1 General

The manufacturer's published installation instructions shall be strictly adhered to and a copy of these instructions shall be available at all times on the jobsite during installation.

5.2 Foundation Drains

The EZflow 0701 is installed on foundation walls that are up to five concrete masonry units high [42 inches (1067 mm)]. The maximum allowable length of the drain is 220 feet (67 m).

The EZflow 1001 is installed on foundation walls that are up to 20 concrete masonry units high [170 inches (4318 mm)].

The EZflow 1201 is installed on foundation walls that are greater than 20 concrete masonry units high [170 inches (4318 mm)].

Design and Installation Instructions for EZ*flow*® Foundation Drainage Systems

1. The **EZ***flow* EPS Aggregate Drainage System is a substitute for gravel and pipe in foundation drains. Unless otherwise stated by the manufacturer, the installation of the **EZ***flow* EPS Aggregate Drainage System in foundation drain trenches should be similar to an installation of gravel and pipe in foundation drain systems.

2. The **EZ***flow* bundles for Foundation Drain applications come in 7" OD with a 3" slotted plastic pipe, and 10" OD with a 4" slotted pipe surrounded by expanded polystyrene (EPS) aggregate fixed in polyethylene netting. The aggregate only bundles consist of EPS aggregate, fixed in polyethylene netting.

3. The plastic stretch wrap should be removed before the five or ten foot long bundles are placed in the trench(es). Do not place removed wrap in trench.

4. In cases where the length required is not in multiples of 5 or 10, the installer or contractor may:

   a. Cut the product down to the needed length and refasten the netting to the pipe, or

   b. Use an additional 5 or 10 feet of product to exceed the required trench length.

5. The **EZ***flow* EPS Aggregate bundles are flexible and can curve around foundations so that no 45° or 90° bends or elbows are necessary.

6. Place the pipe-containing bundle in the trench or on top of the foundation first. The pipe-containing bundles are connected by a standard quick-connecting internal coupler Bundles containing aggregate only are butted end-to-end.

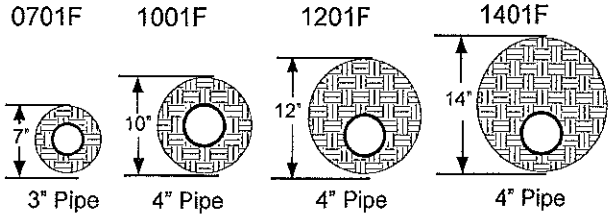
7. Place additional aggregate bundles on top of the pipe-containing bundle until desired height has been achieved. Once the desired height has been achieved, the **EZ***flow* system shall be covered with untreated building paper, a geotextile fabric or other suitable material permitted by the approving authority.

8. Aggregate bundles stacked against a foundation wall can be temporarily held in place by straps, ties, tape, etc.

9. Backfill should be of native soil. Soil within 6" of the EPS bundles shall be loosely placed and not compacted.

10. The **EZ***flow* Drainage System Products used in Foundation Drains are approved by the ICC in an ICC Legacy Report. **EZ***flow* foundation drain installations meet all applicable building codes and specifications.

EZ*flow* Product Sizes



EZ*flow* Accessories

- 3" and 4" Internal Couplers
- 3" and 4" Internal End Caps
- 3" and 4" Internal Tees
- 3" and 4" Internal Wyes

The EZ*flow* Polystyrene Rock

100% Recycled Polystyrene Aggregate

EZflow® Drainage Systems Product Selection Guide

7" Products

Description	Part Number	Package Quantity	Pipe Diameter	Covering[1]
7" OD Aggregate Only Bundle	0701-A	9	n/a	Netting
7" OD Bundle, slotted pipe	0701-F	9	3"	Netting
7" OD Aggregate Only Bundle, geotextile mesh	0701-A-MESH	9	n/a	Mesh
7" OD Bundle, slotted pipe, geotextile mesh	0701-F-MESH	9	3"	Mesh
3" Internal Coupler	AC-COUPLER-3	50		
3" Internal Tee	AC-TEE-3	25		
3" Internal Wye	AC-WYE-3I	25		

10" Products

Description	Part Number	Package Quantity	Pipe Diameter	Covering[1]
10" OD Aggregate Only Bundle	1001-A	5	n/a	Netting
10" OD Bundle, slotted pipe	1001-F	5	4"	Netting
10" OD Aggregate Only Bundle, geotextile mesh	1001-A-MESH	5	n/a	Mesh
10" OD Bundle, slotted pipe centered, geotextile mesh	1001-FC-MESH	5	4"	Mesh
10" OD Bundle, slotted pipe on bottom, geotextile mesh	1001-FB-MESH	5	4"	Mesh
4" Internal Coupler	AC-COUPLER-4	50		
4" External Tee	AC-TEE-4	25		
4" External Wye[2]	AC-WYE-4E	25		
4" External End Cap[3]	AC-CAP-4E	25		

15" Products[4]

Description	Part Number	Package Quantity	Pipe Diameter	Covering[1]
15" OD Aggregate Only Bundle, geotextile mesh	1501-A-MESH	2	n/a	Mesh
15" OD Bundle, slotted pipe centered, geotextile mesh	1501-FC-MESH	2	6"	Mesh
15" OD Bundle, slotted pipe on bottom, geotextile mesh	1501-FB-MESH	2	6"	Mesh
6" Internal Coupler	AC-COUPLER-6	10		
6" External Tee	AC-TEE-6	10		
6" External Wye	AC-WYE-6	10		

[1] Note: Requires field installed covering. Mesh covering is factory installed.
[2] Note: Available at the Brevard, NC plant only.
[3] Note: Available at the Brevard, NC and Portland, OR plants only.
[4] Note: Available at the Garner, NC plant only.

Ring Industrial Group
30 Industrial Park
Oakland, TN 38060

PERFORMANCE. EZ DOES IT.™

P: 1-800-649-0253
F: 1-866-279-9203
RingIndustrial.com

RING

INDUSTRIAL GROUP

MAINE

Request for Approval

of EZ*flow* Systems

November 21, 2006

November 21, 2006

James A. Jacobsen, ES IV
Department of Health and Human Services
Division of Environmental Health
Subsurface Wastewater Program
286 Water Street
Augusta, ME 04333

Dear Mr. Jacobsen,

Please accept this letter and the attachments as our request for approval of the following Ring Industrial Group, **EZ***flow* branded products: 1201P, 1201P GEO, 1202H, 1202H GEO, 1203H, 1203H GEO.

I very much appreciate the opportunity to meet with you on November 30, 2006 to go over this request in person to discuss what other information if any; you might need in order to act upon our request.

In this initial packet I have included product drawings and specification sheets. I have included three studies that compare how our products compare to the traditional gravel drainfield as well as to other graveless products. Dr. Kevin White's study is a laboratory study comparing the various drainfield components, Dr. Bob Rubin's is a field demonstration of reduced trench sizes for various products, and Dr Robert Uebler's Field Survey compares the failure rates for reduced field size products with the conventional gravel trench. Dr. Uebler's study was one of the major attractions at this year's NOWRA Conference.

I have also included copies of three of the 31 other state approvals we currently have issued. I chose these states because we not only have a long history there but so do other companies with which we compete with reduced drainfield sizes compared to gravel and pipe trenches. I can provide other state approvals upon request.

I look forward to meeting you and working together to bring our quality products to your state.

Sincerely,

Theo B. Terry, III, RS
Manager of Technology

Enclosures

Ring Industrial Group
65 Industrial Park
Oakland, TN 38060

PERFORMANCE. (EZ) DOES IT.

P: 1-800-649-0253
F: 1-866-279-9203
RingIndustrial.com

Maine Department of Health and Human Services
Bureau of Health
Division of Health Engineering
Wastewater and Plumbing Control Program

APPLICATION FOR REGISTRATION OF EXPERIMENTAL SYSTEM/INNOVATIVE TECHNOLOGY OR ONSITE SEWAGE DISPOSAL SYSTEM PRODUCT

Please complete the following Sections. Please print or type.

Applicant

Company Name: Ring Industrial Group

Contact Person: Theo B. Terry, III

Address: 65 Industrial Park

Town/City: Oakland State/Province: TN Zip Code: 38060

Country: USA

Telephone: 901-465-9581 ext 212 e-mail: theo.terry@ringindustrial.com

Product

Product Name: EZ flow

Model: 1201P, 1201P GEO, 1202H, 1202H GEO, 1203 H, 1203H GEO

Product Classification (choose one)

Primary or Secondary Treatment Unit

[ ] Septic Tank [ ] Extended Aerobic Treatment Unit [ ] Recirculating Aerobic Unit

[ ] Aerobic Fixed Film Unit [ ] Other (specify) _____

Effluent Filter

[ ] Septic Tank Outlet Filter [ ] Post-Tank Filter [ ] Other (specify) _____

Disposal Device

[ ] Gravel-less Disposal Pipe [X] Gravel-less Disposal Bed [ ] Chamber, Plastic

[ ] Chamber, Other [ ] Other (specify) _____

Miscellaneous

[ ] Pipe [ ] Effluent Flow Distribution Device [ ] Other (specify) _____

Claim

Describe the product's features (attach additional sheets if necessary).
See attached documents

Describe the product's performance (attach additional sheets if necessary).
See attached documents

Has the product received National Sanitation Foundation or Canadian Standards Authority approval?

[X] No [ ] Yes (If "yes", enclose a copy of the certification.)

IMPORTANT NOTE!

Don't forget to enclose relevant product literature, engineering specifications, studies, and third party certifications with this application.

I, Theo B. Terry, III, am the [X] applicant [ ] agent for the applicant of the subject product.
(print name)
I state that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department to deny registration for use of the product in Maine.

Theo B. Terry III
[X] Signature of Applicant
[ ] Signature of Agent for Applicant

November 21, 2006
Date

Soil Column Studies

Kevin D. White, Ph.D., P.E.

Mark Christopher Green
John Crane

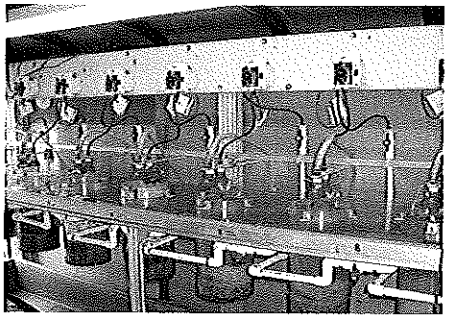
University of South Alabama
Department of Civil Engineering

June 2005

Purpose of the Column Studies

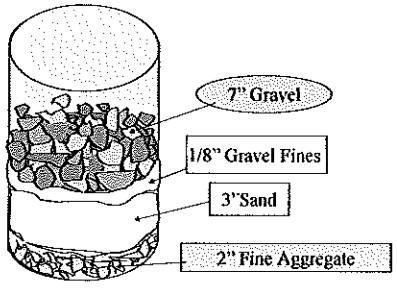
- To define **organic loading rates** for various effluent trench design.
- *Ten columns were constructed as follows:*

Column Study Setup

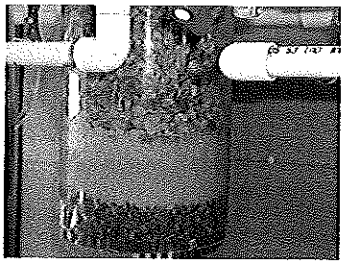


Columns 1 & 2

Washed gravel & fines over sand

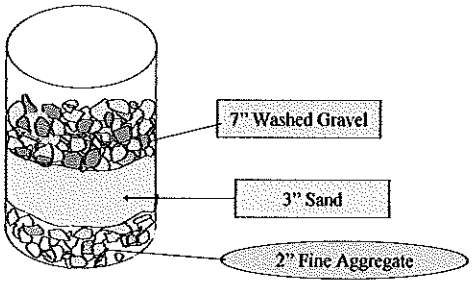


Gravel and Fines

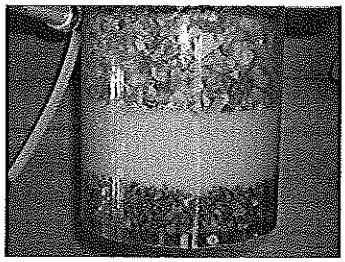


Columns 3 & 4

Washed gravel over sand

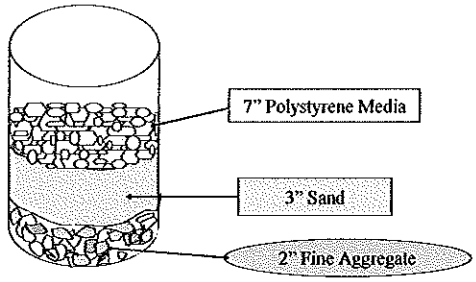


Gravel, No Fines

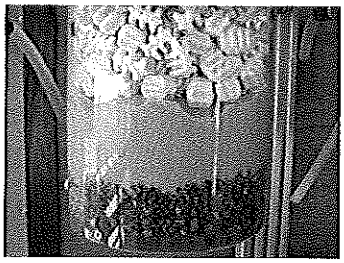


Columns 5 & 6

Polystyrene beads over sand

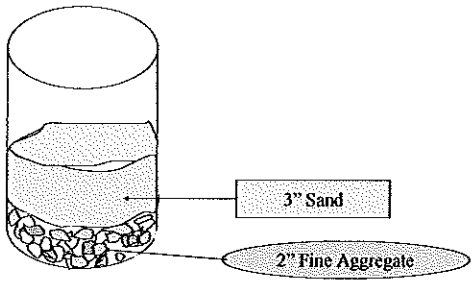


PolyStyrene

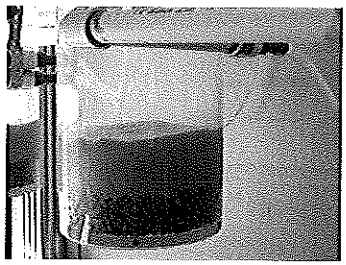


Columns 7 & 8

open system (sand only)

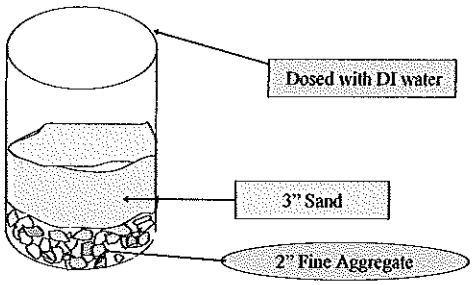


Open System, No Gravel



Columns 9 & 10

Open system, sand only, DI water dosed



Column Material Effective Size and Uniformity

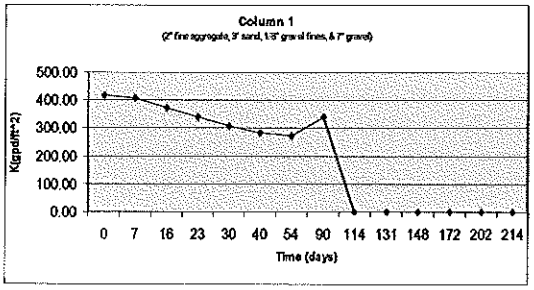
Gradation Data

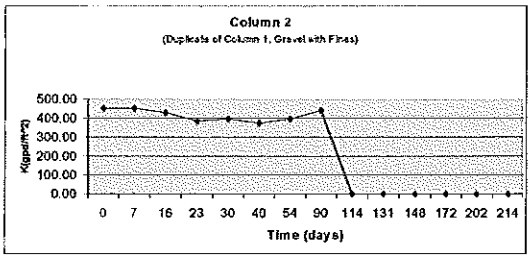
Material	Effective Size (mm)	60-percentile (mm)	Uniformity
Recovered Aggregate	1.2	6	5
Support Aggregate	2.6	4.2	1.6153846
Sand	0.105	0.52	4.952381
Recovered Gravel	7	10.75	1.5357143
Gravel	7	12	1.7142857

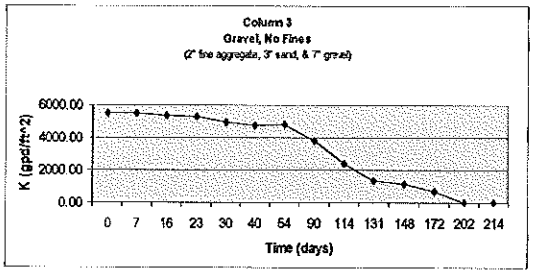
Effluent Dosage

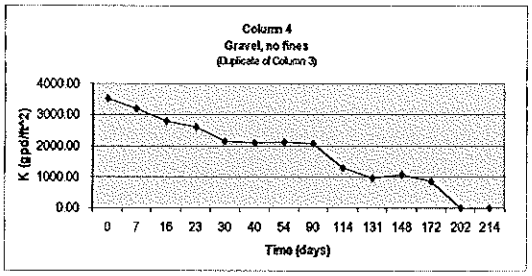
- **2.7L** of effluent in a **24h** period
- **0.9L** dose at **8a, 2p,** and **8p**
- Hydraulic loading rate **2.0 gpd/ft^2**
- Organic loading rate **0.001 lb/day/ft^2**

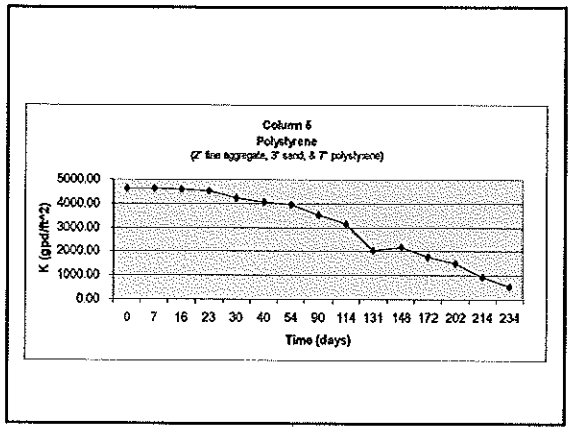
Hydraulic Conductivity Test Results

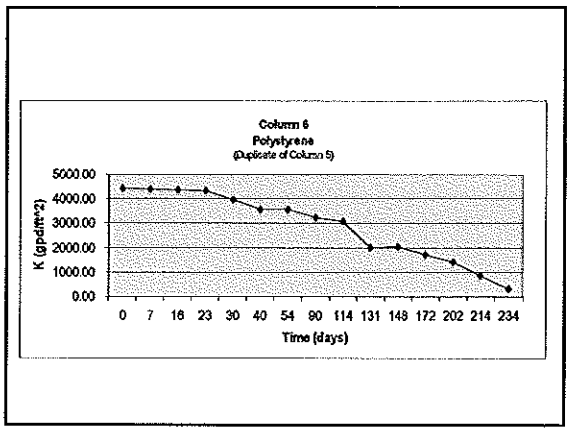


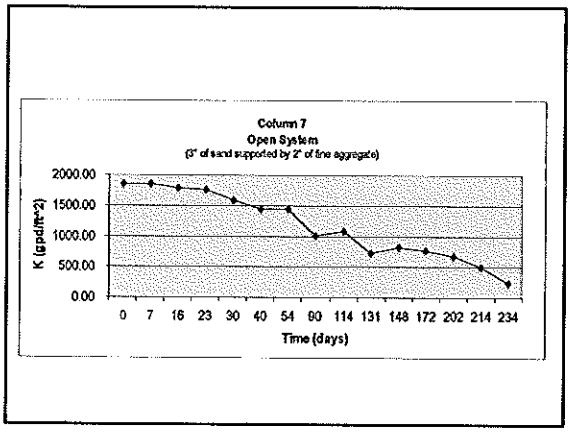


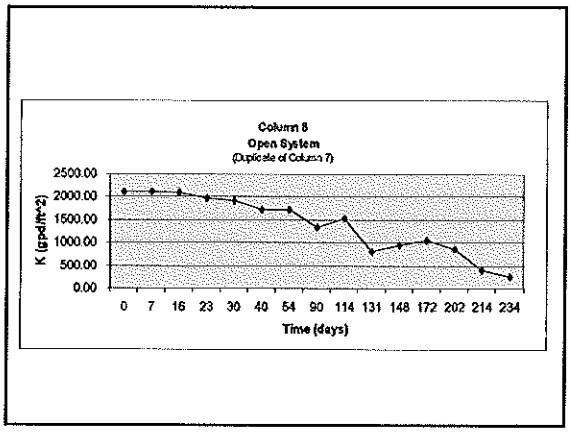


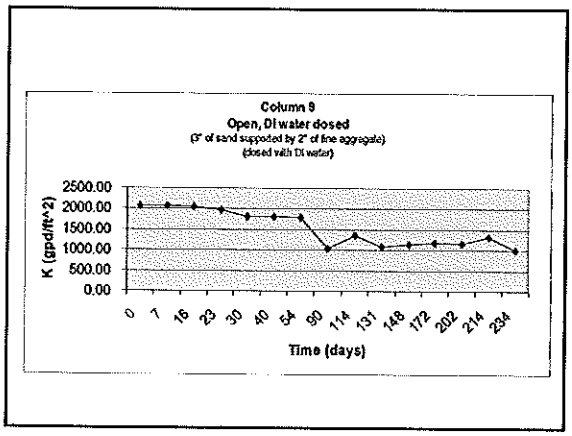


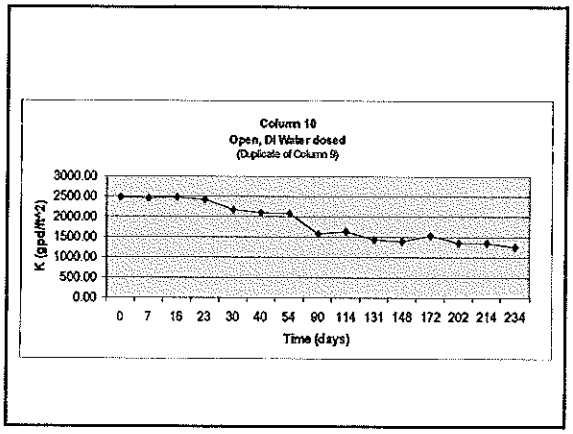

Column 5
Polystyrene
(2" fine aggregate, 3" sand, & 7" polystyrene)
K (gpd/ft^2)
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)


Column 6
Polystyrene
(Duplicate of Column 5)
K (gpd/ft^2)
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)


Column 7
Open System
(3" of sand supported by 2" of fine aggregate)
K (gpd/ft^2)
2000.00
1500.00
1000.00
500.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)


Column 8
Open System
(Duplicate of Column 7)
K (gpd/ft^2)
2500.00
2000.00
1500.00
1000.00
500.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)


Column 9
Open, DI water dosed
(3" of sand supported by 2" of fine aggregate)
(dosed with DI water)
K (gpd/ft^2)
2500.00
2000.00
1500.00
1000.00
500.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)


Column 10
Open, DI Water dosed
(Duplicate of Column 9)
K (gpd/ft^2)
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
0 7 16 23 30 40 54 90 114 131 148 172 202 214 234
Time (days)

Effluent Dose Characteristics

- **BOD** 36 – 57 mg/L (47 mg/L avg.)
- **TSS** 17 mg/L
- **Ammonia** 15 mg/L

Organic Loading Rate

- **Current organic loading rate 0.001 lb/ft^2/day with an average BOD of 46.4.**
- The study done at the University of Florida (Bloomquist) concluded that the organic loading rate should be **< 0.0015 lb/ft^2/day**.
- The EPA Wastewater Treatment Systems Manual suggests an organic loading rate to be **< 0.001 lb/ft^2/day** for a **BOD of 150** and **< 0.0004 lb/ft^2/day** for a **BOD of 30** in coarse, sandy soil.

Conclusions to Date

- Fines negatively impact hydraulic conductivity
  - Initial hydraulic conductivity is much lower
  - Failure occurs quickly (weeks)
- Organic loading rate of 0.001 gpd/ft^2 forms a significant biomat that can severely reduce hydraulic conductivity
- DI water loading shows that its organic loading and biomat that causes hydraulic conductivity failures

Monitoring of Liquid Levels in Selected Dispersal Systems over Time

Robert Rubin, Professor Emeritus, NCSU – BAE
In cooperation with
Houston Crumpler,
Crumpler Plastic Pipe, Roseboro, NC.

Options for dispersal of liquid in soils vary dramatically. Trench characteristics have been identified as one of several factors in the performance of land based wastewater systems. Previous work (Converse, Keys, Tyler, 1998; Loudon, 1994) suggests that the trench options typically accumulate liquid gradually until liquid ponding begins and that further migration of liquid from the trench into the adjacent soil occurs through the trench bottom and the trench sidewall – particularly that at the uppermost fringe of the wetted volume. This assessment of performance of various trench configurations was accomplished at a single site in North Carolina. The site where the testing occurred was a construction office employing 8 persons.

Design flow – 8 employees @25 gallons/employee/day or 200 gpd
Soil: Wagram, deep sand, measured permeability of 2.2 to 2.4 inches per hour. NRCS reports 2 inch per hour in subsoil at depth of 24 to 30 inches. These are the depths where systems placed.
Design load: 0.5 gal/ft sq/day
Area: 200/0.5 = 400 ft sq
Pressure manifold utilized to lift liquid from facility to treatment site. System consists of 1200 gal septic tank and 1200 gallon pump tank.
Configuration; 6 trench configurations and 2 experimental systems developed by Crumpler Plastic Pipe.

Trench configurations or characteristics are:

1. Control: 30 in x 30 in x 20 ft gravel trench designed for 25 gpd or 50 square feet (20 feet of 2.5 ft trench)
2. Chamber developed to allow the 25% reduced length permitted in NC laws and rules (15 feet)
3. EPS (1203H) (15 feet)
4. EPS (1203 T) (15 feet)
5. 10 in fiber wrap pipe (25 feet)
6. 12 inch EPS (1201) (25 feet)

Two experimental dispersal technologies

A 1200 gallon septic tank with a Zabel 1800 Screen provided primary treatment. Flow was directed from the septic tank to a 1200 gallon pump tank and from there through a 0.4 HP Little Giant Effluent Pump to the treatment site. Wastewater was pumped twice a day to a pressure manifold and from the pressure manifold, liquid was directed simultaneously to each of the test trenches.

Liquid was dispersed along a gravity gradient from the manifold to the trenches. A pump was required because the treatment site was up-gradient of the office. The trenches were established with liquid level monitoring ports extending from the trench bottom to the soil surface. The monitoring ports were covered when not in use. Liquid levels were monitored monthly to determine the level of ponding in each of the trenches with time. The study was conducted for three (3) years. Liquid levels are thought to represent an indicator of the acceptance of liquid into the soil through the initial trench/soil interface or barrier. The liquid level monitoring port was located approximately at a point representing 60% of trench length. In a 20 foot trench, the port was at 12 feet from the inlet. In a 15 foot trench, the port was at 10 feet from the inlet. In a 25 foot trench, the port was at 15 feet from the inlet. Liquid levels were monitored monthly (generally the first Sunday in each month). This sampling regimen limits the reliability of the data since system use was generally limited over weekends and the liquid discharged on Friday had some time for assimilation between the Friday dosing and the Sunday dosing.

In addition to the liquid level monitoring, a series of moisture sensors (irrometer watermark indicators) were placed at specified locations adjacent to each of the trenches to monitor moisture levels in the soil. Moisture levels are thought to represent a model for movement of liquid into and through the soil. Moisture follows gradients from low tension to higher tension and the indicators selected reportedly measure moisture tension. These devices proved to be difficult to utilize because of inadequate contact between soil and device. Recent modifications to the indicators reported by Irrometer should allow improved capability to monitor moisture tension. Moisture monitoring data is sporadic and is not reported in this presentation.

Results:

Liquid levels:

All trenches received nearly the same volume of liquid. No meters were utilized on each of the lines, but the manifold was developed to supply near identical volumes to each of the trenches with each dose. Each of the trenches was developed utilizing design criteria established in NC Laws and Rules.

Liquid levels in the gravel trench achieved an apparent equilibrium at approximately 9 months from beginning the project. The chamber and the horizontal EPS achieved an apparent equilibrium at approximately 15 to 18 months and the remaining trenches at approximately 18 to 20 months. This equilibrium was defined as the beginning of observed ponding between dosing events.

Discussion:

These relationships are presented graphically in the figures attached. The monitoring demonstrates the importance of the uppermost level of the liquid fringe in the long term acceptance of liquid into soil systems. This zone is exposed to ponding and aeration and the 0.25 to 1.0 or more inch fringe developed (see chart) facilitates the acceptance of liquid dosed into the soil absorption trench. Systems were dosed 2 times per day. Each dose designed to deliver 12.5 gallons to each of the trenches. The area through which this liquid moved can be calculated based on system geometry and the height of the fringe. Rough calculations for each of the trench configurations are presented below.

1. 25 foot trench with 12 inch trench with 1 inch fringe: ((25ft x 2)+2) x 0.08 ft = 4.33 sq ft
2. 20 foot trench with 24 inch trench and 0.5 inch fringe: ((20ft x 2)+4) x 0.04 ft = 1.76 sq ft
3. 15 foot trench with 36 inch trench and 0.4 inch fringe: ((15ft x 2)+6 x 0.03ft = 1.1 sq ft

The 12.5 gallons must move through the fringe area and the trench bottom. The capacity of these sandy soils to transmit liquid is high. The soil survey of Sampson County indicated values of between 0.6 and 2 inches per hour and measured permeability at the bottom of the trenches ranged from 2.2 to slightly over 2.4 inches per hour. The capacity of these sandy soils to transmit liquid is estimated as much as several feet per day and the potential to move 12.5 gallons through a 1 square foot area in 12 hours is not unrealistic.

12.5 gallons of water represents 12.5 gallons/7.48 gallons per cubic foot = approximately 1.5 cubic feet of water. The 1.5 cubic feet through a 1 square foot window in 12 hours requires the soil transmit 3 feet of water per day. The potential to move liquid increases as the square footage of fringe area increases. Consequently, the potential to move liquid through the larger area associated with the longer trenches is not unrealistic.

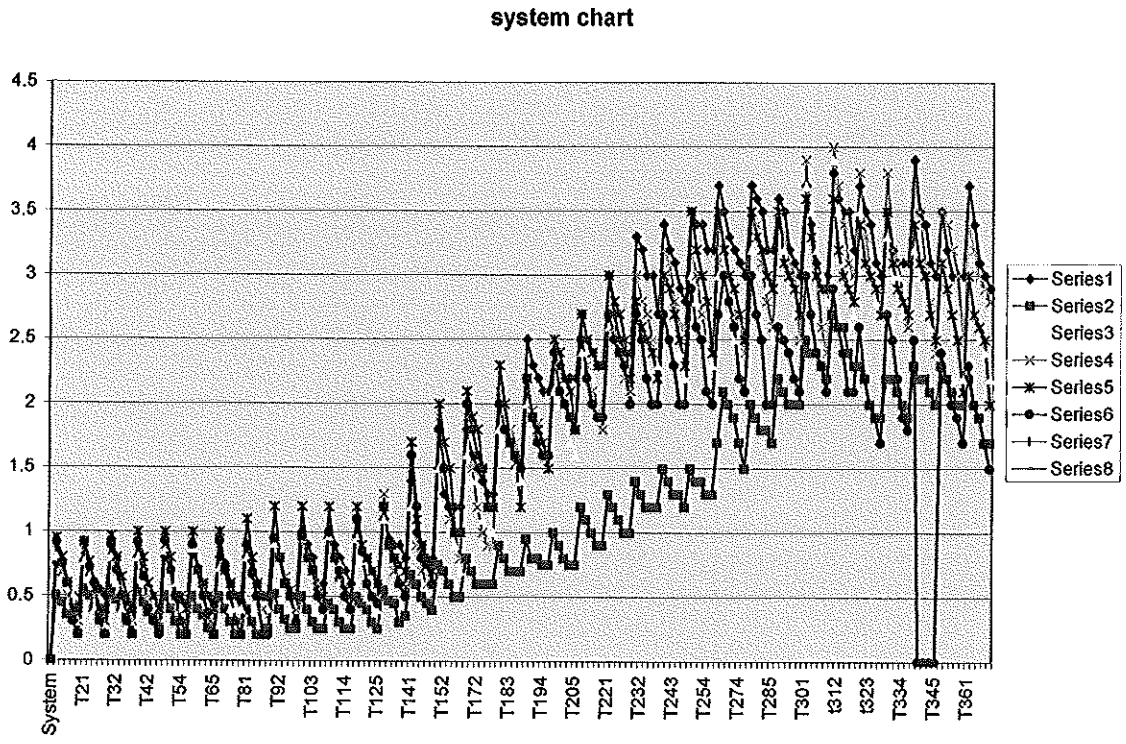
Facilities are designed routinely with a reduction in the area required for assimilation of a specified design flow. The use of a slight reduction in "footprint" did not adversely impact the performance of the systems developed in Sampson County. The flows are small. Extrapolation of the reduction from a single lot treating between 200 GPD and 500 or 600 GPD to a site receiving thousands of gallons per day can not be established. Criteria for larger flows must be established on a site by site basis.

The data collected from this single demonstration can not be extrapolated to justify any greater reductions in area associated with soil systems. Data collected in this demonstration represent no attempt at replication. The wastewater flow from the facility limited the potential for replication on this site. Since the site was developed, several additional sites have been identified and the study will be replicated.

Conclusions:

Liquid levels in soil absorption systems accumulate through time. The goal of our wastewater management efforts should be one of developing sustainable solutions to wastewater management. Dosing and resting does appear to limit ponding in trench systems.

No attempt to measure treatment levels was undertaken in this demonstration. The soil system is assumed to provide reliable treatment provided systems are designed appropriately. There was no evidence of trench volume increasing to a maximum level potentially stored in any of the trenches. Storage was not an issue in this study since the goal was to facilitate discharge from the trench system into the adjoining soil. There was no evidence of plumbing that failed to discharge from the facility served. Each of the systems examined performed satisfactorily through the duration of this demonstration.



Performance of Chamber and EZ1203H Systems Compared to Conventional Gravel Septic Tank Systems in North Carolina

R.L. Uebler, S. Berkowitz, P. Beusher, M. Avery, B. Ogle, K. Arrington and B. Grimes

Abstract

The North Carolina On-Site Wastewater Section conducted a statewide survey, which compared the performance of chamber and EZ1203H systems with 25% trench length reduction to conventional gravel systems. A total of 912 systems were randomly chosen in 6 counties across the state. To control evaluation bias, a group of students from Western Carolina University were hired to inspect each system. A system was considered to have failed if there was evidence of sewage at the ground surface or if an owner reported problems with the system. The statewide failure rate of both standard chamber and EZ1203H systems compared to conventional gravel systems was not statistically different at a 95% confidence level.

INTRODUCTION

Recent legislation in North Carolina provides for the designation of approved Innovative on-site wastewater systems as accepted systems. The legislation was supported by Innovative product manufacturers, because of a perceived stigma attached to Innovative designation of their product, and real permitting differences for Innovative products compared to conventional gravel systems, which were required by the state. Systems, which receive accepted system approval, may be permitted in the same manner as conventional septic tank systems. In order to achieve accepted system status, the manufacturer of a system must submit evidence that the system has been in general use in the state for 5 years. In addition, the manufacturer shall provide the Commission for Health Services with information sufficient to enable the Commission to fully evaluate the performance of the system in this State for at least the five-year period immediately preceding the petition. Rule was subsequently developed by the state, which established the requirements for what constituted "sufficient information" for the Commission to make their evaluation. For trench systems, the Rule requires "the field evaluation of at least 250 randomly selected innovative systems compared with 250 comparably-aged randomly selected conventional systems, with at least 100 of each type of surveyed system currently in use and in operation for at least five years. Systems surveyed shall be distributed throughout the three physiographic regions of the state in approximate proportion to their relative usage in the three regions. The survey shall determine comparative system failure rates, with field evaluations completed during a typical wet-weather season (February through early April), with matched innovative and conventional systems sampled during similar time periods in each region" (NCDEHNR. 2006).

Infiltrator, Inc., which manufactures a chamber system, and Ring Industrial Group, which manufactures the EZ1203H polystyrene aggregate system, subsequently applied for accepted

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system designation. In addition to Infiltrator, three other chamber manufactures, Advanced Drainage Systems, Inc., manufacturer of the Bio-diffuser chamber, Cultec, manufacturer of the Contactor chamber, and Hancor, Inc., manufacturer of the Envirochamber, chose to participate in the survey required for system approval. The objective of the survey was to determine the failure rate of the chamber and EZ1203H systems compared to conventional gravel systems. This paper reports the outcome of the required survey.

Background

Conventional septic tank systems in North Carolina are designed with 3-foot wide trenches, which have a 12-inch gravel depth to provide storage for septic tank effluent. Systems with multiple trenches are spaced with 9-feet of separation between the center of adjacent trenches. A 12 to 18 inch depth of suitable soil is required below the trench to provide treatment of the effluent when it leaves the trench. The amount of trench bottom area required at a site is determined from an evaluation of soil texture. A long-term acceptance rate (LTAR) is chosen for the soil texture found at a site from Table 1.

Table 1. Long-term acceptance rates (LTAR) allowed for the soil texture evaluated at a site.

Soil Group	Texture Family (USDA)	Texture Class (USDA)	LTAR (gpd/ft^2)
I	Sands	Sand, Loamy Sand	1.2 to 0.8
II	Coarse Loams	Sandy Loam, Loam	0.8 to 0.6
III	Fine Loams	Sandy Clay Loam, Silt Loam, Clay Loam, Silty Clay Loam, Silt	0.6 to 0.3
IV	Clays	Sandy Clay, Silty Clay, Clay	0.4 to 0.1

The trench bottom area is then calculated by dividing the design flow, 120 gpd per bedroom, by the LTAR. Trench length is then determined by dividing the required trench bottom area by the trench width of 3 feet.

The chamber systems surveyed in this study were the standard design, which had an average open bottom width of about 29 inches and height of about 12 inches. The polystyrene aggregate systems surveyed were the EZ1203H, which is 12 inches high and 36 inches wide. The North Carolina approval for the both the standard chamber and the EZ1203H, allows for a 25% reduction in trench length compared to a conventional gravel trench system. Other trench requirements for chambers and EZ1203H systems are the same as for conventional systems. Trenches are dug with a 3-foot width, and placed on 9-foot centers, if multiple trenches are required.

Methods and Materials

The Rule developed by the state required that a survey be conducted, which was able to detect if the failure rate, for the standard chamber or EZ1203H systems, was 5 or more percentage points higher than the failure rate for conventional systems. Further, if the comparison showed a difference of at least 5 percentage points (e.g. 9% failure rate for innovative system A and a 4%

failure rate for conventional gravel systems), there should only be a 5% chance that the difference between the two samples would occur by chance. This is the "95% confidence level". If a statistically significant higher failure rate was not detected in the innovative group, than the conclusion would be that the innovative system performs the same as or better than conventional systems. This is a "one sided" test of the difference between proportions.

Preliminary analysis by Dr. Paul Beusher with the NCDHHS State Center for Health Statistics revealed that, a sample size of 300 was needed for each type of system surveyed, in order to conclude with a 95% confidence that a measured failure rate for an innovative system that is 5 percentage points higher than the failure rate for conventional systems is not due to chance. The calculation of required sample size assumed that the samples have an 80% "power" to detect a **true** difference of 5 percentage points. This sample size estimate also assumed an overall septic tank failure rate (across all system types for 5-9 year old systems) in the range of 5%. It was determined that a sample size of 300 for each system would result in valid analysis, regardless of the total number of systems (population) from which the sample was chosen. A slightly larger sample was recommended to be drawn from available records, to allow for sites at which failure status could not be determined, such as inaccessible sites.

It was determined that systems from each of the three physiographic regions must be included in the survey in order for the results to be valid, since soils vary by region of the state. Two counties were chosen in each of North Carolina's physiographic regions (Mountains, Piedmont, and Coast Plain) for the purpose of conducting the required comparison of system performance. The six counties surveyed were selected on the basis of being representative of the region and the fact that they had a good system of record keeping for septic tank system permits. Further, counties were chosen that were known to have large numbers of each system type, so that it would be likely that a statistically valid sample could be drawn from the records for each system type. Since the total sample size for each system type was required to be at least 300 and there were 6 counties chosen, at least 50 systems were selected from each county for the survey. The counties chosen were Alamance (Piedmont), Buncombe (Mountain), Henderson (Mountain), Lincoln (Piedmont), Onslow (Coast) and Wilson (Coast).

A retired employee formerly with the NC Division of Environmental Health, whose primary responsibilities before retirement involved restaurants, was retained to draw a random sample of the required size from each county. This person was chosen because he was familiar with Health Department records, but had not been involved with the permitting of chamber or EZ1203H systems, in order to avoid a possible source of bias in the sample selection. The available records for each type of system were assigned a number. Records were than drawn on the basis of a random number generator until the required number of systems to be inspected was achieved.

A team of third party inspectors, unaffiliated with the NC On-Site Wastewater Section or the product manufacturers, was hired to visit each system for which a record was randomly drawn. The inspectors were Environmental Health students from Western Carolina University under the supervision of Dr. Burton Ogle from WCU. The students were trained to inspect septic tank systems by a former employee of the NC Wastewater Discharge Elimination program now with WCU, whose primary responsibility had been the identification of failed septic tank systems in need of remediation. Systems were surveyed from March through April of 2005, in an effort to

inspect systems during a time when the most failures are normally recorded and control seasonal effects on failure rate. Each system was inspected by two members of the survey team. Only houses, which were known to be occupied, were inspected.

The following questions were answered with a yes or no by the survey team for each system inspected:

1.) Is sewage ponded on the surface?
2.) Does pressure to the soil surface with a shoe result in sewage coming to the surface?
3.) Is there a straight pipe?
4.) Is there evidence of past failure?
5.) Is there evidence of a repair?

In addition, an attempt was made to interview the occupants at each survey site in person or by phone. Answers to the following questions were obtained during the interview:

1.) Has your tank been pumped for other than routine maintenance?
2.) Are you having any of the following problems with your system today: surfacing on the ground; wet over system; odors; back up into the house; other?
3.) Have you had problems with the system in the past: surfacing on the ground; wet over system; odors; back up into the house; other?
4.) How was the problem solved?
5.) Has system been repaired or replaced?

A yes for one or more of the above questions answered by the survey team or the occupant was considered to be a system failure. More information was collected, but was not used to determine system failure.

Results and Discussion

A total of 912 systems were inspected, 303 chamber systems, 306 EZ systems and 303 gravel systems. Interviews were completed with 370 of the occupants. The survey sample contained 290 sites from the Coastal Region, 317 sites from the Piedmont region and 305 sites from the Mountain region. The survey sample had the following age distribution: 307 systems were 2 to 4 years old, 377 systems were 5 to 7 years old, and 228 systems were 8 to 12 years old. No systems older than 12 years were included in the survey because neither the chamber nor EZ1203H were approved in the state at that time.

The following survey results were obtained.

Table 1. System failure rate for conventional gravel, chamber, and EZ1203H systems.

System Type	Systems OK	Systems Failed	Total	Percent Failure
Gravel	281	22	303	7.3
Chamber	277	26	303	8.5
EZ1203H	277	29	306	9.5
Total	835	77	912	8.4

The statewide failure rate was 7.3 % for conventional gravel systems, 8.5% for chamber systems and 9.5% for the EZ1203H systems. The difference in failure rate between the conventional and chamber systems was 1.2%. The difference in failure rate between the conventional and EZ1203H systems was

2.2%. The purpose of this survey was to determine if there was a 5% or greater difference in the failure rate of chamber and EZ1203H systems compared to conventional gravel systems. The difference in failure rate was less than 5% for each system type. Statistical analysis was performed controlling for both physiographic region and age of system. At a 95% confidence level, the null hypothesis of no difference in failure rate could not be rejected for the chamber or EZ1203H system compared to the gravel system, based on the data collected. In laymen's terms, we would say that the chamber and EZ1203H performed the same as gravel when compared on a statewide basis.

Dominant soil texture, upon which LTAR is assigned for system design, varies by physiographic region of the state. In the Coastal region, the two dominant soil groups are sands and fine loams. The most limiting factor to the performance of septic tank systems is often depth to the seasonal high water table. In the Piedmont region, the two most dominant soil groups are fine loams and clays. Soil depth and slowly permeable soils are often the most limiting factors to system performance. In the Mountain region, coarse loams and fine loams are the dominant texture groups. Shallow soil depth and steep slopes are often the most limiting factors to system performance. To see if there was a difference in performance by region, given the differences in dominant site conditions associated with a region, the data was further analyzed by physiographic region of the state (Coastal Plain, Piedmont or Mountains). An insufficient number of sites were surveyed to statistically compare the performance of each system type by region. The data was therefore grouped by region without regard for system type to make the regional comparison, since there was no statistical difference in performance between system types. The results are given in Table 2.

Table 2. System failure rate by physiographic region disregarding differences in system type.

Physiographic Region	Systems OK	Systems Failed	Total	Percent Failure
Coast	256	34	290	11.7
Piedmont	286	31	317	9.8
Mountain	293	12	305	3.9
All Regions	835	77	912	8.4

The failure rate for all systems combined was highest in the Coast, 11.7%, and lowest in the Mountains 3.9%. In the Piedmont area the failure rate was 9.8%, which was similar to the failure rate found in the Coast. The difference in failure rate when the mountains region is compared to both the Piedmont and Coast region was statistically significant at the 95% level. The significant effect of region might be explained as follows. Most systems in the mountains are long and narrower. This factor in conjunction with slope ranging in excess of 25% may promote more efficient movement of sewage away from the drain field, e.g. low linear loading rates, and better system performance.

The data was also analyzed to see if there was a difference in system failure rate as systems aged. System failure rate is summarized in the Table 3 below for three age groups: 1.) 2 to 4 years old, 2) 5 to 7 years old, and 3.) 8 years to 12 years old.

Table 3. System failure rate by age group disregarding differences in system type.

System Age	Systems OK	Systems Failed	Total	Percent Failure
2 to 4 years	283	24	307	7.8
5 to 7 years	351	26	377	6.9
8 to 12 years	201	27	228	11.8
All Ages	835	77	912	8.4

When data for all system types was aggregated within an age group and the aggregated data compared by system age, the failure rate was highest for the 8 to 12 year old systems. The differences between the age groups, while controlling for system type and physiographic region, were not statistically significant at the 95% level. One might expect that the oldest systems should have the highest failure rate as observed, because clogging of the trench can be expected to increase, as more sewage is disposed in the trenches over time. Also, solids will spill over from the septic tank to the absorption field, if settled solids are not periodically removed by the owner as the system ages.

Finally, it is interesting to note that the average failure rate statewide is 8.4% for systems with an age up to 12 years old. There is much speculation in various arenas about the failure rate of ground absorption septic tank systems, with little or no substantive information to support the speculation. Perhaps a side benefit of this survey will be a defensible failure rate upon which to base future discussions.

Summary

The purpose of this survey was to determine if there was a difference in the failure rate of chamber and EZ1203H systems compared to gravel. Based on the data collected, the statewide failure rate of both standard chamber and EZ1203H systems compared to conventional gravel systems was not statistically different at a 95% confidence level. In laymen's terms, we would say that the chamber and EZ1203H systems performed the same as gravel systems.

Acknowledgements

This study could not have been completed without the cooperation of the fine staff from the Alamance, Buncombe , Henderson, Lincoln, Onslow and Wilson County Health Departments, and the hard work of the student surveyors from Western Carolina University. Peter Whitaker from WCU provided training on failure identification to the students. Clay Pennington provided assistance with sample selection. Financial support for this project was provided by Advanced Drainage Systems, Cultec, Hancor, Infiltrator Systems, Ring Industrial Group, and a grant (EW05076) from the USEPA 319 Non-Point Source Pollution Program entitled: In-Field Survey Initiative of Conventional and Innovative Onsite Wastewater Systems Performance In the Mountain, Piedmont and Coastal Physiographic Regions of NC.

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http://www.deh.enr.state.nc.us/osww_new//index.htm

Georgia Department of Human Resources
Division of Public Health
Environmental Health Section

Alternative System Approval

For: EZflow Drainage System Products: EZ0904H, EZ1203H, EZ1303T and 1402H

Issued To: Ring Industrial Group
65 Industrial Park Road
Oakland, Tennessee 38060

In accordance with provisions established in the Department of Human Resources Rules and Regulations for On-Site Sewage Management Systems, Chapter 290-5-26, the EZflow EZ0904H, EZ1203H, EZ1303T and 1402H are approved for use in on-site sewage management systems under the following conditions:

I. System Description

The EZflow Drainage System utilizes wastewater absorption trenches that contain bundles of loosely bound expanded polystyrene (EPS) aggregate in place of rock aggregate. The aggregate shall consist of "Patented EZflow Beads" recycled EPS with a particle density of 1.0 pound per cubic foot, or greater, ranging in size from one-half (1/2") inch to two (2") inches across any axis.

Cylindrical bundles range from a nominal 9-inch to a 14.5-inch diameter, depending on system configuration. The length of the cylindrical bundles range from a minimum of 5 feet to a maximum of 15 feet. The expanded polystyrene aggregate (EPS) is held in a cylindrical shape with high strength polyethylene netting. The netting shall be strong enough to retain the shape of the bundles during system installation and backfilling, corrosion resistant, and of a mesh size to prevent loss of aggregate. At least one cylinder bundle shall contain a perforated flexible plastic pipe for connection to adjacent sections to form a continuous absorption field system. The perforated flexible plastic pipe shall meet ASTM F 405, Standard Specifications for Corrugated Polyethylene Pipe. A series of three holes 5/8" in diameter spaced 120 degrees around the circumference are located every 4 inches along the lateral length of the pipe. Based on the manufacturer's recommendation, the hole orientation during installation may be random.

Alternative System Configurations

EZ0904H Drainage System consists of four, 9-inch diameter cylinder bundles across the bottom of a 36-inch wide absorption trench. Three cylinder bundles contain EPS aggregate only (aggregate bundles may be substituted with pipe and aggregate bundles) and one cylinder bundle consists of EPS aggregate and a four inch diameter perforated flexible plastic pipe. The perforated pipe is centrally located within the aggregate bundle with approximately 2.5 inches of EPS aggregate between the outside of the pipe and the outside of the cylinder. The pipe shall be connected by an internal coupling device, or other approved coupling device, to allow continuous flow from one section to the adjacent section.

EZ1203H Drainage System consists of three, 12-inch diameter cylinder bundles across the bottom of a 36-inch wide absorption trench. The central cylinder bundle contains EPS aggregate and a four-inch diameter perforated flexible plastic pipe. The pipe is offset so there is approximately 6 inches of EPS aggregate from the bottom of the pipe to the bottom of the cylinder, and 2 inches of EPS aggregate from the top of the pipe to the top of the cylinder. The pipe shall be connected by an internal coupling device, or other approved coupling device, to allow continuous flow from one section to the adjacent section. The cylinder bundles on each side of the central cylinder bundle contain EPS aggregate only (aggregate bundles may be substituted with pipe and aggregate bundles).

EZ1303T Drainage System consists of three, 13-inch diameter cylinder bundles placed in a 30-inch wide absorption trench. Two cylinder bundles containing EPS aggregate only (aggregate bundles may be substituted with pipe and aggregate bundles) are placed along the absorption trench bottom. A third cylinder bundle contains EPS aggregate and a four-inch diameter perforated flexible plastic pipe which is centered and placed on top of the two bottom cylinder bundles to form a triangle shape. The pipe is centered or offset, so there is approximately 7 inches of EPS aggregate located between the bottom of the pipe and the bottom of the cylinder, and approximately 2 inches of EPS aggregate is located between the top of the pipe and the top of the cylinder. The pipe shall be connected by an internal coupling device, or other approved coupling device, to allow continuous flow from one section to the adjacent section.

EZ1402H Drainage System consists of two, 14.5-inch diameter cylinder bundles placed across the bottom of a 29-inch to 36-inch wide absorption trench. One cylinder bundle contains EPS aggregate and a four-inch diameter perforated flexible plastic pipe. The pipe is centered or offset so there is approximately 6 inches of EPS aggregate between the bottom of the pipe and the bottom of the cylinder, and approximately 4 inches of EPS aggregate located between the top of the pipe and the top of the cylinder. The pipe shall be interconnected by an internal connection device, or other approved device, to allow continuous flow from one section to the adjacent section. A second cylinder bundle with EPS aggregate only is placed beside the first cylinder bundle (aggregate only bundles may be substituted with a pipe and aggregate bundle).

II. Site Criteria

The EZflow Drainage System may be utilized on sites determined to be suitable for conventional absorption field systems as specified in the DHR Rules and Regulations for On-Site Sewage Management Systems and the Department's Manual for On-Site Sewage Management Systems. The vertical separation requirements from seasonal groundwater, rock, impervious soil layers, or other unsuitable environmental conditions shall be measured from the absorption trench bottom.

The EZ0904H configuration is limited to applications requiring a trench depth of less than 18-inches.

III. Installation Criteria

The EZflow Drainage System shall be installed in the configurations in Section I, in absorption trenches constructed in accordance with the DHR Rules and Regulations for On-Site Sewage Management Systems, the Department's Manual for On-Site Sewage Management Systems and the manufacturer's installation guidelines.

The excavated trench width shall be as indicated in Section I for the selected configuration. The 1402H system bundles shall be placed adjacent to one undisturbed trench sidewall. The void space between the bundles and the opposite trench sidewall shall be backfilled first to hold the two bundles together in place prior to covering the system.

The EZflow Drainage System shall only be utilized for domestic waste as defined in Chapter 290-5-26-.02(rr) Rules and Regulations for On-Site Sewage Management Systems.

The barrier cover for any EZflow configuration shall be as designated by the manufacturer.

IV. Absorption Field Sizing

The sizing of the EZflow Drainage System shall be based upon the anticipated peak daily volume of treated sewage and the characteristics of the soil in which the absorption fields are to be located. The design absorption rate shall be based on the most hydraulically limiting naturally occurring soil horizon encounter at the aggregate and soil interface along the sidewall and trench bottom area to a depth 1 foot below the absorption trench bottom.

For lots less than three acres in size, soil horizons that exceed a percolation rate of 90 minutes per inch shall not be considered for installation.

On tracts or parcels of land of three acres or more, soil horizons that exceed a percolation rate of 120 minutes per inch shall not be considered for installation.

The following equivalency factors shall be used for the EZflow Drainage System Products:

System Configuration	Equivalency Factor
EZ0904H	0.85
EZ1203H	0.75
EZ1303T	0.65
EZ1402H	0.75

Trench Installation:

Step One: Determine the design percolation rate. The design percolation rate shall be based on the most hydraulically limiting soil horizon along the sidewall and trench bottom area interfacing with the product infiltrative surface to a depth 1 foot below the trench bottom.

Step Two: Determine the linear length required for a conventional 36-inch wide gravel absorption field system based on the percolation rate identified in step one.

Step Three: Identify the EZflow configuration to be installed. Multiply the product equivalency factor for the EZflow configuration to be used by the linear length of the conventional system determined in step two. The result is the linear footage required for the EZflow configuration selected.

Example:

Assume: 3-bedroom house and a percolation rate of 45 minutes per inch.

Then: Absorption field square footage required for a conventional 36-inch wide absorption field from Table DT-2 for a 45 minute percolation rate is 300 square feet per bedroom or 900 square feet for the three-bedroom house. The linear length required for the conventional 36-inch wide absorption field is 300 linear feet.

The minimum required linear footage of the EZflow Drainage System is:

EZ0904H	300 ft. x 0.85 = 255 ft
EZ1203H	300 ft. x 0.75 = 225 ft.
EZ1303T	300 ft. x 0.65 = 195 ft.
EZ1402H	300 ft. x 0.75 = 225 ft.

By: _____ Date: 6/23/06

Scott A. Uhlich, Program Manager
Land Use Unit
Environmental Health Section

Revised 6/23/06

Georgia Department of Human Resources
Division of Public Health
Environmental Health Section

Chamber System Approval

For: Infiltrator High Capacity Chamber and Infiltrator High Capacity Sidewinder Chamber

Issued To: Infiltrator Systems Inc.
6 Business Park Road
P.O. Box 768
Old Saybrook, CT 06475

In accordance with provisions established in the Department of Human Resources (DHR) Rules and Regulations for On-Site Sewage Management Systems, Chapter 290-5-26, the Infiltrator Systems, Inc. High Capacity Chamber and High Capacity Sidewinder Chamber models are approved for use in on-site sewage management systems under the following conditions.

I. System Description

The Infiltrator Systems Inc. (ISI) chamber absorption field system utilizes a system of chambers with each chamber unit being a molded polyolefin plastic, arch shaped, hollow structure with an exposed bottom area, solid top, and louvered sidewall for infiltration of effluent into adjoining bottom and side soil areas.

System configuration

The Infiltrator High Capacity Chamber model is a single chamber unit 16 inches high, 34 inches wide and 6.25 feet long. The invert height is 10.0 inches. The chamber units are interlocking to form a continuous absorption field system.

The Infiltrator High Capacity Sidewinder Chamber model is a single chamber unit 16 inches high, 34 inches wide and 6.25 feet long. The invert height is 10 inches. The chamber units are interlocking to form a continuous absorption field system.

II. Site Criteria

The ISI chamber absorption field system may be utilized on sites determined to be suitable for conventional absorption field systems as specified in the DHR Rules and Regulations for On-Site Sewage Management Systems and the Department's Manual for On-Site Sewage Management Systems. The vertical separation requirements from seasonal groundwater, rock, impervious soil layers, or other unsuitable environmental conditions shall be measured from the trench bottom.

III. Installation Criteria

The ISI chamber absorption field system shall be installed in 36-inch wide excavated trenches constructed in accordance with DHR Rules and Regulations for On-Site Sewage Management Systems, the Department's Manual for On-Site Sewage Management Systems and the manufacturer's installation guidelines.

Individual units shall interlock together to form a continuous system. Manufacturer approved end caps shall be utilized. In non-vehicle traffic areas, units may be installed to provide a minimum of 6 inches of soil cover to support a 4,000-lb/axle vehicle load. Vehicular traffic or construction traffic may traverse the chamber system only when the load is bridged with a minimum depth of 12 inches of compacted soil cover over the chambers in the target travel areas. Upon completion of construction, temporary soil mounds used to bridge loads may be removed so that the final desired trench depth is achieved.

IV. Absorption Field Sizing

The sizing of the ISI chamber absorption field system installed in absorption trenches shall be based on the anticipated peak daily volume of treated sewage and the characteristics of the soil in which the absorption field system is to be located. The design absorption rate shall be based on the most hydraulically limiting naturally occurring soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance of one (1') foot below the absorption trench bottom.

For lots less than three acres in size, soil horizons that exceed a percolation rate of 90 minutes per inch shall not be considered for installation.

On tracts or parcels of land of three acres or more, soil horizons that exceed a percolation rate of 120 minutes per inch shall not be considered for installation.

Trench installation:

Step 1. Determine design percolation rate. Design percolation rate shall be based on the most hydraulically limiting soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance of one foot below the absorption trench bottom.

Step 2: Determine the linear length required for a conventional 36-inch wide gravel absorption field system based on the percolation rate identified in step one.

Step 3: Multiply the product equivalency factor by the linear length of the conventional system determined in step two.

Equivalency Factor

Infiltrator High Capacity Chamber	0.65
Infiltrator High Capacity Sidewinder Chamber	0.65

Example: Assume a 3-bedroom house and a 45-minute percolation rate
Then: Absorption field square footage required for a conventional absorption field system from Table DT-2 for a 45-minute percolation rate is 300 square feet per bedroom or 900 square feet for the three-bedroom house.

This requires a 300 linear foot 36-inch wide conventional absorption field.

A. The minimum linear length required for an Infiltrator High Capacity Chamber system is

300 linear feet x 0.65 = 195 linear feet

By: _____ Date: 4/27/06

Scott A. Uhlich, Program Manager
Land Use Unit
Environmental Health Section

Georgia Department of Human Resources
Division of Public Health
Environmental Health Section

Chamber System Approval

For: Quick4 Standard Chamber, Quick4 W Standard Chamber and Quick4 High Capacity Chamber

Issued To: Infiltrator Systems Inc.
6 Business Park Road
P.O. Box 768
Old Saybrook, CT 06475

In accordance with provisions established in the Department of Human Resources (DHR) Rules and Regulations for On-Site Sewage Management Systems, Chapter 290-5-26, the Infiltrator Systems, Inc. Quick4 Standard, Quick4 W Standard and Quick4 High Capacity chamber models are approved for use in on-site sewage management systems under the following conditions.

I. System Description

The Infiltrator Systems Inc. (ISI) Quick4 chamber absorption field system utilizes a system of chambers with each chamber unit being a molded polyolefin plastic, arch shaped, hollow structure with an exposed bottom area, solid top, and louvered sidewall for infiltration of effluent into adjoining bottom and side soil areas.

System configuration

The Quick4 Standard Chamber model is a single chamber unit 12 inches high, 34 inches wide and 52 inches long (effective length 48 inches). The invert height is 8.0 inches. The chamber units are interlocking to form a continuous absorption field system.

The Quick4 W Standard Chamber model is a single chamber unit 12 inches high, 34 inches wide and 52 inches long (effective length 48 inches). The invert height is 8 inches. The chamber units are interlocking to form a continuous absorption field system.

The Quick4 High Capacity Chamber model is a single chamber unit 16 inches high, 34 inches wide and 52 inches long (effective length 48 inches). The invert height is 11.5 inches. The chamber units are interlocking to form a continuous absorption field system.

II. Site Criteria

The ISI Quick4 chamber absorption field system may be utilized on sites determined to be suitable for conventional absorption field systems as specified in the DHR Rules and Regulations for On-Site Sewage Management Systems and the Department's Manual for On-Site Sewage Management Systems. The vertical separation requirements from seasonal groundwater, rock, impervious soil layers, or other unsuitable environmental conditions shall be measured from the trench bottom.

III. Installation Criteria

The ISI Quick4 Standard Chamber and Quick4 High Capacity Chamber absorption field systems shall be installed in 36-inch wide excavated trenches constructed in accordance with DHR Rules and Regulations for On-Site Sewage Management Systems, the Department's Manual for On-Site Sewage Management Systems and the manufacturer's installation guidelines.

Individual units shall interlock together to form a continuous system. Manufacturer approved end caps shall be utilized. In non-vehicle traffic areas, units may be installed to provide a minimum of 6 inches of soil cover to support a 4,000-lb/axle vehicle load. The Quick 4 Standard and Quick4 W Standard models may be installed at a

minimum 18 inch trench bottom depth to provide the minimum 6 inches of soil cover. Vehicular traffic or construction traffic may traverse the chamber system only when the load is bridged with a minimum depth of 12 inches of compacted soil cover over the chambers in the target travel areas. Upon completion of construction, temporary soil mounds used to bridge loads may be removed so that the final desired trench depth is achieved.

IV. Absorption Field Sizing

The sizing of the ISI Quick 4 chamber absorption field system installed in absorption trenches shall be based on the anticipated peak daily volume of treated sewage and the characteristics of the soil in which the absorption field system is to be located. The design absorption rate shall be based on the most hydraulically limiting naturally occurring soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance of one (1') foot below the absorption trench bottom.

For lots less than three acres in size, soil horizons that exceed a percolation rate of 90 minutes per inch shall not be considered for installation.

On tracts or parcels of land of three acres or more, soil horizons that exceed a percolation rate of 120 minutes per inch shall not be considered for installation.

Trench installation:

Step 1. Determine design percolation rate. Design percolation rate shall be based on the most hydraulically limiting soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance of one foot below the absorption trench bottom.

Step 2: Determine the linear length required for a conventional 36-inch wide gravel absorption field system based on the percolation rate identified in step one.

Step 3: Multiply the product equivalency factor by the linear length of the conventional system determined in step two.

	Equivalency Factor
Quick4 Standard Chamber system	.75
Quick4 W Standard Chamber system	.75
Quick4 High Capacity Chamber system	.65

Example: Assume a 3-bedroom house and a 45-minute percolation rate

Then: Absorption field square footage required for a conventional absorption field system from Table DT-2 for a 45-minute percolation rate is 300 square feet per bedroom or 900 square feet for the three-bedroom house.

This requires a 300 linear foot 36-inch wide conventional absorption field.

A. The minimum linear length required for a Quick4 Standard Chamber system is

300 linear feet x 0.75 = 225 linear feet

B. The minimum linear length required for a Quick4 High Capacity Chamber system is

300 linear feet x 0.65 = 195 linear feet

By: _____ Date: 4/27/06

Scott A. Uhlich, Program Manager
Land Use Unit
Environmental Health Section

Georgia Department of Human Resources
Division of Public Health
Environmental Health Section

Chamber System Approval

For: Hancor Standard EnviroChamber, High Capacity SF EnviroChamber and High Capacity SW EnviroChamber Models

Issued To: Hancor, Inc.
401 Olive Street
Findlay, OH. 45839-1047

In accordance with provisions established in the Department of Human Resources (DHR) Rules and Regulations for On-Site Sewage Management Systems, Chapter 290-5-26, the Hancor Standard EnviroChamber, High Capacity SF EnviroChamber and High Capacity SW EnviroChamber models are approved for use in on-site sewage management systems under the following conditions.

I. System Description

The EnviroChamber absorption field system utilizes a system of chambers with each chamber unit being a molded polyolefin plastic, arch shaped, hollow structure with an exposed bottom area, solid top, and louvered sidewall for infiltration of effluent into adjoining bottom and side soil areas.

System configuration

The Standard EnviroChamber model is a single chamber unit 12 inches high, 34 5/16 inches wide and 74 13/16 inches long. The invert height is 7 ¾ inches. The chamber units are interlocking to form a continuous absorption field system.

The High Capacity SF EnviroChamber model is a single chamber unit 18 5/16 inches high, 34 ¼ inches wide and 74 1/4 inches long. The invert height is 13 ¾ inches. The chamber units are interlocking to form a continuous absorption field system.

The High Capacity SW EnviroChamber model is a single chamber unit 17 5/8 inches high, 33 5/8 inches wide and 75 5/8 inches long. The invert height is 13 ¾ inches. The chamber units are interlocking to form a continuous absorption field system.

II. Site Criteria

The Standard, High Capacity SF and High Capacity SW EnviroChamber absorption field systems may be utilized on sites determined to be suitable for conventional absorption field systems as specified in the DHR Rules and Regulations for On-Site Sewage Management Systems and the Department's Manual for On-Site Sewage Management Systems. The vertical separation requirements from seasonal groundwater, rock, impervious soil layers, or other unsuitable environmental conditions shall be measured from the trench bottom.

III. Installation Criteria

The Standard, High Capacity SF and High Capacity SW EnviroChamber absorption field systems shall be installed in 36-inch wide excavated trenches constructed in accordance with the DHR Rules and Regulations for On-Site Sewage Management Systems, the Department's Manual for On-Site Sewage Management Systems and the manufacturer's installation guidelines.

Individual units shall interlock together to form a continuous system. Manufacturer approved end plates shall be utilized. In non-vehicle traffic areas, units may be installed to provide a minimum of 6 inches of soil cover to support a 4,000-lb/axle vehicle load. Vehicular traffic or construction traffic may traverse the chamber system only when the load is bridged with a minimum depth of 12 inches of compacted soil cover over the chambers in target travel areas. Upon completion of construction, temporary soil mound used to bridge loads may be removed so the final desired trench depth is achieved. Chamber units shall have a minimum of 12 inches of soil cover to meet H-10 load requirements.

The Standard EnviroChamber may be installed at an 18 inch minimum trench bottom depth to provide the minimum 6 inches of soil cover.

IV. Absorption Field Sizing

The sizing of the Standard, High Capacity SF and High Capacity SW EnviroChamber absorption field systems installed in absorption trenches shall be based on the anticipated peak daily volume of treated sewage and the characteristics of the soil in which the absorption trench system is to be located. The design absorption rate shall be based on the most hydraulically limiting naturally occurring soil horizon that comes in contact with the infiltrative surface of the chamber sidewall, trench bottom and for a distance of one (1') foot below the absorption trench bottom.

For lots less than three acres in size, soil horizons that exceed a percolation rate of 90 minutes per inch shall not be considered for installation.

On tracts or parcels of land of three acres or more, soil horizons that exceed a percolation rate of 120 minutes per inch shall not be considered for installation.

Trench Installation:

Step 1. Determine the design percolation rate. The design percolation rate shall be based on the most hydraulically limiting soil horizon along the sidewall and trench bottom area interfacing with the product infiltrative surface to a depth 1 foot below the trench bottom.

Step 2. Determine the linear length required for a conventional 36-wide conventional absorption field system based on the percolation rate identified in step one.

Step 3. Multiply the product equivalency factor by the linear length of the conventional system determined in step two.

	Equivalency Factor
Standard EnviroChamber	.75
High Capacity SF EnviroChamber	.65
High Capacity SW EnviroChamber	.65

Example: Assume a 3-bedroom house and a 45 minute percolation rate.

Then: Absorption field square footage required for a conventional 36-inch wide absorption field system from Table DT-2 for a 45 minute percolation rate is 300 square feet per bedroom or 900 square feet for the three-bedroom house.

This requires a 300 linear foot 36-inch wide conventional absorption field.

The minimum linear feet required for a Standard EnviroChamber system.

300 linear feet x 0.75 = 225 linear feet

The minimum linear feet required for a High Capacity SF or High Capacity SW EnviroChamber system.

300 linear feet x 0.65 = 195 linear feet

By: _____ Date: 4/27/06

Scott A. Uhlich, Program Manager
Land Use Unit
Environmental Health Section

Georgia Department of Human Resources
Division of Public Health
Environmental Health Section

Chamber System Approval

For: BioDiffuser Standard chamber model
BioDiffuser 14-inch High Capacity and 16-inch High Capacity chamber models
ARC36 and ARC36 HC chamber models

Issued To: PSA, Inc.
P.O. Box 218902
Columbus, OH. 43221

In accordance with provisions established in the Department of Human Resources Rules and Regulations for On-Site Sewage Management Systems, Chapter 290-5-26, the BioDiffuser Standard, BioDiffuser 14-inch High Capacity, BioDiffuser 16-inch High Capacity, ARC36 and ARC36 HC chamber models are approved for use in on-site sewage management systems under the following conditions.

I. System Description

The BioDiffuser and ARC36 chamber systems utilize a system of chambers with each chamber being a molded polyolefin plastic, arch shaped, hollow structure with an exposed bottom area, solid top, and louvered sidewall for infiltration of effluent into adjoining bottom and side soil areas.

System configuration

The BioDiffuser Standard model is a single chamber unit 11.5 inches high, 33.5 inches wide and 6.2 feet long. The invert height is 5.8 inches. The chamber units are interlocking to form a continuous absorption field system.

The BioDiffuser 14-inch High Capacity model is a single chamber unit 14 inches high, 34 inches wide, and 75 inches long. The invert height is 9 inches. The chamber units are interlocking to form a continuous absorption field system.

The BioDiffuser 16-inch High Capacity model is a single chamber unit 16 inches high, 34 inches wide, and 75 inches long. The invert height is 11.3 inches. The chamber units are interlocking to form a continuous absorption field system.

The ARC36 model is a single chamber unit 13 inches high, 34.5 inches wide and 63 inches long (effective length is 60 inches). The invert height is 7.13 inches. The chamber units are interlocking to form a continuous absorption field system.

The ARC36 HC model is a single chamber unit 16 inches high, 34.5 inches wide and 75.26 inches long (effective length is 72 inches). The invert height is 10.75 inches. The chamber units are interlocking to form a continuous absorption field system.

II. Siting Criteria

The PSA BioDiffuser and ARC 36 absorption field systems may be utilized on sites determined to be suitable for conventional absorption field systems as specified in the DHR Rules and Regulations for On-Site Sewage Management Systems and the Department's Manual for On-Site Sewage Management Systems. The vertical separation requirements from seasonal groundwater, rock, impervious soil layers, or other unsuitable environmental conditions shall be measured from the trench bottom.

III. Installation Criteria

The PSA BioDiffuser and ARC 36 absorption field systems shall be installed in 36 inch wide excavated trenches constructed in accordance with DHR Rules and Regulations for On-Site Sewage Management Systems, the Department's Manual for On-Site Sewage Management Systems, and the manufacturer's installation guidelines.

Individual units snap together to form a continuous system. Manufacturer approved end plates shall be utilized. In non-vehicle traffic areas, units may be installed to provide a minimum of six (6") inches of soil cover to support a 4,000-lb/axle vehicle load. Vehicle traffic or construction traffic may traverse the chamber system only when the load is bridged with a minimum depth of twelve (12") inches of compacted soil cover over the chambers in the target travel area. Upon completion of construction, temporary soil mounds used to bridge loads may be removed so the final desired trench depth is achieved.

The BioDiffuser Standard and ARC 36 chamber model may be installed at a minimum 18 inch trench bottom depth to provide a minimum 6 inches of soil cover.

IV. Absorption Field Sizing

The sizing of the BioDiffuser Chamber and ARC 36 absorption field systems installed in absorption trenches shall be based on the anticipated peak daily volume of treated sewage and the characteristics of the soil in which the absorption field system is to be located. The design absorption rate shall be based on the most hydraulically limiting naturally occurring soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance of one (1') foot below the absorption trench bottom

For lots less than three acres in size, soil horizons that exceed a percolation rate of 90 minutes per inch shall not be considered for installation.

On tracts or parcels of land of three acres or more, soil horizons that exceed a percolation rate of 120 minutes per inch shall not be considered for installation.

Trench Installation:

Step 1. Determine design percolation rate. Design percolation rate shall be based on the most hydraulically limiting soil horizon that comes in contact with the infiltrative surface of the sidewall, trench bottom and for a distance one foot below the absorption the absorption trench bottom.

Step 2. Determine the linear length required for a conventional 36 inch wide conventional absorption field system based on the percolation rate identified in step one.

Step 3. Multiple the product equivalency factor by the linear length of the conventional system determined in step two.

	Equivalency Factor
BioDiffuser Standard chamber system	.75
BioDiffuser 14-inch High Capacity chamber system	.65
BioDiffuser 16-inch High Capacity chamber system	.65
ARC36 chamber system	.75
ARC36 HC chamber system	.65

Example: Assume a 3-bedroom house and a 45-minute percolation rate

Then: Absorption field square footage required for a conventional absorption field system from Table DT-2 for a 45-minute percolation rate is 300 square feet per bedroom or 900 square feet for the three-bedroom house.

This requires a 300 linear foot 36-inch wide conventional absorption field.

A. The minimum linear length required for a BioDiffuser standard chamber and ARC36 chamber system is:

300 linear feet x 0.75 = 225 linear feet

B. The minimum linear length required for a BioDiffuser 14-inch, 16-inch High Capacity chamber system and ARC36 HC chamber system is:

300 linear feet x 0.65 = 195 linear feet

By: _____ Date: 4/27/06

Scott A. Uhlich, Director
Land Use Program
Environmental Health Section

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH
ON-SITE WASTEWATER SECTION

INNOVATIVE WASTEWATER SYSTEM APPROVAL

INNOVATIVE WASTEWATER NO: IWWS-95-3-R3

ISSUED TO:
Ring Industrial Group
E*Zflow* Brand Drain fields
65 Industrial Park Drive
Oakland, TN 38060
901-465-6333; Fax: 901-465-1181; www.ezflowlp.com

FOR:

***EZflow Drainage Systems (formerly Houck Drainage Systems)*:**

EZ1003T (Formerly HDS 2003 Triangular)
EZ1203T (Formerly HDS 2012 Triangular)
EZ1203H (Formerly HDS 2012 Horizontal)

DATE: October 10, 1995 IWWS-95-3R Issued
October 7, 1998 IWWS-95-3-R2 Issued
April 18, 2002 IWWS-95-3-R3 Issued

In accordance with 15A NCAC 18A .1969, the EZflow Drainage Systems EZ1003T, EZ1203T, and EZ1203H have been found to meet the standards for an innovative system when all of the conditions specified herein are met.

I. PERMITTING

Prior to the installation of an approved EZflow Brand **EZ1003T , EZ1203T, or EZ1203H,** System at a site for which application is being made for an Improvement Permit or Construction Authorization or at a site for which an Improvement Permit or Construction Authorization has been previously issued for a system described in 15A NCAC 18A.1955, .1956, or .1957, the owner or authorized agent shall notify the local health department. The local health department shall issue an Improvement Permit or Construction Authorization or amend the previously issued Improvement Permit or Construction Authorization allowing for the use of the proposed innovative system upon a finding that all provisions of this approval and all other applicable rules shall be met. Use of the proposed innovative system and any conditions shall be described in the construction authorization or amended construction authorization, as applicable. Such information shall also be described on the operation permit to be issued upon the acceptable completion of the system installation.

II. SYSTEM DESCRIPTIONS AND DESIGN CRITERIA

The EZflow brand Drainfield Systems replace conventional rock and pipe drainfield systems.

Description:

Aggregate shall consist of: EZflow patented bead is a 3-Dimensional rectangular shaped product with void channels and surface area protuberances. Dubbed the "double E", the Geosynthetic expanded polystyrene (EPS) aggregate size ranges from .75 to 1.75 inches along any axis. The particle density is approximately 1.2 pound per cubic foot or greater.

Product: Cylindrical bundles (also referred to herein as cylinders) are approximately 10 inches or 12 inches in diameter, and approximately 10 feet long. The product nomenclature depicts the diameter, the number of bundles and the orientation. (e.g. EZ1003T: 10 inch bundles with three pieces in a triangular configuration.)

The expanded polystyrene aggregate is held in a cylindrical shape with high strength netting. The physical and chemical properties of the netting shall be durable and resistive enough to retain the shape of the bundles and, to withstand system installation, backfilling, corrosion, and loss of aggregate under intended use.

Alternative configurations are described below:

A. **EZ1003T (formerly HDS 2003 Triangular) Drainfield System** consists of three, 10-inch diameter cylinders placed in a trench 24 inches wide. Two bottom cylinders containing aggregate only, with the netting tied off at both ends to prevent the escape of aggregate, are placed against opposite sides of the trench bottom (retaining a gap of approximately four inches between the bundles when placed in the 24-inch wide trench). A third cylinder containing aggregate and a 4-inch diameter flexible plastic perforated pipe as is typically used in nitrification lines is centered on top of the bottom two bundles in the middle of the trench. The pipe shall be certified as complying with ASTM F 405, Standard Specification for Corrugated Polyethylene (PE) tubing and fittings, and shall be in accordance with 15A NCAC 18A .1955(f). The 4-inch corrugated pipe is surrounded by approximately 2.5 to 3 inches of the EZflow aggregate. The netting for the central cylinder is tied off at both ends to the pipe. The pipe may be connected by an internal coupling device to allow continuous flow from one section to the next.

B. **EZ1203T (formally HDS 2012 Triangular) Drainfield System** consists of three, 12-inch diameter cylinders in a trench 30 inches wide. Two bottom cylinders containing aggregate only, with the netting tied off at both ends to prevent the escape of aggregate, are placed against opposite sides of the trench bottom creating a gap of approximately 5 to 6 inches between the bundles. A third cylinder containing aggregate and a 4-inch diameter perforated flexible plastic pipe as is typically used in nitrification lines is centered on top of the bottom two bundles in the middle of the trench. The pipe shall be certified as complying with ASTM F 405, Standard Specification for Corrugated Polyethylene (PE) tubing and fittings, and shall be in accordance with 15A NCAC 18A .1955(f). The 4-inch pipe is centered or slightly offset from center towards the top of the cylinder whereby 4 to 6 inches of aggregate is located between the bottom of the pipe and the bottom of the cylinder, and 4 to 1-1/2 inches of aggregate is located between the top of the pipe and the top of the cylinder, respectively. The netting for the central cylinder is tied off at both ends to the pipe. The pipe may be

connected by an internal coupling device to allow for continuous flow from one section of pipe to the next.

C. **EZ1203H (formally HDS 2012 Horizontal) Drainfield System** consists of three, 12-inch diameter cylinders across the bottom of a trench 36 inches wide. The outer cylinders contain aggregate only, with the netting tied off at both ends to prevent the escape of aggregate. The central cylinder contains aggregate and a 4-inch diameter perforated flexible plastic pipe as is typically used in nitrification lines. The pipe shall be certified as complying with ASTM F 405, Standard Specification for Corrugated Polyethylene (PE) tubing and fittings, and shall be in accordance with 15A NCAC 18A .1955(f). The 4-inch pipe is offset from center towards the top of the cylinder whereby 6 inches of aggregate is located between the bottom of the pipe and the bottom of the cylinder, and 1-1/2 to 2 inches of aggregate is located between the top of the pipe and the top of the cylinder. The netting for the central cylinder is tied off at both ends of the pipe. The pipe may be connected by an internal coupling device to allow continuous flow from one section to the next.

III. SITING CRITERIA:

The EZflow Drainfield Systems may be utilized on any site that one can use rock aggregate and pipe which meet the following criteria:

A. Sites which are classified Suitable or Provisionally Suitable for a conventional nitrification field system in accordance with 15A NCAC 18A .1948(a) and (b).

B. Sites which have been reclassified as Provisionally Suitable in accordance with 15A NCAC 18A .1956(2), (4), (5), and (6).

C. Sites which may be reclassified as Provisionally Suitable in accordance with 15A NCAC 18A .1956(1), except that for the triangular configurations at least 29 and 31 inches for EZ1003T and EZ1203T, respectively, of naturally occurring soil must be present above saprolite, rock, or soil wetness conditions, and all other factors are Suitable or Provisionally Suitable.

D. Sites which meet the criteria for new or existing fill in accordance with 15A NCAC 18A .1957(b). The provisions of Rule .1957(b) are applicable whenever any portion of the aggregate bundles in an EZflow system extends into fill material. There shall be no reduction in trench length compared to conventional gravel trench. This reference to "fill material" applies to the site fill and not the backfill placed between the trench and the cylinder sidewall.

D. The required vertical separation shall be measured from the trench bottom.

IV. EZFLOW DRAINFIELD SYSTEM SIZING:

A. The maximum long-term acceptance rate (LTAR) shall be as follows:

Table 1

Textural Group		LTAR (GPD/ft^2)	
		Natural	**Saprolite**
Soil/Group I (Sands)	Sand	0.8 - 1.0	0.6-0.8
	Loamy Sand		0.5-0.7
Soil Group II (Coarse Loams)	Sandy Loam	0.6 - 0.8	0.4 - 0.6
	Loam		0.2-0.4
Soil Group III (Fine Loams)	Silt Loam	0.3 - 0.6	0.1-0.3
	Other Fine Loams		N.A.
Soil Group IV	Clays	0.1 - 0.4	N.A.

B. The LTAR shall be based on the most hydraulically limiting naturally occurring soil horizon within three feet of the ground surface or to a depth of one foot below the trench bottom whichever is deeper.

C. To determine the minimum total trench bottom area (ft ^{2}) required, divide the design daily sewage flow by the applicable LTAR shown in Table 1 above. The minimum linear footage for EZflow Drainfield Systems shall be determined by dividing the total trench bottom area by the following equivalency factors:

Table 2

EZflow Product Configuration	**Excavated Trench Width**	**Equivalency Factor (SF/LF)**
EZ1003T (2003 Triangular)	24-inch	3.0
EZ1203T (2012 Triangular)	30-inch	**4.61 (Warranty System)***
		4.0
EZ1203H (2012 Horizontal)	36-inch	**4.61 (Warranty System)***
		4.0

***System sizing approval based on provision of manufacturer's warranty, as required by Section 2.4, Session Law 2001-505 (House Bill 1019), effective December 19, 2001. Requirements specific to Warranty Systems are detailed in Section VIII, below**

Example:
Assume: Three bedroom residence with a design daily sewage flow of 360 gallons on a Group III sandy clay loam soil:

Then: Total computed trench bottom area is:
360 GPD (GPD/BR)/0.5 (GPD/SF) (LTAR) = 720 ft^2/BR

The minimum required linear footage of EZFlow Drainfield Systems are:

Table 3

Product Configuration	Square footage required (equivalent conventional)	Equivalency Factor (SF/LF)	Total Linear Feet
EZ1003T (Warranty System)	720	3.0	240
EZ1003T			
EZ1203T (Warranty System)	720	4.61	156
EZ1203T		4.0	180
EZ1203H (Warranty System)	720	4.61	156
EZ1203H		4.0	180

D. The **EZ1203H** Horizontal Drainfield System may be used in a bed system with the three cylindrical bundles placed in rows next to each other. The minimum area (without reduction or equivalency factor) for a bed system shall be determined as required in 15A NCAC 18A.1955(d).

E. The **central cylinder of the EZ1203H** which contains the off-set four-inch pipe may be used as an alternative to rock aggregate in a low pressure pipe (LPP) system, sized equivalent to LPP systems as required in 15A NCAC 18A .1957(a). The single 12-inch diameter cylinder shall be installed within a 12 to 18-inch wide trench. The LPP small diameter pressure laterals (one to two inches) shall be placed within the four-inch pipe sleeve and otherwise designed in accordance with Rule .1957(a). All orifices shall be drilled in the LPP laterals to face upward, except for a hole placed in the middle and a hole placed 25 percent from the distal end of each line, which shall face downward to allow for drainage. The minimum backfill requirement of six inches, as described below, shall also apply.

F. The available space requirements of Rule .1945 shall be met, and this approved innovative system may be designated as the required replacement system. However, whenever a Warranty System is proposed whereby the initial system has more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional wastewater system, there shall be sufficient repair area to install either a conventional gravel trench system, or an approved innovative system which has no more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional system, and both the initial and replacement system areas shall be Suitable or Provisionally Suitable for a conventional system in accordance with Rules .1948(a) and (b), or Rules .1956(1), (2), (4), (5), and (6).

V. INSTALLATION CRITERIA:

A. The EZflow Drainfield Systems shall be configured in accordance with Section II, above, installed in excavated trenches constructed with the following minimum center-to-center spacing, trench widths, and soil cover. Dimensional Minimums are included for installation and inspection guidance:

Table 4

Product Configuration	Minimum Trench Spacing (feet)	Trench Width (Inches)	Min. Soil Cover (inches)	Min. Trench Depth (inches)	♣Min. Pipe Depth below Grade	♣Min. Pipe Ht. Above Trench Bottom
EZ1003T	7.5	24	6	23	11	10 inches
EZ1203T (Including Warranty System)	9.0	30	6	25	12	11 inches
EZ1203H (Including Warranty System)	9.0	36	6	18	12	6 inches

*** Note: that on sloping lots, minimum required trench depths may be greater.**

♣ Measurements for pipe height are to the pipe invert or bottom of pipe.

B. A backfill barrier shall be placed over the EPS aggregate cylinders to prevent the infiltration of backfill material into the trench void spaces. The backfill barrier shall be 60 pound weight untreated building paper provided by the manufacturer or alternate with equal or better performance characteristics. An alternate backfill barrier shall be approved in writing by the manufacturer on a case-by-case basis. The barrier shall not be placed along the trench sidewalls below the pipe invert elevation. The barrier must be protected from becoming wet enough to tear until backfilling is completed.

C. Native Soil removed from the trench excavation may be used as backfill and shall be placed along the sidewalls in the EZflow Triangular Drainfield Systems to a minimum compacted (carefully walked in) height level with the center of the top EPS cylinder. Backfill shall be free of trash or debris. The area adjacent to the cylinders shall be free of large (8" or greater) clods that do not break apart during the walk in procedure. Special attention should be given when backfilling the Triangular Systems so as not to disturb the configuration. Vehicular traffic and excavation equipment should not travel over any uncovered drainfield. The latest version of the manufacturer's installation procedures shall be followed.

D. The EZflow Drainfield Systems shall be installed in a level trench in all directions (both across and along the trench bottom) and shall follow the contour of the ground surface elevation (uniform depth), with all continuous adjoining 10-foot cylindrical bundles placed end to end, with the central bundle distribution pipe interconnected, without any dams, stepdowns or other water stops.

E. EZflow Drainfield Systems installed on sloping sites may use distribution devices or step downs as described in 15A NCAC 18A .1955(j) and (l) when it is necessary to change level nitrification line segments from upper to lower elevations. The minimum step-down height for the EZflow Triangular configurations may be reduced to be only up to the center of the pipe in the upstream trench.

F. Manufacturer's installation instructions for the EZflow Drainfield Systems shall be followed, except as required herein or by 15A NCAC 18A .1900 et. seq.

G. The system shall be installed by a contractor authorized in writing by Ring Industrial Group for EZflow Brand Drainfield Systems.

VI. OPERATION AND MAINTENANCE REQUIREMENTS:

The EZflow Drainfield Systems shall have a minimum classification as a Type IIIg system (other non-conventional trench systems) in accordance with Table V(a) of Rule 15A NCAC 18A .1961(b).

VII. REPAIR OF SYSTEMS:

The provisions of 15A NCAC 18A .1961(c) shall govern the use of the EZflow Drainfield Systems for repairs to existing malfunctioning wastewater systems.

VIII. WARRANTY SYSTEMS (EZ1203T and EZ1203H only when installed with length reductions in excess of 25%)

A. The Manufacturer shall provide the approved Warranty in effect on the date of the Operation Permit issuance to the owner or purchaser of the system. The terms and conditions of the Warranty shall be approved by the Department, pursuant to applicable Laws and Rules. The Warranty shall be valid for a five-year period from the date of first use of the wastewater system, as indicated by the date of issuance of either the Operation Permit or the Certificate of Occupancy for the facility served by the system (whichever is later).

B. The Manufacturer shall issue the Warranty to the property owner through it's authorized installer who shall sign the Warranty indicating the system has been installed in accordance with the Manufacturer's specifications, any conditions of the Approval granted by the DENR, and all conditions of the Authorization to Construct a Wastewater System by the local health department. The installer or contractor shall promptly return a copy of the signed Warranty to the Manufacturer indicating Address and Location of the system, date the system was placed into use, and type and model of system installed.

C. The Warranty shall provide that the manufacturer shall provide all materials and labor that may be necessary to provide a fully functional wastewater system at no cost to the Owner. This section shall not be construed to require that a manufacturer warrant an innovative wastewater system that is not properly sized to meet the design load required for a particular use, that is improperly installed, or that is improperly operated and maintained, in accordance with 15A NCAC 18A .1900 et. seq.

D. Warranty repairs such as full replacement of the nitrification system, extension of the nitrification system or other repairs shall be completed pursuant to a repair Authorization to Construct to be issued by the local health department in accordance with Rule .1961(l).

E. The Warranty shall be attached to the Operation Permit issued by the Health Department for the wastewater system. The Warranty transfers to any subsequent owners of the system up to the end of the five-year applicability period.

IX. APPLICABILITY

This Innovative Wastewater System Approval supersedes previous approvals IWWS-94-1, IWWS-95-3, IWWS-95-3R and IWWS-95-3-R2.

Approved By: _____ **Date:** _____

NORTH CAROLINA DEPARTMENT
OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH
ON-SITE WASTEWATER SECTION

INNOVATIVE WASTEWATER SYSTEM APPROVAL

INNOVATIVE WASTEWATER SYSTEM NO: IWWS-97-2-R6

ISSUED TO: PSA, Inc.
P.O. Box 3000
Hilliard, OH 43026

Tel: 800-733-7473 Fax: 614-658-0204 www.ads-pipe.com

FOR: "BioDiffuser" chambered sewage effluent subsurface disposal system (Standard Model 11" High Unit, Angle Chamber Section, Bio 3 Model, and ARC 36 Model).

APPROVAL DATES:	March 21, 1997	12 Inch Cover H-10 Load Design
	August 10, 2000	6 Inch Cover (Shallow Placement) Design
	July 25, 2001	Class IV Cover
	October 5, 2001	Angle Chamber Section
	November 4, 2002	Warranty System with Revised Equivalency Factors
	April 9, 2003	Bio 3
	March 10 2006	ARC 36

In accordance with 15A NCAC 18A.1969, an application by PSA, Inc., of Hilliard, Ohio for a revised approval of their chamber (gravel-less) nitrification trench system has been reviewed. The following BioDiffuser Chamber systems have been found to meet standards of an innovative system when all of the conditions of this approval are met for the following models:

- Standard Model with 6 inch cover
- Angle Chamber section
- Bio 3 with 6 inch cover
- ARC 36 with 6 inch cover

I. PERMITTING

Prior to the installation of the approved BioDiffuser chamber nitrification trench system at a site for which application is being made for an Improvement Permit or Construction Authorization or at a site for which an Improvement Permit or Construction Permit or Construction Authorization has been previously issued for a system described in 15A NCAC 18A. 1955,.1956, or .1957, the owner or owner's authorized representative shall notify the local health department. The local health department shall issue an Improvement Permit or a Construction Authorization or amend the previously issued Improvement Permit or Construction Authorization allowing for the use of the proposed innovative system upon a finding that all provisions of this approval and all other applicable rules shall be met. Use of the proposed innovative system and any conditions shall be described in the Construction Authorization or amended Construction Authorization, as applicable. Such information shall also be described on the Operation Permit to be issued upon the acceptable completion of the system installation.

II. SYSTEM DESCRIPTION

a. Minimum pretreatment by septic tank as required in 15A NCAC 18A. 1952.

b. BioDiffuser units consist of high density polyethylene arch-shaped injection molded chambers. The Standard Model unit is approximately 11 inches high, with an average inside width of 2.5 feet (30 inches), an overall length of 6 ft. 2 ¼ inches, and ¼-inch wide slotted sidewalls approximately 6 inches high. The Bio 3 Model unit is approximately 12 inches high, with an average inside width of 1.6 feet (19 inches), an overall length of 7 ft. 2 in, and ¼-inch wide slotted sidewalls approximately 9 inches high. The ARC 36 unit is approximately 13 inches high, with an average inside width of 2.5 feet (30 inches), an overall length of 5 ft., and ¼-inch wide slotted sidewalls approximately 6 inches high. The chamber sidewall slopes approximately 20 degrees toward the chamber center and away from the trench sidewall. Note: 16 Standard BioDiffuser chamber units are approximately equal to 100 linear feet; 14 Bio 3 BioDiffuser chamber units are approximately equal to 100 linear feet; 20 ARC 36 BioDiffuser units are equal to 100 linear feet [See Table I below].

c. Each chamber unit shall be properly and permanently marked in compliance with the appropriate standard, and conditions of this approval as follows:

- Standard
- Bio 3
- ARC 36

d. Each chamber unit is designed to mechanically interlock with the downstream chamber forming a complete nitrification trench that consists of an inlet end plate and a solid end plate to be located at the distal end of any chamber nitrification line.

e. The Angle Chamber Section may be utilized as an accessory for the Standard and the Bio 3 models to achieve turns as necessary in all applications including but not limited to shallow cover with 6 inches of soil.

TABLE I
BioDiffuser Chamber Dimensions

Model	Length Overall (ft)	Height (in)	Bottom Width (in)	Average Open Bottom Width (in)	Slotted Sidewall Height (in)	Invert[1] Height (in)
Standard	6.25	11	33.5	28.9	6	6
ARC 36	5.0	13	34.5	29.2	7.13	6
Bio 3	7.14	12.38	22	19.3	8.95	6 or 11.75

[1]Invert Height is for a 4-inch diameter Schedule 40 PVC Pipe

III. SITING CRITERIA

The BioDiffuser nitrification trench assembly may be utilized on sites which meet the following criteria:

a. Sites which are classified Suitable or Provisionally Suitable for a conventional nitrification field system in accordance with 15A NCAC 18A. 1948(a) or (b).

b. Sites which have been classified as Provisionally Suitable in accordance with 15A NCAC 18A.1956(1),(2),(4),(5), and (6).

c; Sites which meet the criteria for new or existing fill in accordance with 15A NCAC 18A.1957(b). The provisions of Rule .1957(b) are applicable whenever the trench bottom is installed less than 12 inches below the naturally occurring soil surface. There shall be no reduction in trench length compared to conventional gravel trench. This

reference to "fill material" applies to the site fill and not the backfill placed between the trench and the chamber sidewall.

d. The required vertical separation shall be measured from the bottom edge of the chamber.

IV. BIODIFFUSER CHAMBER SYSTEM SIZING

a. The maximum long-term acceptance rate (LTAR) shall be as follows:

TABLE II

Textural Group		LTAR (gpd/sq.ft.)	
		Natural Soil	Saprolite
Soil Group I (Sands)	Sands	0.8 – 1.0	0.6 – 0.8
	Loamy Sand		0.5 – 0.7
Soil Group II (Coarse Loams)	Sandy Loam	0.6 – 0.8	0.4 – 0.6
	Loam		0.2 – 0.4
Soil Group III (Fine Loams)	Silt Loam	0.3 – 0.6	0.1 – 0.3
	Other Fine Loams		N.A.
Soil Group IV	Clays	0.1 – 0.4	N.A.

b. The LTAR shall be based on the most hydraulically limiting naturally occurring soil horizon within three feet of the ground surface or to a depth of one foot below trench bottom, whichever is deeper.

c. To determine the total trench bottom area (ft ²) required, the design daily sewage flow shall be divided by the applicable long-term acceptance rate shown in Table II above. The minimum linear footage for BioDiffuser Systems shall be determined by dividing the total trench bottom area by the following equivalency factors:

TABLE III

Product	Excavated Trench Width (inch)	Equivalency Factor* (SF/LF)
Standard	36	4.00
		4.61 (Warranty System)*
ARC 36	36	4.00
		4.61 (Warranty System)**
Bio 3	24	3.00

***Reduction in nitrification trench length allowed by use of these Equivalency Factors, as compared to sizing requirements delineated in Rule .1955 for conventional systems, apply only to drainfields receiving effluent of domestic strength or better quality. Any proposed use of the system for facilities producing higher strength wastewater shall be sized in adherence with conditions set forth in Rule .1969(9).**

****System sizing approval based on provision of manufacturer's warranty, as required by Section 2.4, Session Law 2001-5-5 (House Bill 1019), effective December 19, 2001. Requirements specific to Warranty Systems are detailed in Section III, below.**

EXAMPLE:
Assume: Three bedroom residence with a design daily sewage flow of 360 gallons on a sandy clay loam (Group III) soil.

Then: Total computed trench bottom area is:

360 gpd/0.5 LTAR = 720 ft²

The required linear footage of the Standard BioDiffuser system is:
720 ft² /4.0 ft. = 180 linear ft.
(Where 4.0 ft. is the equivalency factor for the Standard BioDiffuser chamber system.)

d. The minimum area (without reduction or equivalency factor) for a bed system shall be determined as required in 15A NCAC 18A.1955(d) except that the chambers shall be placed in rows next to each other.

e. The available space requirements of 15A NCAC 18A.1945 shall apply, and this approved innovative system may be designated as the required replacement system. However, whenever a Warranty System is proposed whereby the initial system has more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional wastewater system, there shall be sufficient repair area to install either a conventional gravel system, or an approved innovative system which has no more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional wastewater system, and both the initial and replacement system areas shall be Suitable or Provisionally Suitable for a conventional system in accordance with Rules .1948(a) and (b), or rules .1956(1), (2), (4), (5), and (6).

V. DESIGN AND INSTALLATION CRITERIA

Table IV
BioDiffuser Chamber Systems

Model	Maximum Trench Width (in)	Minimum Trench Depth* (in)	Minimum Trench Spacing (ft.o.c.)	Minimum Soil Cover (in)
Standard	36	17	9	6
ARC 36	36	19	9	6
Bio 3	24	18.4	7	6

***Minimum trench bottom depth below finished grade. Shallow installations to a minimum of 12-inches below natural grade are acceptable where needed, with approved imported backfill added to achieve the required 6-inches of cover. Manufacturer's installation procedures for shallow placed systems shall be followed.**

a. The BioDiffuser chamber system used in nitrification trenches shall be installed according to the minimum and maximum dimensions in Table IV.

b. The inlet to the BioDiffuser chamber shall be through the provided cutout in the uppermost portion of the inlet panel. For dosed systems receiving effluent from a pump or siphon, manufacturer's installation procedures shall be followed, including provisions to dissipate inflow rate so as to minimize soil scouring, venting of each line, and modifications that enable the presence and effectiveness of these provisions to be field-verified.

c. Clean Group I, II, III, or IV soil backfill (soil normally found in the upper 10 inches of the trench excavation) shall be placed along the chamber sidewall area to a minimum compacted (walked-in) height that is equal to the height of the top of the chamber louvers. Backfill shall be free of trash or debris. Backfill placed adjacent to the louvered sidewalls shall be free of large (8" or greater) clods that do not break apart during the walk-in procedure. The latest version of the manufacturer's installation instructions shall be followed. Additional soil backfill (Group I, II, III, or IV) shall be placed above the chambers to a minimum compacted height according to the following conditions:

1. to achieve H-10 load rating capability, a minimum of 12 inches of adequately compacted cover must be installed above the BioDiffuser units;
2. for Shallow Placement installations, a minimum of 6 inches of adequately compacted cover must be installed above the BioDiffuser units; and

3. the person installing the system shall be certified (documented) by PSA, Inc. as specially trained and qualified to install the BioDiffuser chamber units with a minimum soil cover of 6 inches (Shallow Placement).

No construction equipment shall traverse the chamber system unless the load is temporarily bridged over the trench so as not to disturb the chambers.

d. Individual chamber trenches shall be constructed level in all directions (both across and along the trench bottom) and shall follow the contour of the ground surface (uniform depth) with continuous interlocking chambers, including the Angle Chamber Section, without any dams, stepdowns, or other water stops.

e. The BioDiffuser systems installed on a sloping site may use distribution devices or stepdowns as described in 15A NCAC 18A.1955(j) and (l) when it is necessary to change level nitrification line segments from upper to lower elevations. However, the requirement to fully utilize the upstream nitrification trench applies to an elevation at least equal to the top of the chamber louvers.

f. After installation of chambers in trench or bed configuration, a filter fabric barrier shall be installed to cover the chambers if chambers are installed in uncompacted, fine, or very fine uniform sand and at least one of the following are present:

1. Installations are left uncovered and subject to a major rain event.
2. Systems are subject to not being sodded (or stabilized) in a timely manner after final cover-up has occurred.
3. The drainfield is not protected from surface drainage.

The filter fabric shall be non-woven, weight 0.35 oz./s.y. to 1 oz./s.y., have apparent opening size (AOS) 20-30 U.S. Sieve (ASTM D-4571), or alternate with equal or better performance characteristics. An alternate fabric shall be approved in writing by the manufacturer on a case-by-case basis.

g. Manufacturer's installation instructions for the BioDiffuser system used in septic tank systems shall be followed except as required herein or 15A NCAC 18A.1900 et.seq.

h. The system shall be installed by a contractor appropriately certified in writing by the manufacturer.

VI. OPERATION AND MAINTENANCE REQUIREMENTS

The BioDiffuser chamber system shall have a minimum classification as a Type III g. System (other non-conventional trench systems) in accordance with Table V(a) of 15A NCAC 18A.1961(b).

VII. REPAIR OF SYSTEMS

The provisions of 15A NCAC 18A.1961(c) shall apply to the use of the BioDiffuser chamber system for repairs to existing malfunctioning septic tank systems.

VIII. WARRANTY SYSTEMS

All approved BioDiffuser chambers, when installed in any system in accordance with the conditions of this approval and all applicable Rules, are warranted by the Manufacturer to perform (maintain structural integrity) under varying field temperatures.

The BioDiffuser Standard chamber and ARC 36 chamber may be installed at length reductions in excess of 25% to a limit of 35% length reduction (4.61 square feet per linear foot) when all previous listed, and the following, conditions, are met:

a. The Manufacturer shall provide the approved Warranty in effect on the date of the Operation Permit issuance to the owner or purchaser of the system. The terms and conditions of the Warranty shall be approved by the Department, pursuant to applicable Laws and Rules. The Warranty shall be valid for a five-year period from the date of the first use of the wastewater system, as indicated by the date of issuance of either the Operation Permit or the Certificate of Occupancy for the facility served by the system (whichever is later).

b. The Manufacturer shall issue the Warranty to the property owner through it's authorized installer, who shall sign the Warranty indicating the system has been installed in accordance with the Manufacturer's specifications, any conditions of the Approval granted by the Department, and all conditions of the Authorization to Construct a Wastewater System by the local health department. The Installer or contractor shall promptly return a copy of the signed Warranty to the Manufacturer indicating Address and Location of the system, date the system was placed into use, and type and model of the system installed.

c. The Warranty shall provide that the Manufacturer shall provide all materials and labor that may be necessary to provide a fully functional wastewater system at no cost to the Owner. This section shall not be construed to require that a manufacturer warrant an innovative wastewater system that is not properly sized to meet the design load required for a particular use, that is improperly installed, or that is improperly operated and maintained, in accordance with 15A NCAC 18A .1900 et. seq.

d. Warranty repairs such as full replacement of the nitrification system, extension of the nitrification system, or other repairs shall be competed pursuant to a repair Authorization to Construct to be issued by the local health department in accordance with Rule .1961(1).

e. The Warranty shall be attached to the Operation Permit issued by the Health Department for the wastewater system. The Warranty transfers to any subsequent owners of the system up to the end of the five-year applicability period.

Approved by:_____ Date:_____

Terry L. Pierce, Director, Division of Environmental Health

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES DIVISION OF ENVIRONMENTAL HEALTH ON-SITE WASTEWATER SECTION

INNOVATIVE WASTEWATER SYSTEM APPROVAL

INNOVATIVE WASTEWATER SYSTEM NO: IWWS-93-2-R10

ISSUED TO:

Infiltrator Systems, Inc.
P. O. Box 768
Old Saybrook, CT 06475
800-221-4436; Fax: 860-577-7001; www.infiltratorsystems.net

FOR: "Infiltrator" chambered (Standard, Standard SideWinder, Standard SC, Equalizer 36, High Capacity, Contour Wedge, Standard Contour Swivel, and Quick 4 Standard and Quick 4 Standard W, and Quick 4 Equalizer 36) sewage effluent subsurface disposal systems.

APPROVAL DATES:		
	25 August 1994	Standard Chamber
	26 April 1999	SC (Shallow or 6-inch cover) Load Design
	26 April 1999	High Capacity Chamber
	17 January 2001	Standard SideWinder and Contour Wedge
	4 October 2001	Equalizer 36 and Standard SideWinder SC (Shallow or 6-inch cover) Load Design
	18 April 2002	High Capacity SideWinder and Revised Equivalency Factors
	20 March 2003	Equalizer 36 Swivel and Standard Contour Swivel
	8 April 2003	Revised (Warranty) Equivalency Factors
	19 December 2003	Quick 4 Standard Chamber
	7 April 2004	Minor Revisions/Edits
	September 29, 2004	Quick 4 Standard W Chamber
	1 November 2005	Quick 4 Equalizer 36 Chamber

In accordance with 15A NCAC 18A.1969, an application by Infiltrator Systems, Inc. of Old Saybrook, CT for a revised approval of the chamber (gravel-less) nitrification trench system has been reviewed. The following Infiltrator Chamber systems have been found to meet standards of an innovative system when all of the conditions of this approval are met for the following models:

?? Standard and Standard SideWinder (polyethylene) with 12 inch cover
?? High Capacity (polyethylene) with 12 inch cover

?? Quick 4 Standard, Quick 4 Standard W, Standard SC and Standard SideWinder SC (polypropylene) Models with 6 inch cover
?? Equalizer 36 with 6 inch cover
?? Quick 4 Equalizer 36 with 6 inch cover
?? High Capacity SideWinder (polypropylene) with 12 inch cover
?? Contour Wedge
?? EQ 36 Swivel
?? Contour Swivel - Standard

I. PERMITTING

Prior to the installation of the approved Infiltrator chamber nitrification trench system at a site for which application is being made for an Improvement Permit or Construction Authorization or at a site for which an Improvement Permit or Construction Authorization has been previously issued for a system described in 15A NCAC 18A.1955, .1956, or .1957, the owner or authorized agent shall notify the local health department. The local health department shall issue an Improvement Permit or Construction Authorization or amend the previously issued Improvement Permit or Construction Authorization allowing for the use of the proposed innovative system upon a finding that all provisions of this approval and all other applicable rules shall be met. Use of the proposed innovative system and any conditions shall be described in the construction authorization or amended construction authorization, as applicable. Such information shall also be described on the operation permit to be issued upon the acceptable completion of the system installation.

II. SYSTEM DESCRIPTION

a. Minimum pretreatment by septic tank as required in 15A NCAC 18A .1952.

b. Standard and Standard SideWinder chamber units (including High Capacity Model) consist of a high density polyethylene arch-shaped injection molded chamber. The Quick 4 Standard, Standard SC and Standard SideWinder SC units consist of polypropylene arch-shaped injection molded chamber. Standard and High Capacity approved models have an average inside width of 2.5 ft (30 inches) and an overall length of 6 ft 2¼ inches. The connected overall length of a Quick 4 Standard and Quick 4 Standard W chamber is 4 feet. The Standard, Standard SideWinder, Standard SideWinder SC, and Standard SC units are approximately one foot high with slotted sidewalls approximately 6 inches high. The High Capacity and High Capacity SideWinder Models are approximately 16 inches high with slotted sidewalls approximately 10.75 inches high. The chamber sidewall slope is approximately 20 degrees toward the chamber center or away from the trench sidewall. The Equalizer 36 chamber is 13.5 inches high and 22 inches wide with an average inside width of 19 inches and a total open area (sidewall and bottom) of approximately 3.0 SF/LF and overall length of 8 ft 4 inches. The Quick 4 Equalizer 36 chamber is 12.5 inches high

and 22 inches wide with an average inside width of 19.3 inches and overall length of 4 feet. Note: sixteen Standard or High Capacity Infiltrator chambers are approximately equal to 100 linear feet. Twenty-five Quick 4 Standard, Quick 4 Standard-W, and Quick 4 Equalizer 36 chambers are approximately equal to 100 linear feet. Twelve Equalizer 36 Infiltrator chambers are approximately equal to 100 linear feet. [See Table I below].

c. Each chamber unit shall be properly and permanently marked in compliance with the appropriate standard, and conditions of this approval as follows:

?? Standard or Standard SideWinder
?? Quick 4 Standard, Quick 4 Standard W, Standard SC or Standard SideWinder SC
?? High Capacity or High Capacity SideWinder
?? Equalizer 36 or Quick 4 Equalizer 36
?? Contour Wedge
?? EQ 36 Swivel
?? Contour Swivel - Standard

d. Each chamber unit is designed to mechanically interlock with the downstream chamber forming a complete nitrification trench that consists of an inlet plate with a splash plate located below the inlet on the trench bottom and a solid end plate to be located at the distal end of any chamber nitrification line.

e. The contour wedge, EQ 36 swivel or standard contour swivel can be utilized as accessories to achieve turns as necessary in all applications as applicable, including but not limited to shallow cover with 6 inches of soil, or the standard and high capacity units with 12 inches of soil.

TABLE I

Infiltrator Chamber Dimensions						
Model	Length Overall (ft)	Height (in)	Bottom Width (in)	Average Open Bottom Width (in)	Slotted Sidewall Height (in)	Invert[1] Height (in)
Standard & Standard SideWinder (polyethylene)	6.25	12.3	33.3	28.9	6	6.9

Standard SC and Standard SideWinder SC (polypropylene)	6.25	12.3	33.3	28.9	6	6.9
Quick 4 Standard (polypropylene)	4.0	12.5	33.5	27.7	7. 4 (avg) 8.2 upper, 6.7 lower	8.0
Quick 4 Standard W (polypropylene)	4.0	12.5	33.75	29.0	7. 4 (avg) 8.2 upper, 6.7 lower	8.0
High Capacity and High Capacity SideWinder (polyethylene)	6.25	15.9	33.2	29.3	10.8	10.2
Equalizer 36 (polyethylene)	8.33	13.6	22.8	19.6	9.6	6.0 or 9.0
Quick 4 Equalizer 36 (polypropylene)	4.0	12.5	22.8	19.3	10.0 (avg) 9.3 upper, 10.7 lower	6.0

[1]Invert Height is for a 4-inch diameter Schedule 40 PVC Pipe

III. SITING CRITERIA

The Standard, Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder, Standard SideWinder SC, Equalizer 36, Quick 4 Equalizer 36, High Capacity and High Capacity SideWinder Infiltrator nitrification trench assemblies may be utilized on any site that one can use rock aggregate and pipe which meet the following criteria:

a. Sites which are classified as Suitable or Provisionally Suitable for a conventional nitrification field system in accordance with 15A NCAC 18A .1948(a) or (b).
b. Sites which have been reclassified as Provisionally Suitable in accordance with 15A NCAC 18A.1956(1), (2), (4), (5), and (6).

c. Sites which meet the criteria for new or existing fill in accordance with 15A NCAC 18A .1957(b). The provisions of Rule .1957(b) are applicable whenever any portion of the chamber in an Infiltrator System extends into fill material. There shall be no

reduction in trench length compared to conventional gravel trench. This reference to "fill material" applies to the site fill and not the backfill placed between the trench and the chamber sidewall.

d. The required vertical separation shall be measured from the bottom edge of the chamber.

IV INFILTRATOR CHAMBER SYSTEM SIZING:

a. The maximum long-term acceptance rate (LTAR) shall be as follows:

TABLE II

Textural Group		LTAR (gpd/sq.ft.)	
		Natural Soil	Saprolite
Soil/Group I (Sands)	Sands	0.8 - 1.0	0.6-0.8
	Loamy Sand		0.5-0.7
Soil Group II (Coarse Loams)	Sandy Loam	0.6 - 0.8	0.4 - 0.6
	Loam		0.2-0.4
Soil Group III (Fine Loams)	Silt Loam	0.3 - 0.6	0.1-0.3
	Other Fine Loams		N.A.
Soil Group IV	Clays	0.1 - 0.4	N.A.

b. The LTAR shall be based on the most hydraulically limiting naturally occurring soil horizon within three feet of the ground surface or to a depth of one foot below trench bottom, whichever is deeper.

c. To determine the total trench bottom area (ft^2) required; the design daily sewage flow shall be divided by the applicable long-term acceptance rate shown in Table II above. The minimum linear footage for Infiltrator Systems shall be determined by dividing the total trench bottom area by the following equivalency factors:

Table III

Product	Excavated Trench Width (inch)	Equivalency Factor* (SF/LF)
Quick 4 Standard (polypropylene)	36	**4.3 (Warranty System)****
		3.8
Quick 4 Standard W (polypropylene)	36	**4.61 (Warranty System)****
		4.00

Standard (polyethylene)	36	**4.61 (Warranty System)****
		4.00
Standard SC (polypropylene)	36	**4.61 (Warranty System)****
		4.00
Standard Sidewinder (polyethylene)	36	**4.61 (Warranty System)****
		4.00
Standard Sidewinder SC (polypropylene)	36	**4.61 (Warranty System)****
		4.00
High Capacity (polyethylene)	36	**4.61 (Warranty System)****
		4.00
High Capacity SideWinder (polyethylene)	36	**4.61 (Warranty System)****
		4.00
Equalizer 36 (polyethylene)	24	3.00
Quick 4 Equalizer 36 (polypropylene)	24	3.00

***Reduction in nitrification trench length allowed by use of these Equivalency Factors, as compared to sizing requirements delineated in Rule .1955 for conventional systems, apply only to drainfields receiving effluent of domestic strength or better quality. Any proposed use of the system for facilities producing higher strength wastewater shall be sized in adherence with conditions set forth in Rule .1969(7).**

****System sizing approval based on provision of manufacturer's warranty, as required by Section 2.4, Session Law 2001-505 (House Bill 1019), effective December 19, 2001. Requirements specific to Warranty Systems are detailed in Section VIII, below. Where products have two equivalency factors based on the provision of a manufacturer's warranty, equivalency factors between the two factors may be used if a warranty is provided.**

EXAMPLE:

Assume: Three bedroom residence with a design daily sewage flow of 360 gallons on a sandy clay loam (Group III) soil.

Then: Total computed trench bottom area is:
360 gpd/0.5 LTAR = 720 ft^2;

The required linear footage for Standard Infiltrator Systems is:
720 ft^2/4.0 ft = 180 linear ft.
(Where 4.0 ft. is the equivalency factor for the Standard Infiltrator chamber system)

d. The minimum area (without reduction or equivalency factor) for a bed system shall be

determined as required in 15A NCAC 18A .1955(d) except that the chambers shall be placed in rows next to each other.

e. The available space requirements of Rule .1945 shall be met, and this approved innovative system may be designated as the required replacement system. However, whenever a Warranty System is proposed whereby the initial system has more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional wastewater system, there shall be sufficient repair area to install either a conventional gravel trench system, or an approved innovative system which has no more than a 25% reduction in nitrification trench length as compared to the total nitrification trench length required for a 36-inch wide conventional system, and both the initial and replacement system areas shall be Suitable or Provisionally Suitable for a conventional system in accordance with Rules .1948(a) and (b), or Rules .1956(1), (2), (4), (5), and (6).

V. DESIGN AND INSTALLATION CRITERIA:

a. The Infiltrator chamber system used in nitrification trenches shall be installed according to the minimum and maximum dimensions in Table IV.

TABLE IV

Infiltrator Chamber Systems

Infiltrator Installation Requirements				
Model	Maximum Trench Width (in)	Minimum Trench Depth (in)	Minimum Trench Spacing (ft.o.c)	Minimum Soil Cover (in)
Standard (polyethylene) **(including Warranty System)**	36	24	9	12
Standard SideWinder (polyethylene) **(including Warranty System)**	36	24	9	12

Quick 4 Standard, Quick 4 Standard W and Standard SC (polypropylene) **(including Warranty System)**	36	18	9	6
Standard SideWinder SC (polypropylene) **(including Warranty System)**	36	18	9	6
High Capacity and High Capacity SideWinder (polyethylene) **(including Warranty System)**	36	30	9	12
Equalizer 36 (polyethylene)	24	19.5	7	6
Quick 4 Equalizer 36 (polyethylene)	24	18.5	7	6

b. The inlet to the Infiltrator chamber shall be in the uppermost portion of the specially prepared inlet panel ("end cap"). For dosed systems receiving effluent from a pump or siphon, manufacturer's installation procedures shall be followed, including provisions to dissipate inflow rate so as to minimize soil scouring and modifications that enable the presence and effectiveness of these provisions to be field-verified.

c. Backfill shall be placed between the trench and chamber sidewall to a minimum compacted (carefully walked in) height that is equal to the top of the chamber louvers. Chamber systems can be installed utilizing native soil backfill (Group I, II, III, or IV). Backfill shall be free of trash or debris. The area adjacent to louvers shall be free of large (8"or greater) clods that do not break apart during the walk in procedure. The latest version of the manufacturer's installation procedure shall be followed. The Standard, Standard SideWinder, High Capacity, and High Capacity SideWinder chamber models require additional soil backfill (Group I, II, III, or IV) to a minimum compacted cover of 12 inches is required above the chamber. The Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC, Equalizer 36, and Quick 4 Equalizer 36 chamber models may be installed with a minimum compacted cover of 6 inches (shallow placement) when the following conditions are met:

1. Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC, Equalizer 36, or Quick 4 Equalizer 36 chamber units are used;
2. The person installing or constructing the system is certified (documented) by Infiltrator Systems, Inc. as specially trained and qualified to install the Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC, Equalizer 36, or Quick 4 Equalizer 36 chamber units with a minimum soil cover of 6 inches;
3. The person installing the Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC Equalizer 36, or Quick 4 Equalizer 36 chamber system shall produce certification documentation upon the request by the State or local health department.
4. When installing the Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC, Equalizer 36, or Quick 4 Equalizer 36 chambers in shallow placement (6 inches of soil cover) in Group I (sand) soils (including specially constructed Infiltrator Contour Wedge and Swivel units), the installer shall carefully follow the manufacturer's installation guideline for shallow placement.

Vehicular traffic or construction equipment may traverse the chamber system only when the load is bridged over the trench so as not to disturb the chambers. The load may be bridged with a minimum of six inches of compacted soil cover over shallow chamber models (Quick 4 Standard, Quick 4 Standard W, Standard SC, Standard SideWinder SC, Equalizer 36, and Quick 4 Equalizer 36) and a minimum of 12 inches of compacted soil cover over other Infiltrator chamber models.

d. Infiltrator Swivel units (EQ36 Swivel and Standard Contour Swivel) shall be installed on undisturbed soil which is level with the adjacent drainfield trench bottoms. The installer shall be responsible for compacting the trench bottom beneath the Swivel units according to the manufacturer's guidelines when the units are installed in Group I (sand) soil. Backfill for the Swivel units shall be hand-compacted (carefully walked in) up to the top of the adjacent chamber units. Backfill shall be native soil (Group I, II,III, or IV). Backfill for the Swivel units shall be free of trash or debris and clods larger than 3" which do not break apart during the hand-compaction procedure.

e. Individual chamber trenches shall be constructed level in all directions (both across and along the trench bottom) and shall follow the contour the ground surface elevation (uniform depth) with continuous interlocking chambers, including specially constructed Infiltrator Contour Wedge, EQ36 Swivel and Standard Contour Swivel units, without any dams, stepdowns or other water stops.

f. Infiltrator systems installed on a sloping site may use distribution devices or stepdowns as described in 15A NCAC 18A .1955(j) and (l) when it is necessary to change level nitrification line segments from upper to lower elevations. The Multi-Port end cap of the Quick 4 model chambers may be used as a stepdown by making the cross-over out of one of its upper pre-marked ports (8-inches above the bottom of

the end-cap) and conveying effluent through a solid pipe segment installed on a positive downhill grade down to the next lower trench in series. The pre-marked ports on the top of chambers may be used to receive effluent from an upper trench by a cross-over pipe. Stepdown installation details shall be in accordance with Infiltrator Systems North Carolina Design and Installation Manual.

g. After installation of chambers in trench or bed configuration, a filter fabric barrier shall be installed to cover the chambers (except Quick 4 chamber models) if chambers are installed in uncompacted, fine or very fine uniform sand **and** at least one of the following conditions are present:

   1. Installations are left uncovered and subject to a major rain event.
   2. Systems are subject to not being sodded (or stabilized) in a timely manner after final cover-up has occurred.
   3. The drainfield is not protected from surface drainage.

   The filter fabric shall be non-woven, weight 0.35 oz./s.y. to 1 oz./s.y., have apparent opening size (AOS) 20-30 U.S. Sieve (ASTM D-4571), or alternate with equal or better performance characteristics. An alternate fabric shall be approved in writing by the manufacturer on a case-by-case basis.

h. Manufacturer's installation instructions for the applicable Infiltrator system used in septic tank systems shall be followed except as required herein or 15A NCAC 18A .1900 et.seq.

i. All Infiltrator chamber systems shall be installed by a contractor or installer appropriately certified in writing by the manufacturer.

j. All Infiltrator chamber systems shall be installed with Infiltrator end caps at the inlet and distal ends of each chamber row.

VI. OPERATION, MAINTENANCE AND MONITORING REQUIREMENTS:

The Infiltrator chamber system shall have a minimum classification as a Type III g system (other non-conventional trench systems) in accordance with Table V(a) of 15A NCAC 18A .1961(b).

VII. REPAIR SYSTEMS

The provisions of 15A NCAC 18A .1961(l) shall apply to the use of Infiltrator chamber systems for repairs to existing malfunctioning septic tank systems.

VIII. WARRANTY SYSTEMS (Standard, Standard SC, Quick 4 Standard W, High Capacity, High Capacity Sidewinder, Standard Sidewinder and Standard Sidewinder SC only when installed with length reductions in excess of 25% and for Quick 4 Standard only when installed with length reductions in excess of 21%)

a. The Manufacturer shall provide the approved Warranty in effect on the date of the Operation Permit issuance to the owner or purchaser of the system. The terms and conditions of the Warranty shall be approved by the Department, pursuant to applicable Laws and Rules. The Warranty shall be valid for a five-year period from the date of first use of the wastewater system, as indicated by the date of issuance of either the Operation Permit or the Certificate of Occupancy for the facility served by the system (whichever is later).

b. The Manufacturer shall issue the Warranty to the property owner through it's authorized installer who shall sign the Warranty indicating the system has been installed in accordance with the Manufacturer's specifications, any conditions of the Approval granted by the DENR, and all conditions of the Authorization to Construct a Wastewater System by the local health department. The installer or contractor shall promptly return a copy of the signed Warranty to the Manufacturer indicating Address and Location of the system, date the system was placed into use, and type and model of system installed.

c. The Warranty shall provide that the manufacturer shall provide all materials and labor that may be necessary to provide a fully functional wastewater system at no cost to the Owner. This section shall not be construed to require that a manufacturer warrant an innovative wastewater system that is not properly sized to meet the design load required for a particular use, that is improperly installed, or that is improperly operated and maintained, in accordance with 15A NCAC 18A .1900 et. seq.

d. Warranty repairs such as full replacement of the nitrification system, extension of the nitrification system or other repairs shall be completed pursuant to a repair Authorization to Construct to be issued by the local health department in accordance with Rule .1961(l).

e. The Warranty shall be attached to the Operation Permit issued by the Health Department for the wastewater system. The Warranty transfers to any subsequent owners of the system up to the end of the five-year applicability period.

Approved by:_____ Date:_____

SAFETY AND BUILDINGS DIVISION
Plumbing Product Review
P.O. Box 7162
Madison, Wisconsin 53707

Wisconsin
Department of Commerce

Jim Doyle, Governor
Cory L. Nettles, Secretary

June 2, 2003

RING INDUSTRIAL GROUP, EZFLOW
BEN BERTEAU
65 INDUSTRIAL PARK RD.
OAKLAND TN 38060

Re: Description: LEACHING SYSTEM, POLYSTYRENE AGGREGATE
Manufacturer: RING INDUSTRIAL GROUP, EZFLOW
Product Name: EZ FLOW
Model Number(s): EZ1203H (3-12" bundles with pipe in center bundle in 5 ft. or 10 ft. lengths) and EZ1203HP (3-12" bundles with pipe in each bundle in 5 ft. or 10 ft. lengths)
(EISA of 5 ft. length product = 25.0 sq. ft./product, EISA of 10 ft. length product = 50.0 sq. ft./product, Width = 36 inches, Height = 12 inches, Max. depth of bury = 8 ft., Open bottom area of = 2.65 sq. ft./linear foot of product)
Product File No: 20030127

The specifications and/or plans for this plumbing product have been reviewed and determined to be in compliance with chapters Comm 82 through 84, Wisconsin Administrative Code, and Chapters 145 and 160, Wisconsin Statutes.

The Department hereby issues an alternate approval to s. Comm 83.44 (4) (a) 1.a. based on the Wisconsin Statutes and the Wisconsin Administrative Code. This approval is valid until the end of June 2008.

This approval supercedes the approval issued on February 19, 2003, under product file number 20020187.

This alternate approval is contingent upon compliance with the following stipulation(s):

- EISA means the Equivalent Infiltrative Soil Area per product which is used to size the soil treatment/dispersal cell using soil application rates specified in Table 83.44-1 or Table 83.44-2 of the Wis. Adm. Code.

- This product may be installed in dispersal cells in place of stone aggregate specified in approved POWTS Component Manuals. When the distribution cell is not sized based on the EISA rating, the dispersal cell area must be equal to or greater than the area required for stone aggregate. Each 5 ft. length product has a equivalent stone aggregate area of 15 sq. ft. and each 10 ft. length product has a equivalent stone aggregate area of 30 sq. ft.

- This product must be installed with the inlet invert of the distribution cell piping at least 6 inches above the infiltrative surface of the distribution cell.

- This product must be installed in accordance with the manufacturer's printed instructions, product approval, and plan approval. If there is a conflict between the manufacturer's instructions and the product approval and/or plan approval, the product approval and/or plan approval will take precedence.

- This product must have geotextile fabric that meets requirements of s. Comm 84.30 (6) (g), Wis. Adm. Code, installed directly on top of the product and extending down along the sides of the product to a point at least six inches from the bottom of the product.

- When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must receive wastewater having a BOD5 value between 30 and 220 mg/L and a TSS value between 30 and 150 mg/L.

- When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in individual excavations that create a dispersal cell that is horizontally separated from other dispersal cells in other excavations by at least 3 feet. The 3-foot measurement is measured between the closest outside edges of the product listed in the regarding block of the product approval letter.

- When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, the dispersal cell design must allow at least six inches of ponding in the product without backflow of wastewater into the drainpipe that discharges into this product.

- When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in a dispersal system, which has the top of the dispersal cell at or below original grade.

The department is in no way endorsing this product or any advertising, and is not responsible for any situation which may result from its use.

Sincerely,

Michael J. Beckwith, CIPE
Plumbing Product Reviewer
phone: 608-266-6742
fax: 608-267-9566
e-mail: mbeckwith@commerce.state.wi.us

PRODUCT APPROVALS OR ALTERNATE PRODUCT APPROVALS

Product Description: LEACHING CHAMBER

Manufacturer's Name	Product Name	Model Number(s)	Approval Stipulation	GOOD THRU
ADS, INC.	BIO DIFFUSER	11" STANDARD (EISA with out fabric = 31.1 sq. ft./chamber, EISA with fabric = 25.4 sq. ft./chamber w/fabric, Laying length = 6.21 ft., Width = 34 inches, Height = 11 inches, Max. depth of bury = 8 ft., Open bottom area = 15.2 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	06/07
ADS, INC.	BIO DIFFUSER	16" HIGH CAPACITY (EISA with out fabric = 31.1 sq. ft./chamber, EISA with fabric = 25.6 sq. ft./chamber w/fabric, Laying length = 6.21 ft., Width = 34 inches, Height = 16 inches, Max. depth of bury = 8 ft., Open bottom area = 15.3 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	05/06
ADS, INC.	BIO DIFFUSER BIO 3	Bio 3 (EISA with out fabric = 24.2 sq. ft./chamber, EISA with fabric = 19.2 sq. ft./chamber w/fabric, Laying length = 7.15 ft., Width = 22 inches, Height = 12 inches, Max. depth of bury = 8 ft., Open bottom area = 11.5 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	04/07
ADVANCED DRAINAGE SYSTEMS, INC.(ADS)	LEACHING CHAMBER	ARC 36 (EISA with out fabric = 25.0 sq. ft./chamber, EISA with fabric = 20.3 sq. ft./chamber w/fabric, Laying length = 5.0 ft., Width = 34.5 inches, Height = 13 inches, Max. depth of bury = 4 ft., Open bottom area = 12.1 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	10/10
CULTEC, INC.	CULTEC CONTRACTOR LEACHING CHAMBER	100N (EISA = 34.1 sq. ft./chamber, Laying length = 7.5 ft., Width = 35 inches, Height = 12-1/2 inches, Max. depth of bury = 8 ft. (H-10) or 20 ft (H-20), Open bottom area = 19.7 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299	04/07
CULTEC, INC.	CULTEC CONTRACTOR MODEL EZ-24	EZ-24 (EISA = 14.7 sq. ft./chamber, Laying length = 8 ft., Width = 16 inches, Height = 12-1/2 inches, Max. depth of bury = 8 ft. (H-10) or 20 ft. (H-20), Open bottom area = 8.8 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299	04/07
HANCOR INC	ENVIROCHAMBER	HI CAPACITY 135 gallon capacity model (EISA with out fabric = 31.1 sq. ft./chamber, EISA with fabric = 27.0 sq. ft./chamber w/fabric, Laying length = 6.21 ft., Width = 33.5 inches, Height = 18 inches, Open bottom area = 16.15 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	04/10
HANCOR INC	ENVIROCHAMBER	HI CAPACITY 138 gallon capacity model (EISA with out fabric = 30.7 sq. ft./chamber, EISA with fabric = 26.6 sq. ft./chamber w/fabric, Laying length = 6.13 ft., Width = 34 inches, Height = 17-1/2 inches, Open bottom area = 15.9 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	04/10

PRODUCT APPROVALS OR ALTERNATE PRODUCT APPROVALS

(continued) **LEACHING CHAMBER**

Manufacturer's Name	Product Name	Model Number(s)	Approval Stipulation	GOOD THRU
HANCOR INC	ENVIROCHAMBER	STANDARD (EISA with out fabric = 30.7 sq. ft./chamber, EISA with fabric = 26.6 sq. ft./chamber w/fabric, Laying length = 6.13 ft., Width = 34 inches, Height = 12 inches, Open bottom area = 15.9 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	04/10
INFILTRATOR SYSTEMS INC	HIGH CAPACITY SIDEWINDER CHAMBER	HIGH CAPACITY SIDEWINDER (EISA with out fabric = 31.0 sq. ft./chamber, EISA with fabric = 25 sq. ft./chamber, Laying length = 6.19 ft., Width = 34 inches, Height = 16 inches, Max. depth of bury = 8 ft., Open bottom area = 15.1 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	05/10
INFILTRATOR SYSTEMS INC.	QUICK4 STANDARD-W CHAMBER	QUICK4 STANDARD-W CHAMBER (EISA for chambers with out fabric = 20.0 sq. ft./chamber, EISA for chambers with fabric = 16.1 sq. ft./chamber w/fabric = 20.0 sq. ft./chamber, EISA for end caps = 5.8 sq. ft./pair of end caps, Laying length of chamber = 4.0 ft., Laying length of end caps = 1.0 ft., Width = 34 inches, Height = 12 inches, Max. depth of bury = 8 ft., Open Bottom area = 9.64 sq.ft./chamber, 3.5 sq.ft./pair of end caps)	1274, 1296, 1297, 1298, 1299, 1622	03/10
INFILTRATOR SYSTEMS, INC	EQUALIZER 36	EQUALIZER 36 (EISA with out fabric = 28.4 sq. ft./chamber, EISA with fabric = 22.6 sq. ft./chamber, Laying length = 8.36 ft., Width = 22 inches, Height = 13-1/2 inches, Max. depth of bury = 8 ft., Open bottom area = 13.5 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	03/10
INFILTRATOR SYSTEMS, INC	INFILTRATOR QUICK 4 STANDARD	INFILTRATOR QUICK 4 STANDARD (EISA for chambers with out fabric = 19.1 sq. ft./chamber, EISA for chambers with fabric = 15.2 sq. ft./chamber, EISA for end caps = 5.8 sq. ft./pair of end caps, Laying length of chamber = 4.0 ft., Laying length of end caps = 1.0 ft., Width = 34 inches, Height = 12 inches, Max. depth of bury = 8 ft., Open Bottom area = 9.1 sq.ft./chamber, 3.5 sq.ft./pair of end caps)	1274, 1296, 1297, 1298, 1299, 1622	02/09
INFILTRATOR SYSTEMS, INC	INFILTRATOR STANDARD	STANDARD (EISA for chambers with out fabric = 31.1 sq. ft./chamber, EISA for chambers with fabric = 25.9 sq. ft./chamber, Laying length = 6.22 ft., Width = 34 inches, Height = 12 inches, Max. depth of bury = 8 ft., Open bottom area = 15.5 sq.ft./chamber)	1274, 1296, 1297, 1298, 1299, 1622	04/07
INFILTRATOR SYSTEMS, INC	INFILTRATOR STANDARD SIDEWINDER	STANDARD SIDEWINDER (EISA for chambers with out fabric = 30.8 sq. ft./chamber, EISA for chambers with fabric = 24.8 sq. ft./chamber, Laying length = 6.16 ft., Width = 34 inches, Height = 12 inches, Max. depth of bury = 8 ft.,	1274, 1296, 1297, 1298, 1299, 1622	04/10

(continued) **LEACHING CHAMBER**

Manufacturer's Name	Product Name	Model Number(s)	Approval Stipulation	GOOD THRU
		Open bottom area = 14.9 sq.ft./chamber)		

Product Description: LEACHING SYSTEM, POLYSTYRENE AGGREGATE

Manufacturer's Name	Product Name	Model Number(s)	Approval Stipulation	GOOD THRU
RING INDUSTRIAL GROUP, EZFLOW	EZFLOW DRAINAGE SYSTEM	EZ1203H (3-12" bundles with pipe in center bundle in 5 ft. or 10 ft. length), EZ1203HP (3-12" bundles with pipe in each bundle in 5 ft. or 10 ft. length), EZ1201P (1-12" bundle with pipe in 5 ft. or 10 ft. lengths), EZ1201A (1-12" bundle containing aggregate only) and EZ0601A (1-6" bundle containing polystrene aggregate only). (EISA of EZ1203 H or EZ1203HP in 5 ft. lengths = 25.0 sq. ft./product, EISA of EZ1203 H or EZ1203HP in 10 ft. lengths = 50.0 sq. ft./product, Width = 36 inches, Height = 12 inches, Max. depth of bury = 8 ft.)	1274, 1296, 1328, 1329, 1330, 1331, 1332, 1423, 1424, 1501	11/08

Product Description: LEACHING UNIT, GRAVELLESS

Manufacturer's Name	Product Name	Model Number(s)	Approval Stipulation	GOOD THRU
ELJEN CORP.	ELJEN IN-DRIAN SYSTEM	TYPE A,36"X24"x7" AND TYPE SAND, 18"x48"x7"	862, 1122	08/06

APPROVAL STIPULATIONS

862 This product must be installed in accordance with the manufacturer's printed instructions, the plan approval, and ch. Comm 83, Wis. Admin. Code, system sizing criteria. If there is a conflict between the manufacturer's instructions and the plan approval, the plan approval, product approval and code requirements will take

1122 This plumbing product may only be installed in conventional soil absorption systems, in ground pressure distribution systems and mound systems.

1274 This product must be installed in accordance with the manufacturer's printed instructions, product approval, and plan approval. If there is a conflict between the manufacturer's instructions and the product approval and/or plan approval, the product approval and/or plan approval will take precedence.

1296 When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must receive wastewater having a BOD5 value between 30 and 220 mg/L and a TSS value between 30 and 150 mg/L.

1297 When this product is installed in a distribution cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in individual excavations that create a row of chambers that are horizontally separated from other rows in other excavations by at least 3 feet. The 3-foot measurement is measured between the closest out side edges of the

1298 When this product is installed in a distribution cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, the distribution cell design must allow at least six inches of ponding in the chambers without backflow of wastewater into the drainpipe that discharges into the chambers.

1299 When this product is installed in a distribution cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in a distribution system, which has the top of the distribution cell at or

1328 When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in individual excavations that create a dispersal cell that is horizontally separated from other dispersal cells in other excavations by at least 3 feet. The 3-foot measurement is measured between the closest outside edges of the product listed in the regarding block of the product approval letter.

1329 When this product is installed in a dispersal cell the design of the dispersal cell must allow at least six inches of ponding in the product without backflow of wastewater into the drainpipe that discharges into this product.

1330 When this product is installed in a dispersal cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, this product must be installed in a dispersal system, which has the top of the dispersal cell at or below

1331 This product must have geotextile fabric that meets requirements of s. Comm 84.30 (6) (g), Wis. Adm. Code, installed directly on top of the product and extending down along the sides of the product to a point at least six inches from the bottom

1332 EISA means the Equivalent Infiltrative Soil Area per product which is used to size the soil treatment/dispersal cell using soil application rates specified in Table 83.44-1 or Table 83.44-2 of the Wis. Adm. Code.

1423 This product may be installed in dispersal cells in place of stone aggregate specified in approved POWTS Component Manuals or Department approved systems. When the distribution cell is not sized based on the EISA rating, the dispersal cell area must be equal to or greater than the area required for stone aggregate.

1424 This product must be installed with the inlet invert of the distribution cell piping at least 6 inches above the infiltrative surface of the distribution cell.

1501 This product may be installed at a depth that exceeds the maximum depth stated in the regarding block of this approval, when the manufacturer provides in writing that the proposed installation depth is acceptable for the individual installation.

1622 When this product is installed with geotextile fabric on the sides of this product in a distribution cell that is sized based on the EISA rating stated in the regarding block of the product approval letter, the EISA rating with fabric must be used to size the

MANUFACTURERS' ADDRESSES

ADS, INC.
PSA, INC.
DICK BACHELDER
71 ORCHARD FARM RD.
YORK ME 03909
(207) 363-2528

ADVANCED DRAINAGE SYSTEMS, INC.(ADS)
PSA,INC.
GERRY SNOWDEN/DICK BACHELDER
4640 TRUMAN BLVD
HILLIARD OH 43026
(614) 658-0284

CULTEC, INC.
ROBERT DITULLIO
878 FEDERAL ROAD
BROOKFIELD CT 06804
(203) 775-4416

ELJEN CORP.
JOSEPH GLASSER
15 WESTWOOD ROAD
STORRS CT 06268
(203) 429-9486

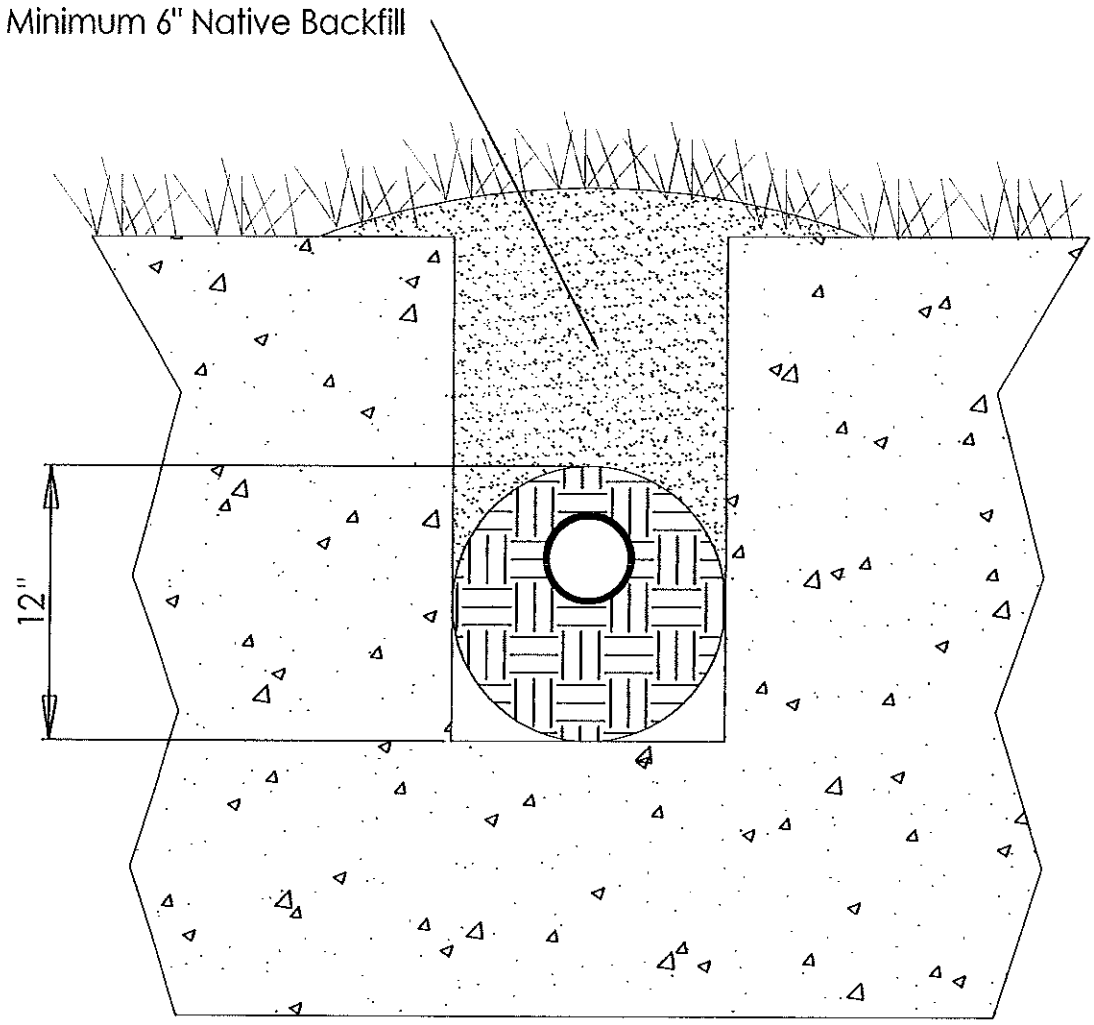
HANCOR INC
SHAWN LUTON
1207 SAVANNAH LN
MONROE GA 30655-8223
(770) 267-2756

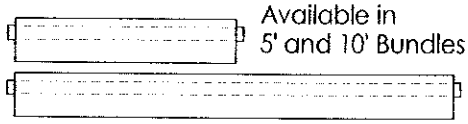
INFILTRATOR SYSTEMS INC
CARL W. THOMPSON
6 BUSINESS PARK RD
PO BOX 768
OLD SAYBROOK CT 06475
(800) 221-4436

INFILTRATOR SYSTEMS INC.
DAVID LENTZ
6 BUSINESS PARK RD.
PO BOX 768
OLD SAYBROOK CT 06475
(800) 221-4436

INFILTRATOR SYSTEMS, INC
CARL W. THOMPSON
6 BUSINESS PARK RD.
PO BOX 768
OLD SAYBROOK CT 06475
(800) 221-4436

RING INDUSTRIAL GROUP, EZFLOW
BEN BERTEAU
65 INDUSTRIAL PARK RD.
OAKLAND TN 38060
(901) 465-3607





Available in
5' and 10' Bundles

EPS Aggregate Drainage System

UNITS: INCHES

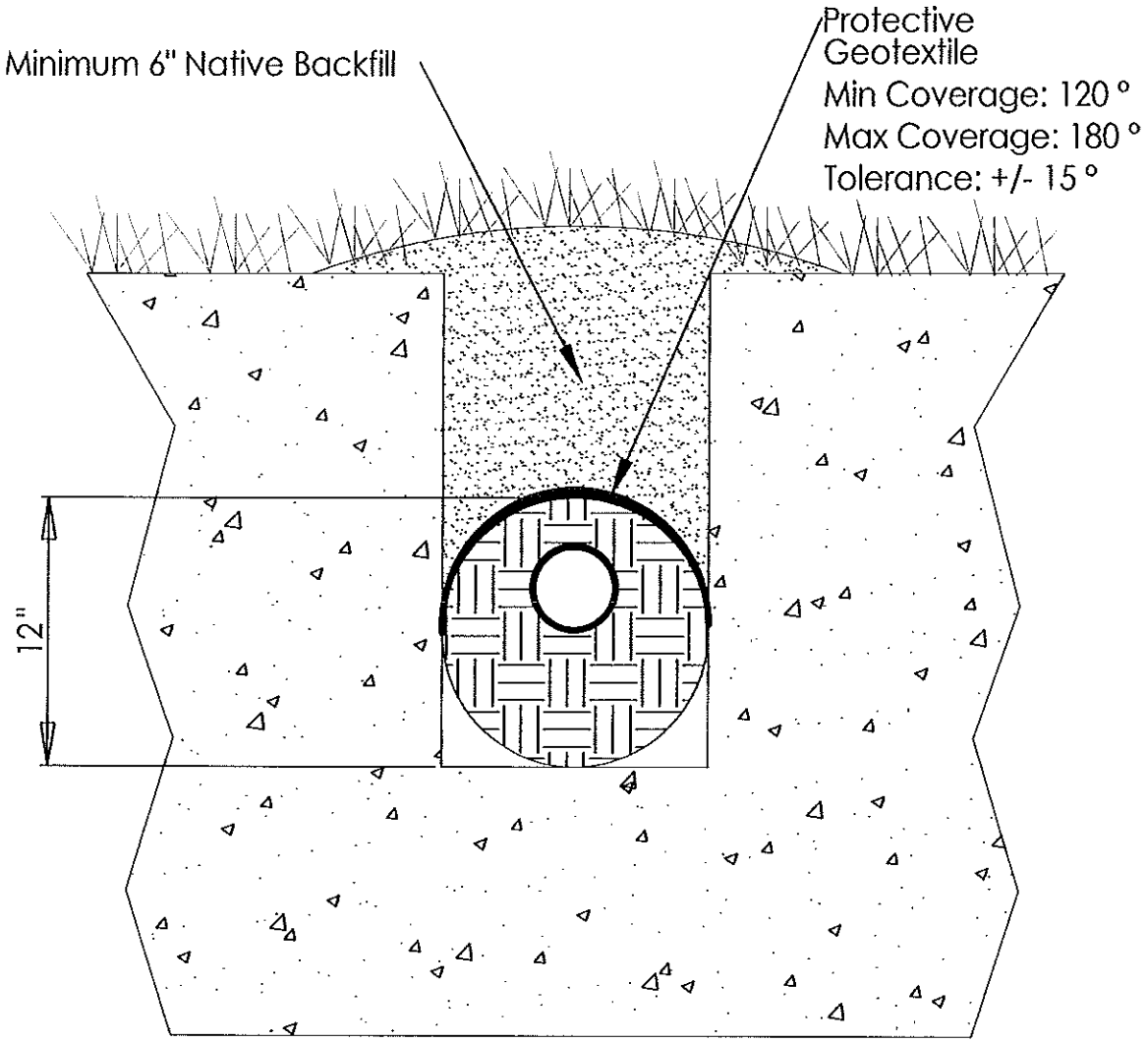
Last Edited: 07/28/2006

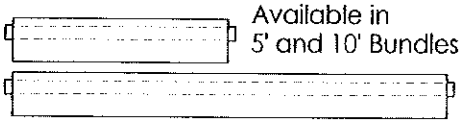
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

1201P





Available in
5' and 10' Bundles

EPS Aggregate Drainage System

UNITS: INCHES

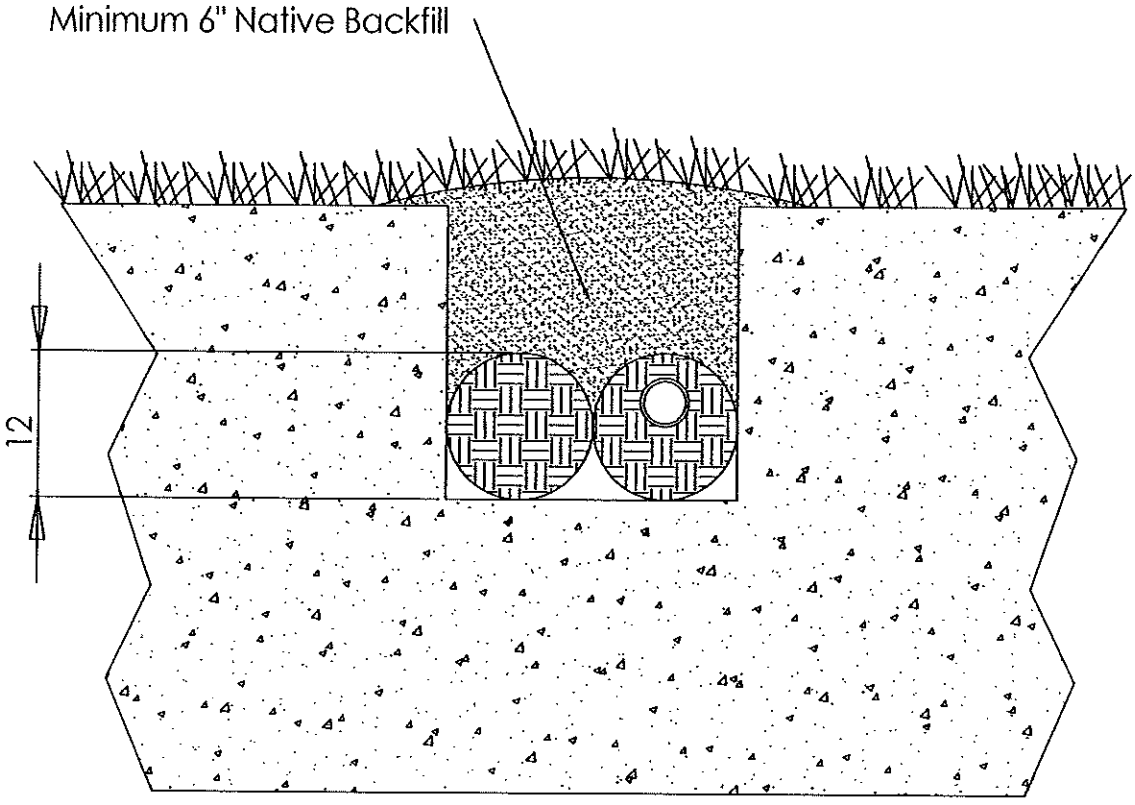
Last Edited: 07/31/2006

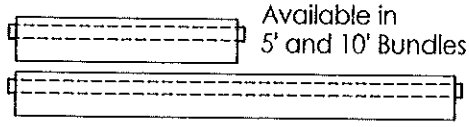
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

1201 GEO





Available in
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EPS Aggregate Drainage System

UNITS: INCHES

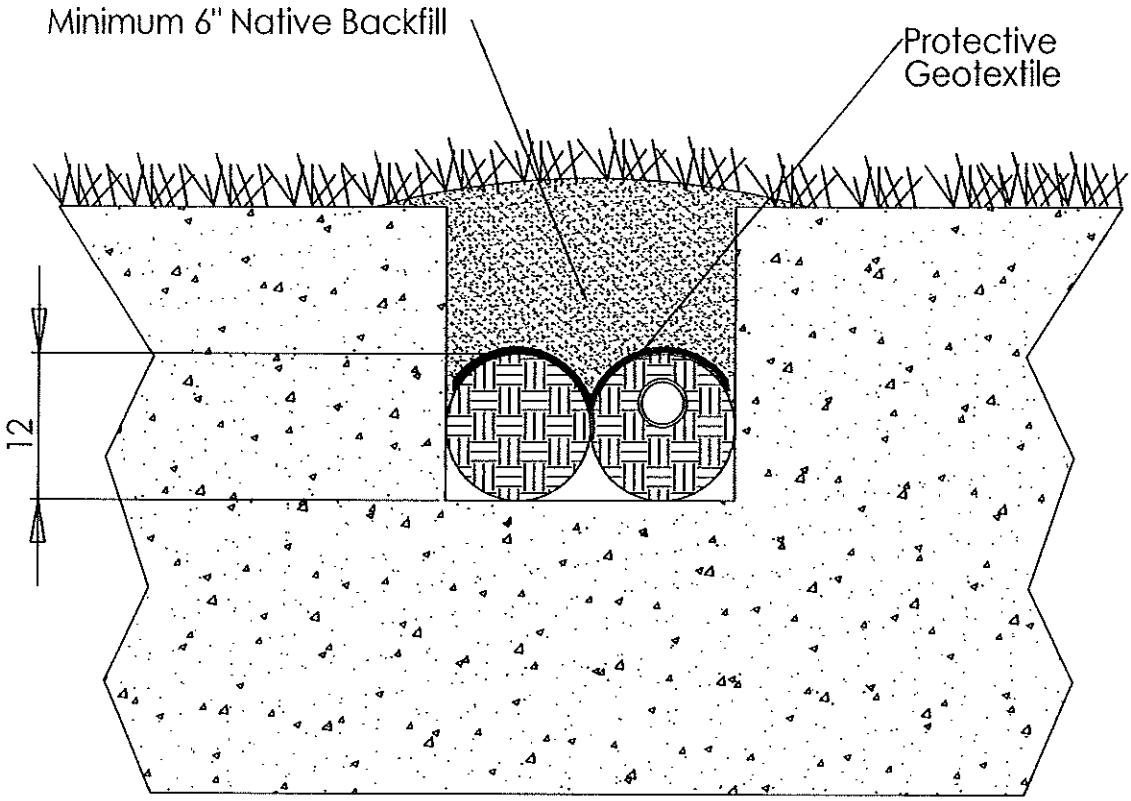
Last Edited: 07/25/2006

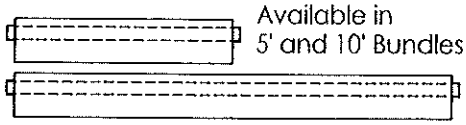
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

1202H





Available in 5' and 10' Bundles

EPS Aggregate Drainage System

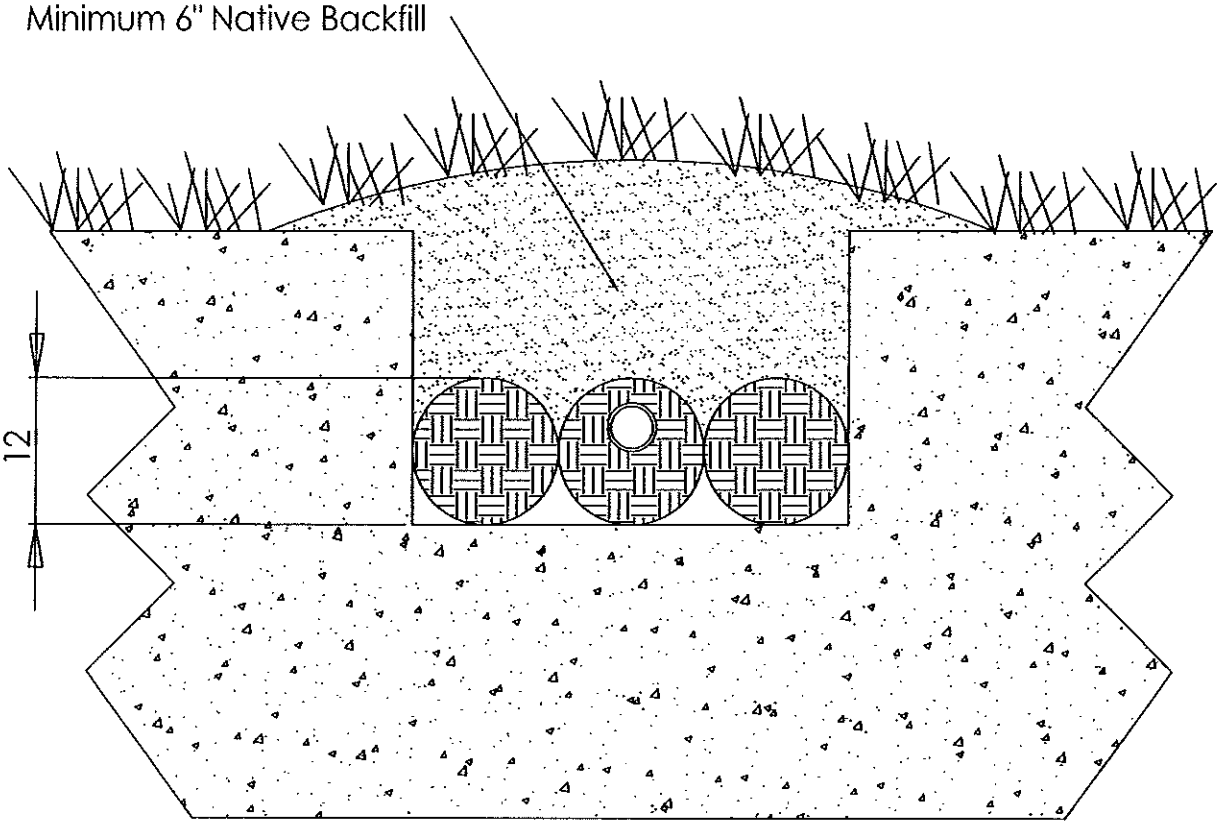
UNITS: INCHES

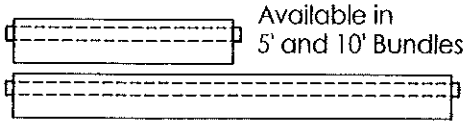
Last Edited: 07/31/2006

Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™
RING INDUSTRIAL

1202GEO





Available in
5' and 10' Bundles

EPS Aggregate Drainage System

UNITS: INCHES

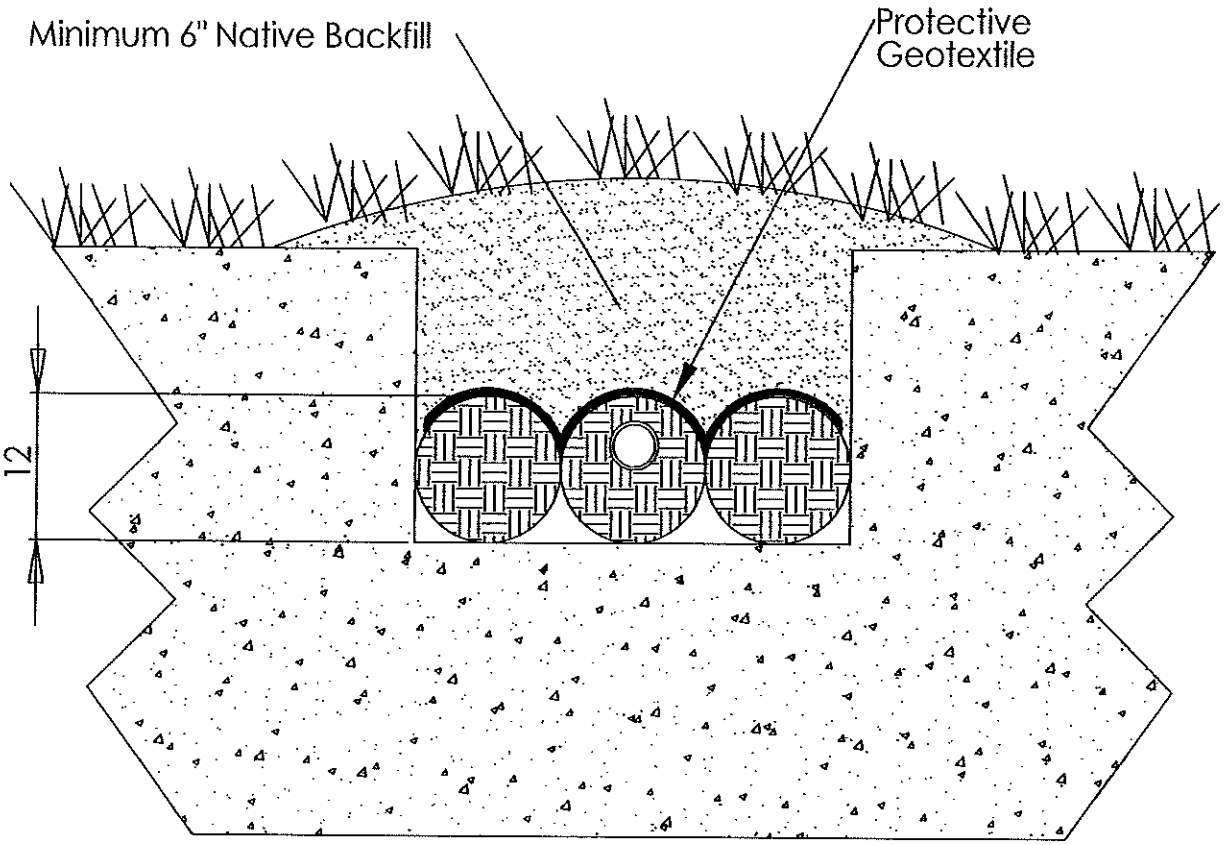
Last Edited: 07/27/2006

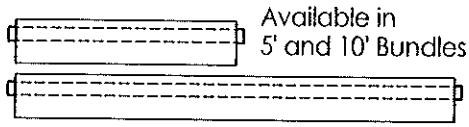
Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow™

RING INDUSTRIAL

1203H





Available in 5' and 10' Bundles

EPS Aggregate Drainage System

UNITS: INCHES

Last Edited: 07/31/2006

Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

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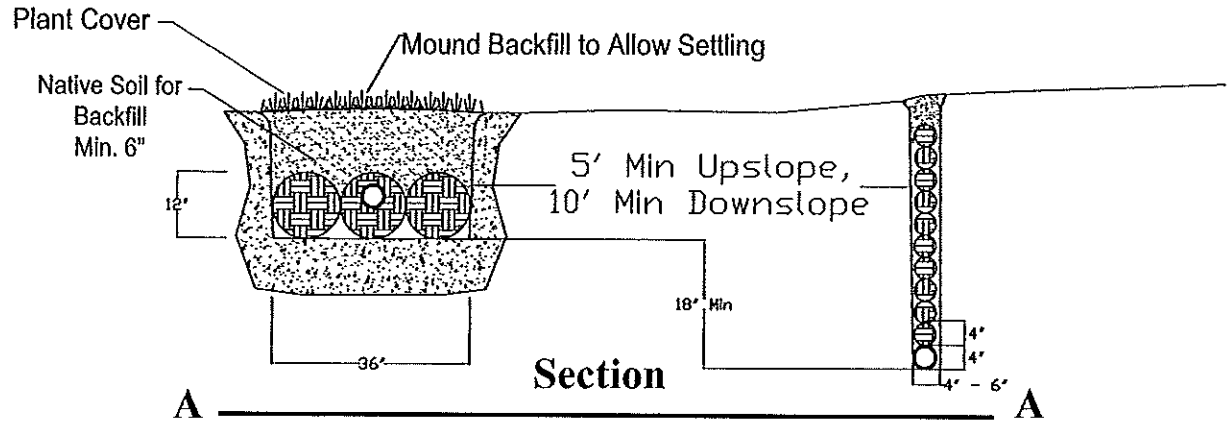
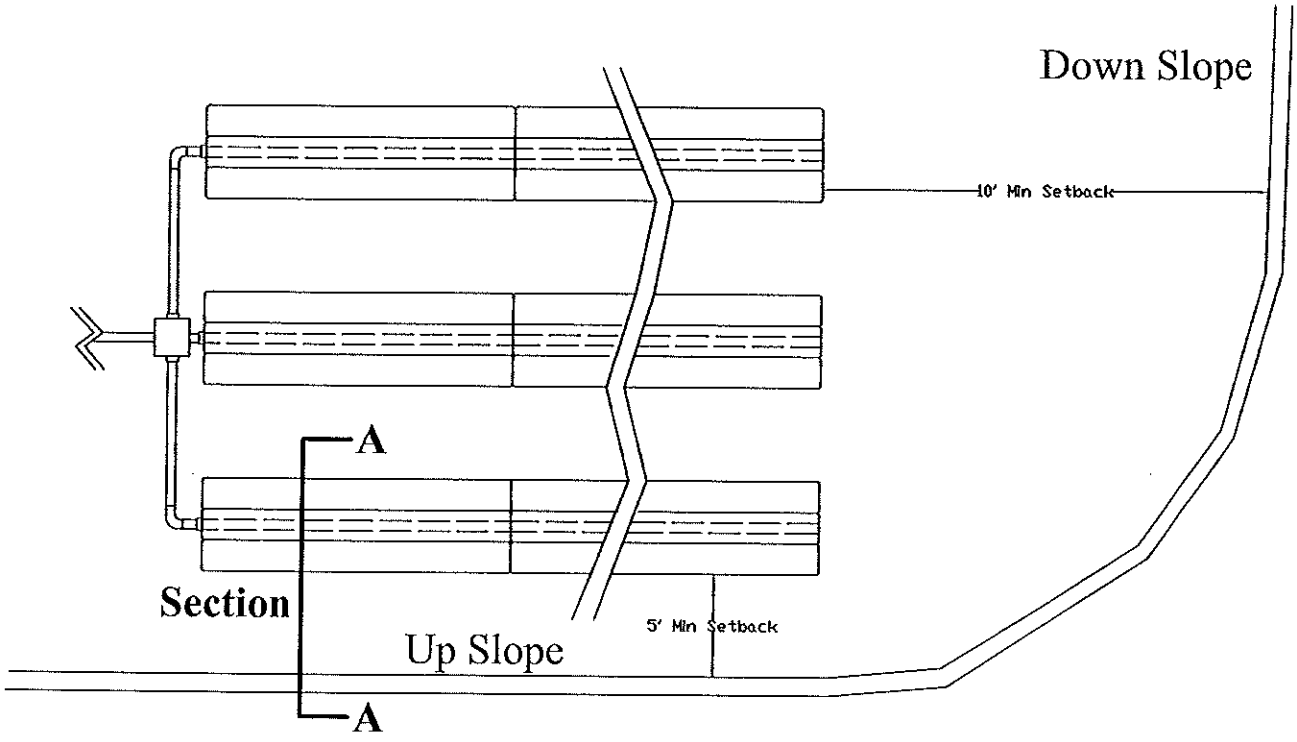
RING INDUSTRIAL

1203GEO

EZ1203H with 0400 Curtain Drain

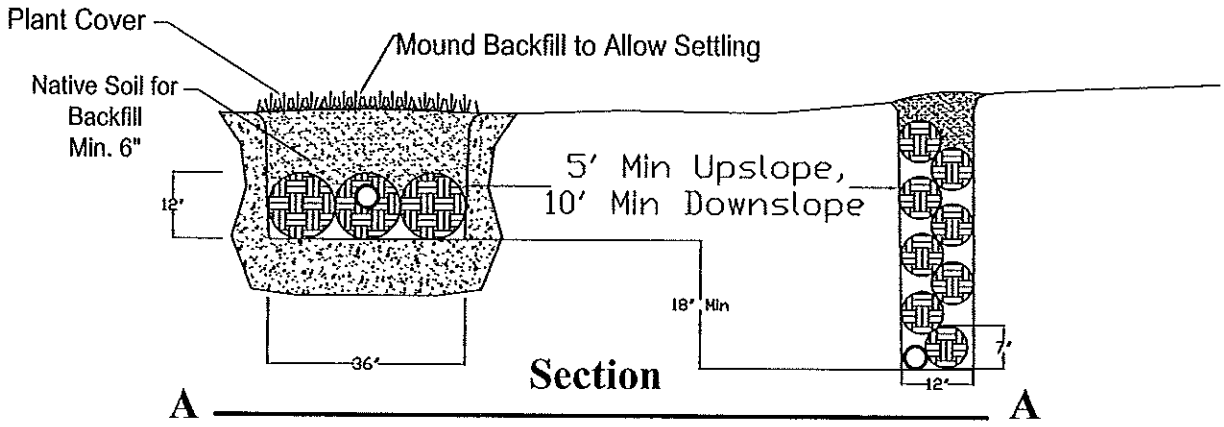


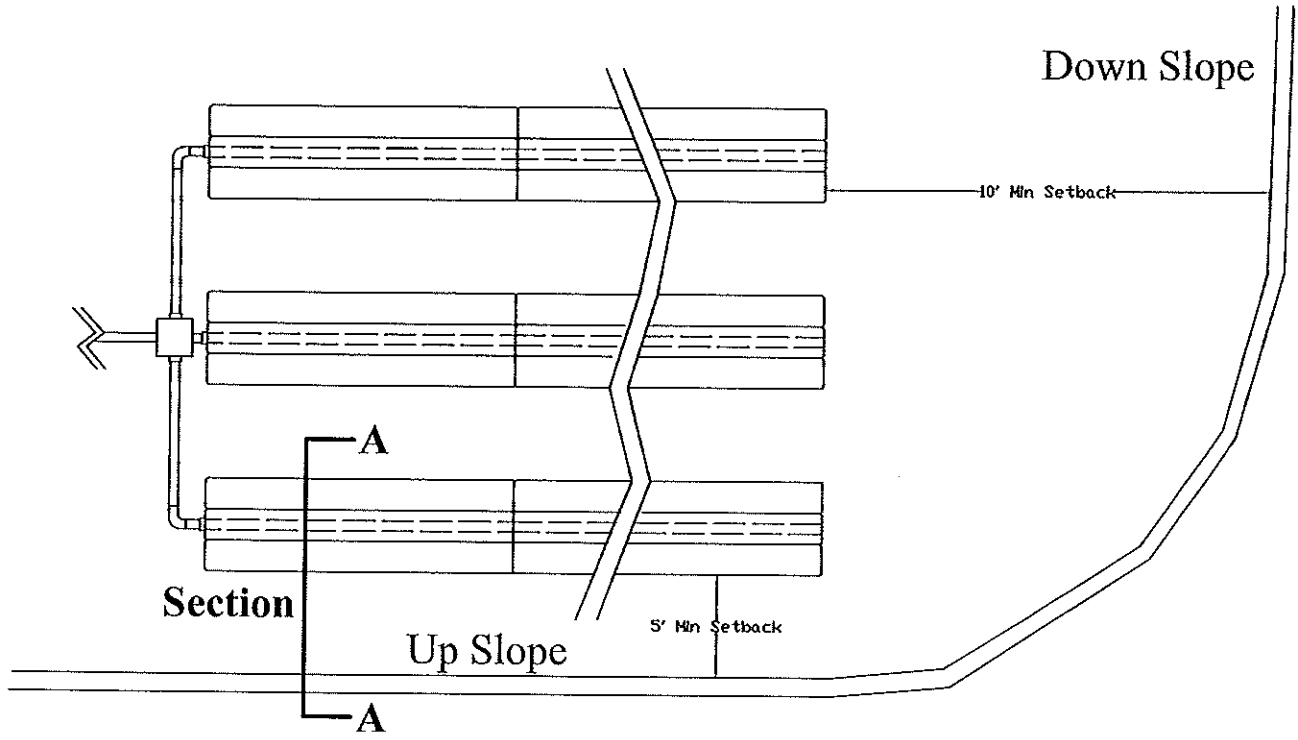


Product Notes: 0400CD is a prefabricated curtain drain and shall be designed and installed in accordance with 902 KAR 10:085.

EZ1203H with 0400 Curtain Drain			EZflow
Ring Industrial Group 65 Industrial Park Rd. Oakland, TN 38060			
NOT TO SCALE	FILE NAME:1203H – 0400CD	SHEET 1 of 1	DATE: 01-26-06

EZ1203H with 0700 Curtain Drain

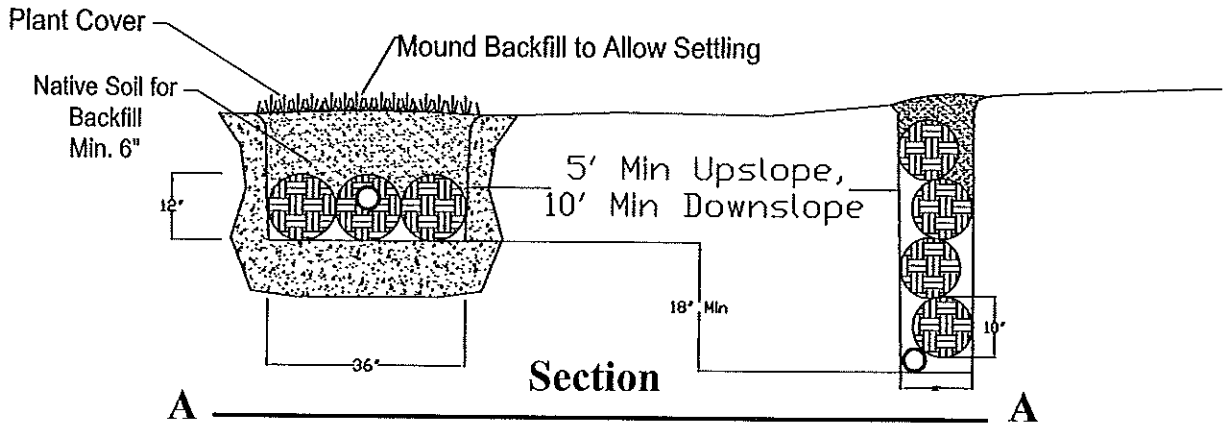


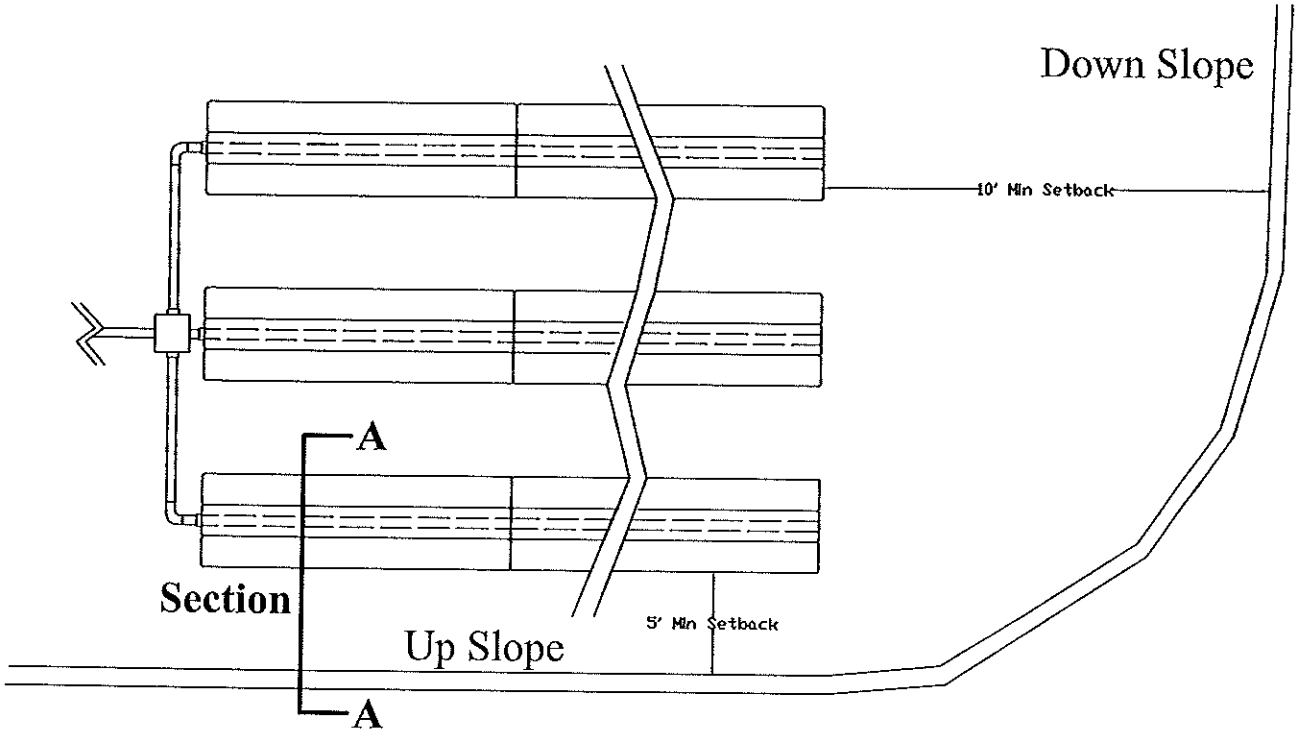


Product Notes: 0700CD is a prefabricated curtain drain and, shall be designed and installed in accordance with 902 KAR 10:085.

EZ1203H with 0700 Curtain Drain			EZflow
Ring Industrial Group 65 Industrial Park Rd. Oakland, TN 38060			
NOT TO SCALE	FILE NAME:1203H – 0700CD	SHEET 1 of 1	DATE: 01-26-06

EZ1203H with 1000 Curtain Drain





Product Notes:

1000CD is a prefabricated curtain drain and shall be designed and installed in accordance with 902 KAR 10:085.

EZ1203H with 1000 Curtain Drain

Ring Industrial Group
65 Industrial Park Rd.
Oakland, TN 38060

EZflow

NOT TO SCALE	FILE NAME:1203H – 1000CD	SHEET 1 of 1	DATE: 01-26-06