ANUA

P.O. Box 77457
Greensboro, NC 27417

T 336-547-9338
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w www.anua-us.com

MEMORANDUM

TO: MASE Members

FROM: Colin Bishop, REHS, RS
Director of Sales and Government Relations

DATE: October 19, 2012

RE: Puraflo and Platinum Maine Approvals

We want to share some exciting news with you!

The Puraflo Peat Fiber Biofilter has been approved in Maine since 1998. Recently, we received a revised approval to reduce the separation to a limiting layer to 12 inches. The letter from the Maine Subsurface Wastewater Unit is attached. Puraflo has a long and successful track record in the US as a single pass media filter. Puraflo is recognized for the ability to reduce pathogens and operate effectively under intermittent use situations. It has become the system of choice for extreme sites in environmentally sensitive areas. Puraflo can be coupled with a stone dispersal pad situated beneath the modules. This provides a very cost effective solution for homeowners.

Also, we recently received approval for the Platinum Submerged Aerated Filter. The letter from the Maine Subsurface Wastewater Unit is attached. Platinum treats to secondary standards and provides significant nitrogen reduction. Key product benefits include: underground installation (including blower and low profile access covers), submerged aerated filter with no by-pass of media, integrated biomass return from clarifier to primary tank and small footprint for environmentally sensitive installation in residential, small neighborhood and commercial applications. Platinum is suitable for high strength waste applications such as restaurants and convenience stores. Platinum can be coupled with Puraflo to provide the highest level treatment for the most sensitive sites.

Anua provides designers with tools to make the job easier. We have many Excel design spreadsheets to help you design a system that meets the requirements of Maine and Anua. We would be glad to provide these to you via email.

Please review the enclosed literature. Our website is www.anua-us.com. If you have any questions or need further information please contact me at 409-466-4644 or colin.bishop@anua-us.com.

Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services
Paul R. LePage, Governor Mary C. Mayhew, Commissioner

Department of Health and Human Services
Maine Center for Disease Control and Prevention
286 Water Street
11 State House Station
Augusta, Maine 04333-0011
Tel.: (207) 287-8016; Fax: (207) 287-9058
TTY Users: Dial 711 (Maine Relay)

Tel. (207) 287-5672 Subsurface Wastewater Unit Fax (207) 287-4172

September 5, 2012

Anua
Attn.: Colin Bishop, REHS, RS
P. O. Box 77457
Greensboro, NC 27417

Subject: Product Registration, Platinum Submerged Aerated Filter, Models 6, 8, 10, 12, 60, 80, 120, and 150

Dear Mr. Bishop:

The Division of Environmental Health has completed a review of a registration application for your company's products. This information was submitted pursuant to Section 6.HH of the Subsurface Wastewater Disposal Rules for registration for use in Maine.

The Platinum Submerged Aerated Filter consists of a multiple compartment aerated treatment unit which includes media blocks to accommodate fixed film biota. The device can be configured with an integral lift station if necessary. You have requested a 12 inch separation from the limiting factor and 50 percent reduction in disposal area when this device is used. According to the information you provided, the Platinum Submerged Aerated Filter has been certified by the European Committee for Standardization Standard EN 12566-3, which is analogous to ANSI/NSF Standard 40 for wastewater treatment systems.

On the basis of the information submitted, the Division has determined that the Platinum Submerged Aerated Filter is acceptable for use in the State of Maine, provided that it is installed, operated, and maintained in conformance with the manufacturer's directions.

Disposal areas may be separated vertically by 12 inches from limiting factors when the Platinum Submerged Aerated Filter is used. Although the Division does not grant disposal area size reductions for specific aerated treatment units, disposal area size may be reduced pursuant to Table 4B of the Subsurface Wastewater Disposal Rules.

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 Platinum Submerged Aerated Filter. 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.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen
Project Manager, Webmaster
Division of Environmental Health
Drinking Water Program
Subsurface Wastewater Unit
e-mail: james.jacobsen@maine.gov

/jaj

xc: Product File

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TTY Users: Dial 711 (Maine Relay)

August 14, 2012

Anua
Attn.: Colin Bishop, REHS, RS
P. O. Box 77457
Greensboro, NC 27417

Subject: Revised Product Registration, Puraflo Peat Fiber Biofilter

Dear Mr. Bishop:

The Division of Environmental Health has completed a review of a request for a revised registration for your company's product. This information was submitted pursuant to Section 6.HH of the Subsurface Wastewater Disposal Rules for registration for use in Maine.

The Puraflo Peat Fiber Biofilter consists of a residential lift station which collects septic tank effluent, and a peat filtration module. The lift station provides effluent to upper portion of the filtration module. Filtrate is collected at the bottom of the module and disposed of in a separate disposal area, or it is disposed of via a stone layer beneath the module, at the designer's discretion. Modules are rated at 150 to 1,500 gallons per day, for models P150*1A through P150*10B, respectively. Multiple modules may be used for greater design flows.

According to the information you provided, the Puraflo Peat Fiber Biofilter has been certified by the National Sanitation Foundation (NSF) pursuant to ANSI/NSF Standard 40 for residential wastewater treatment systems.

You have requested that the separation distance from the seasonal high groundwater table and bedrock (limiting factors) be reduced to 12 inches when Puraflo Peat Fiber Biofilters are used.

On the basis of this information the Division has determined that the Puraflo Peat Fiber Biofilter is acceptable for use in the State of Maine, provided that it is installed, operated, and maintained in conformance with the manufacturer's directions and the following conditions:

1. The vertical separation between the seasonal high groundwater table or bedrock and the bottom of the disposal area may be no less than 12 inches when Puraflo Peat Fiber Biofilters are used.

2. The vertical separation to the limiting factor must be measured from the bottom of the stone layer underlying a filter module when such a design is proposed.

3. The disposal area size must be calculated as a stone bed, when the stone layer underlying a filter module option is proposed.

4. The disposal area size may be reduced pursuant to Table 4B of the Subsurface Wastewater Disposal Rules when Puraflo Peat Fiber Biofilters are used.

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 Puraflo Peat Fiber Biofilter. 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.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen
Project Manager, Webmaster
Division of Environmental Health
Drinking Water Program
Subsurface Wastewater Unit
e-mail: james.jacobsen@maine.gov

/jaj

xc: Product File

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Case Study

Quick Facts

Application:	Residential
Product:	Platinum submerged aerated filter
Installer:	McKim Construction
Location:	Loudoun County, VA

High-Quality Treatment Solution in a High-Value Subdivision

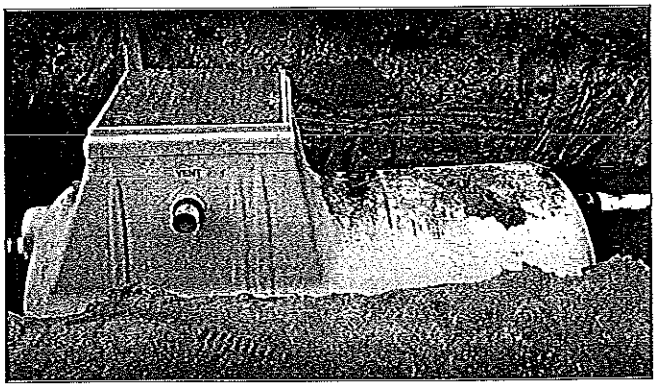
Situation

Loudoun County is an affluent suburb Northwest of Washington, D.C. K Hovnanian Homes is building a dozen homes in the Woodmar Farms subdivision which is not connected to the municipal sewer system.

The designer of the upscale, single-family home needed an onsite wastewater treatment system that was quiet, robust, affordable, simple to install and easy to maintain.

Solution

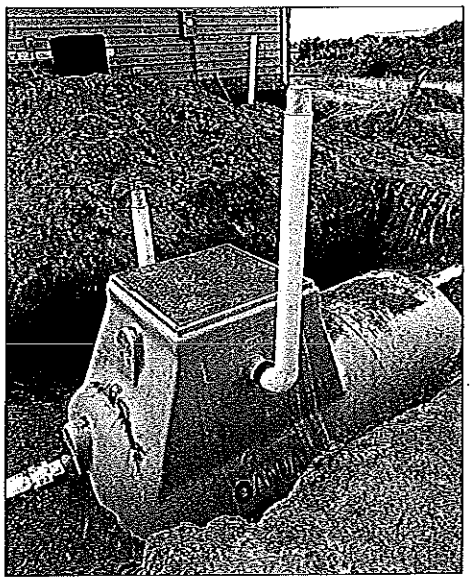
The Platinum is a submerged aerated filter (SAF) that was recently approved by the Virginia Department of Health for the TL-2 standard. Treatment systems comply with the TL-2 standard by achieving ≤30:30 mg/l BOD:TSS during a third-party testing protocol. An additional benefit is Platinum reduces total nitrogen by more than 50%. The Platinum model APG12 was selected over competitive products due to:



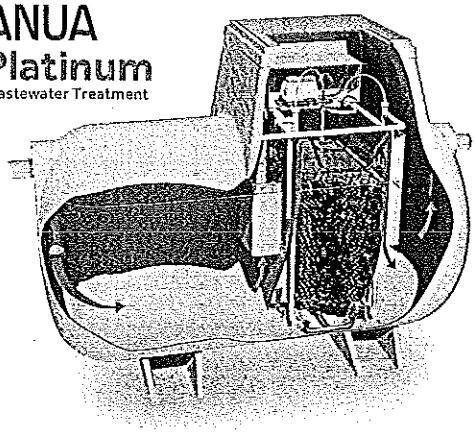
- Smaller footprint
- Ease of installation
- More robust treatment process
- Low noise and lower power consumption
- Structural quality of components.

Results

The Platinum replaces the need for a costly alternative treatment system and produces the high-quality effluent needed for environmentally-sensitive areas. Key product benefits include: underground installation (including blower and low profile access covers), submerged aerated filter with no by-pass of media, integrated biomass return from clarifier to primary tank and small footprint. Platinum can be used in residential, small neighborhood and commercial applications.



ANUA
Platinum
Wastewater Treatment



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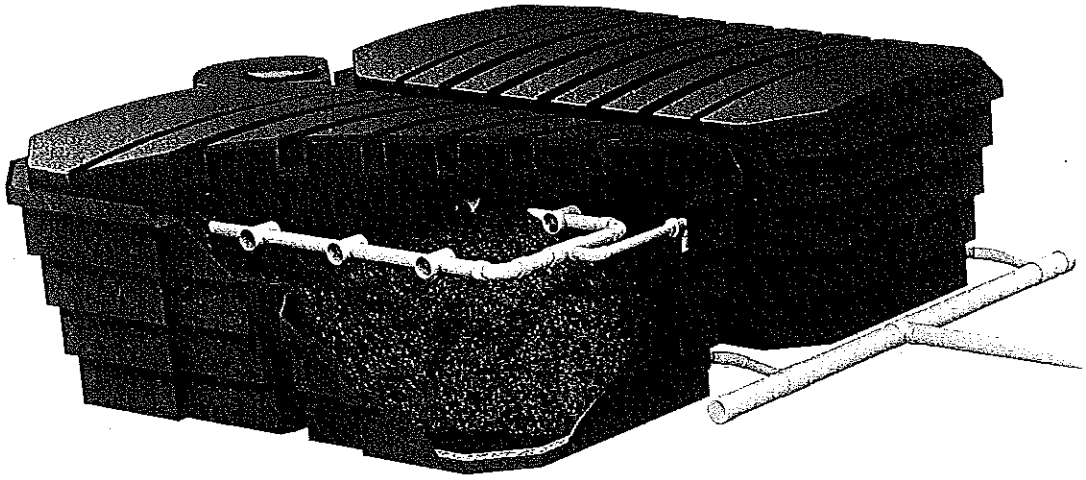
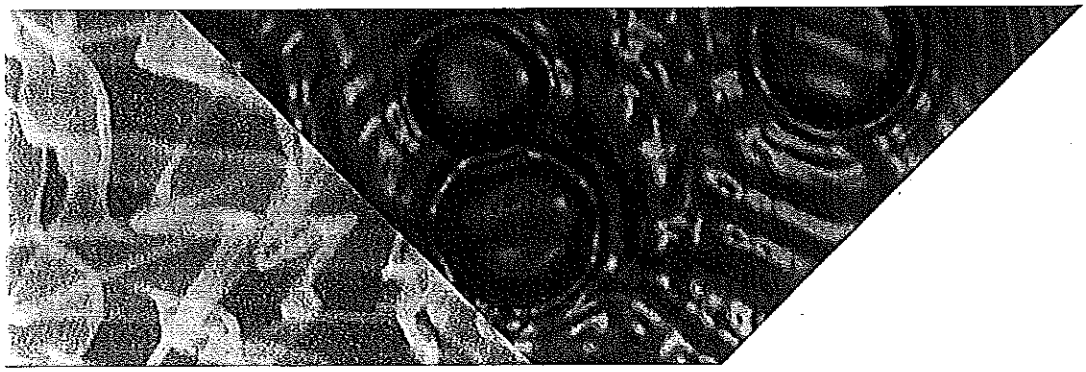
Think Green

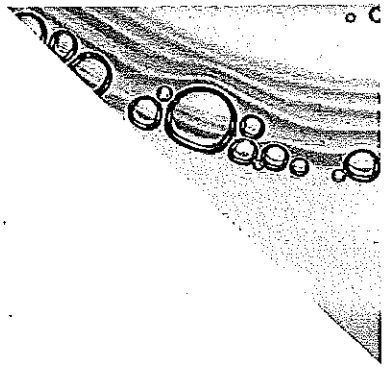


It's Time for a New Contract with Nature

- More than double the life of other peat media
- Low operating and maintenance costs
- Suitable for LEED certification
- Odor-free natural system
- Guaranteed, high quality performance protects health and the environment
- Compact wastewater treatment system
- Pre-assembled - Installs in hours not days
- Superior solution for difficult soils, shallow water tables and size restrictive sites
- Ideal for home, schools, offices, parks, churches, and communities
- High-quality treatment protects receiving waters
- Ideal for repairs
- Ideal for vacation homes and sites subject to intermittent use

Call: 336-547-9338 or visit: www.anua-us.com

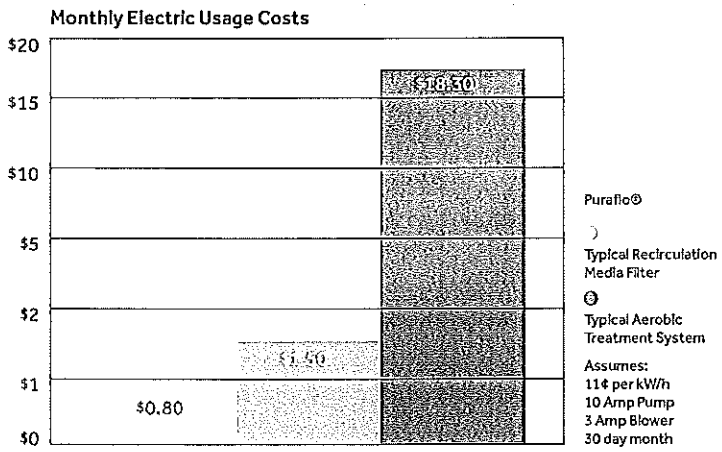




Low Power + Low Maintenance = Big Savings

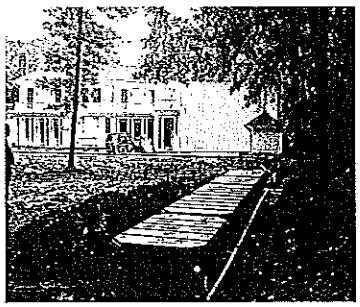
Reducing cost to the homeowner, Puraflo® requires significantly less power than many other treatment systems recirculating media filter aerobic treatment unit.

Compare with ATU's and typical media fiters and it is easy to see, the Puraflo peat biofilter is the green friendly, energy saving solution for home, office, and community developments.

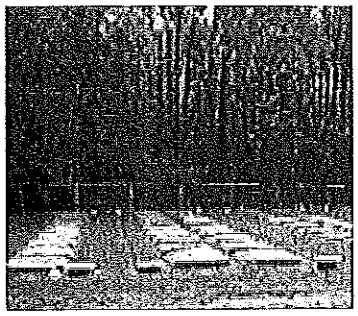


Reduced Complexity Lowers the Cost of Operation and Maintenance.

No blowers or pumps required. Treated effluent emerges from the Puraflo modules and disperses either into a gravel pad directly below the modules or is collected for dispersal by other methods, including gravel trenches, LPP, drip irrigation and other conventional disposal methods.



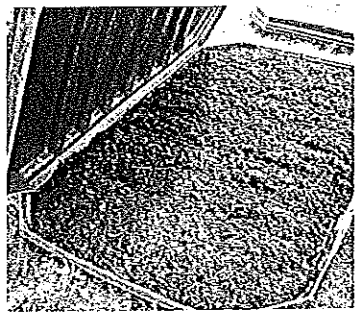
Residential Systems



Community Systems

The Difference is the Fiber - It Lasts Twice as Long as our Competitors

Puraflo peat fiber is imported from the Republic of Ireland and has a greater resistance to decay and degradation than other peat media. This is due to its extremely fibrous structure and high lignin content.



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Case Study

Quick Facts

Application:	Intermittent Use
Product:	Puraflo®
Distributor:	Emmons Pump & Control, Inc.
Designer:	Jarrett Engineering
Installer:	Chris Gabriels General Contractor
Location:	Lake George, NY

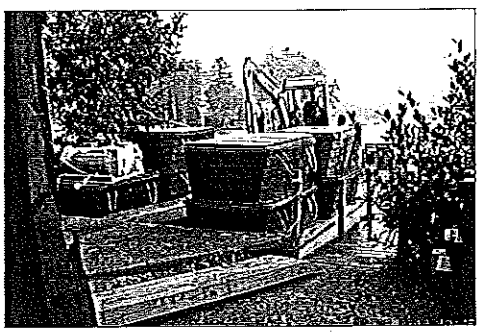
Puraflo® Provides Cleaner Effluent for Lake George Homeowners

Situation

Lake George is a long, narrow lake draining northwards into Lake Champlain and the St. Lawrence River drainage basin located at the southeast base of the Adirondack Mountains in northern New York. The lake is home to 395 islands. While the year-round population of Lake George is about 1,000, the population from Memorial Day to Labor Day can be greater than 50,000.

Lake George is the primary water supply for the residents of the islands, as well as the areas surrounding the lake.

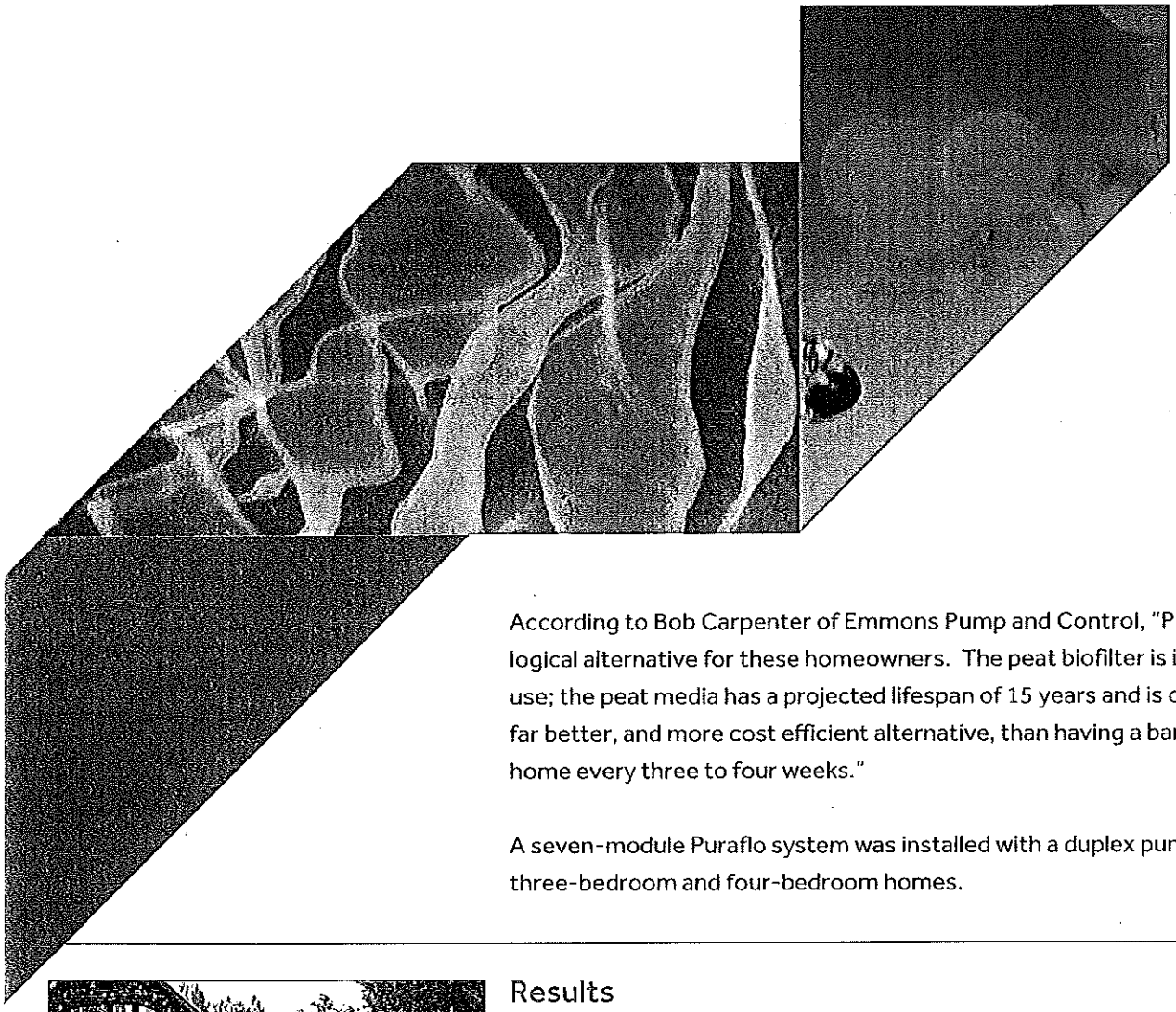
Two of the four homes on a 100,000 square foot island had a defective wastewater treatment system. The subsurface for these homes, and virtually all of the homes on the islands, is typically 18 inches before you reach solid rock thus providing poor retention for natural wastewater treatment before it enters the lake.



Solution

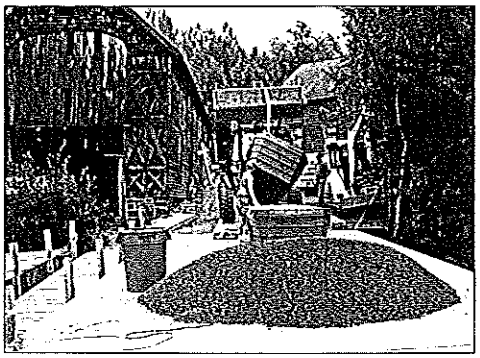
After meetings with the Lake George Water Association and code enforcement officers, it was determined that a Puraflo peat fiber biofilter was the optimal solution to the problem.

The alternative was installing large, above-ground tanks that would have required pumping via a barge pump every three to four weeks the homes were occupied.



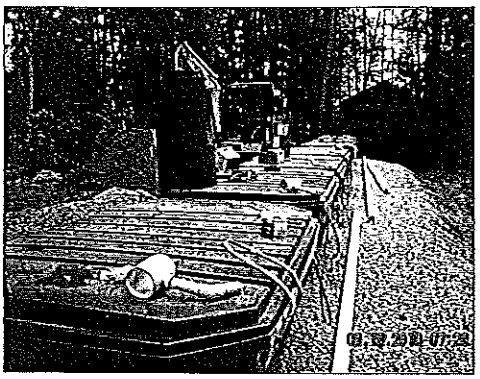
According to Bob Carpenter of Emmons Pump and Control, "Puraflo was the only logical alternative for these homeowners. The peat biofilter is ideal for intermittent use; the peat media has a projected lifespan of 15 years and is odor-free. Puraflo is a far better, and more cost efficient alternative, than having a barge pump visit your home every three to four weeks."

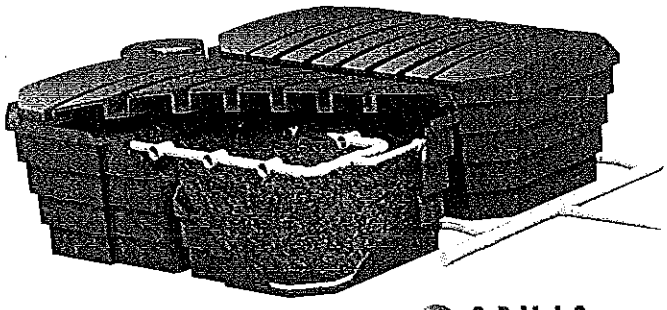
A seven-module Puraflo system was installed with a duplex pump system for the three-bedroom and four-bedroom homes.



Results

After installation, Emmons Pump received an order to install a three-module system for a cliff-side home on the lakeshore. Bob Carpenter is looking forward to a lot of business at Lake George in the coming years as more and more homeowners learn about the Puraflo peat biofilter and the quality of effluent produced that eventually enters the lake.





ANUA
Puraflo®
Wastewater Treatment

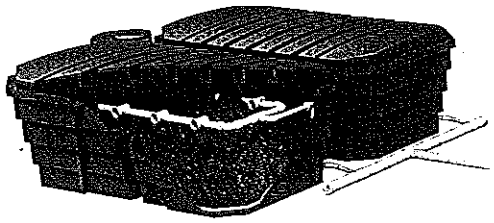
ANUA

You're Covered America

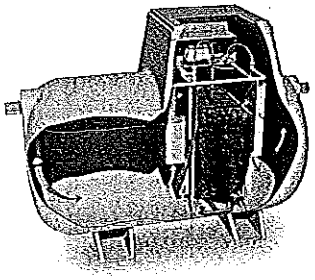
Regardless of your situation:

- Economic uncertainty
- Water or air treatment challenges
- Complex environmental requirements

Anua's full range of clean water and clean air solutions are affordable, reliable and sustainable.

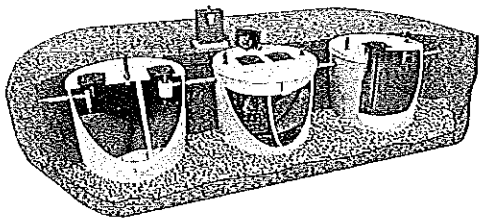


Clean Water Solutions



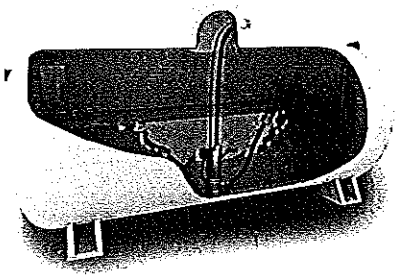
Secondary Treatment
- Platinum
- Puraflo

Advanced Secondary or Tertiary Treatment
- Platinum with Puraflo Polishing Filter
- Puraflo



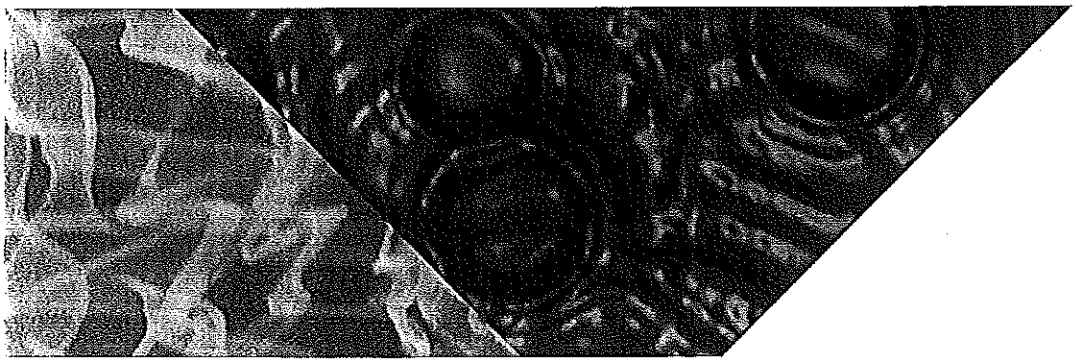
Nitrogen Reduction
- Platinum
- Puraflo Dn
- PuraMax Packaged Product

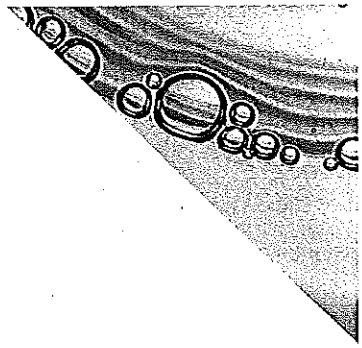
High-Strength Wastewater
- Platinum
- PuraMax Packaged Product



Water Reuse
- Platinum with Puraflo Polishing Filter
- PuraDrip
- PuraMc
- PuraM
- RainSava

Call: 336-547-9338 or visit: www.anua-us.com

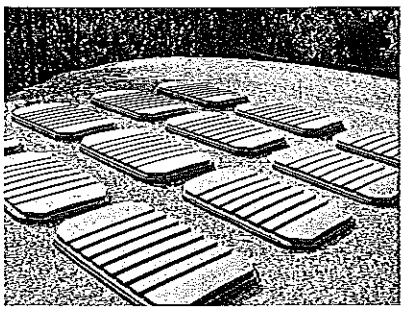




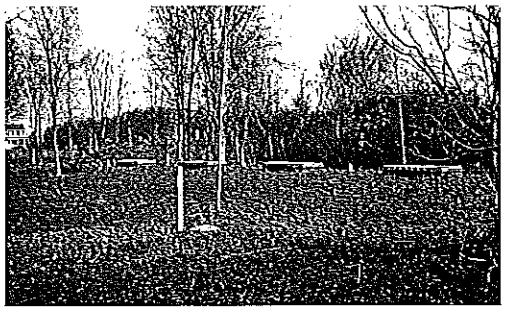
Effluent Dispersal Options

Anua's solutions can combine treatment and dispersal which offers many benefits:

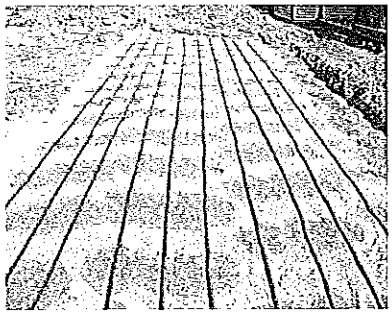
- Lower total cost and smaller footprint
- Alternative to costly direct discharge systems
- Green-friendly system that has low power consumption and protects highly sensitive watersheds
- Based on sound science by modeling hydraulic loading to prevent surfacing and water mounding



Bury it
In-ground pad

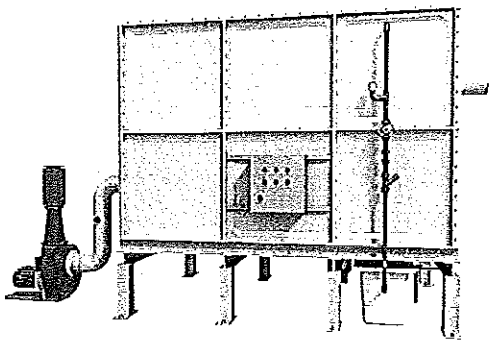


Elevate it
Mounded pad



Extreme site or difficult terrain
PuraDrip

Clean Air Solutions



Monashell

Compact Monashell

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Call: 336-547-9338 or visit: www.anua-us.com

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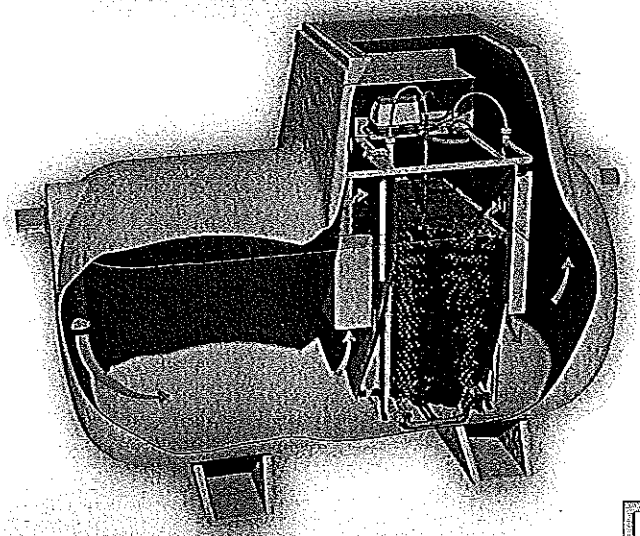
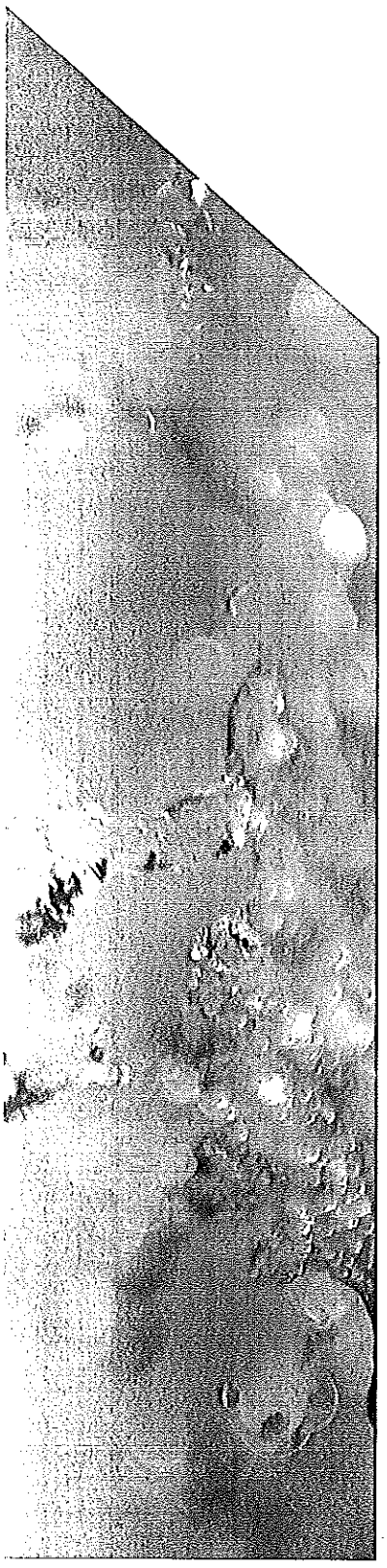


Platinun

Wastewater Treatme
System for
Residential Use

The Platinum wastewater treatment system for residential use provides wastewater treatment for single-family homes. The key features of the Platinum wastewater treatment system are the low power consumption and reduced maintenance.



The only moving part in the Platinum wastewater treatment system is a small air delivery system with very low power consumption.

Why Choose the Platinum System?

- Highly-efficient
- Environmentally sensitive
- Virtually silent operation
- Very low power requirements
- Below-ground installation
- Factory assembled and installed by certified installers
- Certified to European Committee for Standardization (CEN) Standard EN 12566-3
- Odorless
- Flexible applications with integral pump, external compressor enclosure and alarm systems

Features and Benefits of the Platinum Wastewater Treatment System:

- Environmentally sensitive with a small footprint producing a high-quality effluent
- Low power consumption means low operating expense
- Below ground installation does not take up valuable yard space or leave unsightly equipment exposed
- Minimal maintenance results in low total cost of ownership and greater peace of mind

Call 336-547-9338 or
email: info@anua-us.com
for more information.

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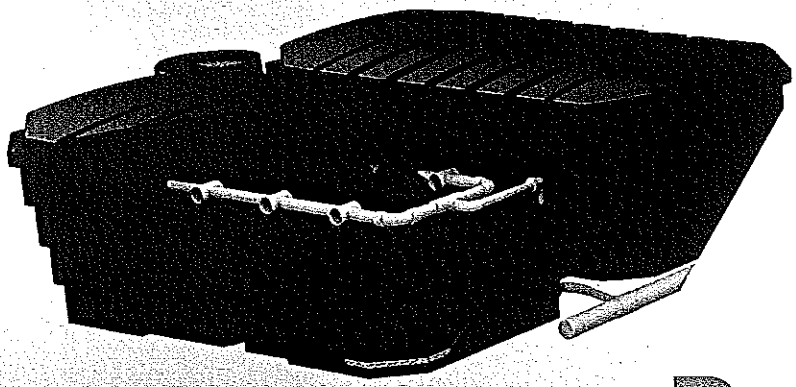

Puraflo

Peat Fiber Biofilter Wastewater Treatment System

If you have a residential or light commercial development requiring a wastewater treatment system or an existing site needing repairs or upgrades, the Puraflo peat fiber biofilter system is the most versatile, green-friendly, low energy, natural solution where simple, reliable operation and maintenance are required.

Why Choose the Puraflo® System?

- Modular design assures flexible phasing options
- System designs incorporate either a Type A (integrated drain field/pad) or Type B (discharge to separate drain field area)
- Completely odor-free
- Very low or no power requirements
- Seasonal or intermittent use compatible
- Factory assembled
- P150N models certified to NSF/ANSI Standard 40
- Configurations for nitrogen removal available
- Green solution, based on simple, passive, single pass biofiltration principles
- Unique peat fiber with high lignin content provides for a longer media life
- Minimal system maintenance with no annual fluffing or raking of the peat fiber media
- Optional remote monitoring using telemetry

Applications

- Single-family homes
- Multi-family homes
- Communities
- Small commercial operations
- Intermittent use (e.g., vacation homes, campgrounds)
- Churches
- Schools

Most Versatile Treatment

Types of Effluent or Water Treated by Puraflo	Modes of Puraflo Operation	Types of Dispersal with Puraflo
Septic	Single Pass	Combination Treatment/Dispersal - In-Ground Gravel Pad - Mounded Sand Pad (PureMound)
Graywater	Recirculation	Treatment with Separate Dispersal - Gravel Trench - Chambers - Drip Irrigation
Blackwater	Polishing Tertiary	
Aerobic Treatment Unit	Denitrification	

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Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services

Paul R. LePage, Governor Mary C. Mayhew, Commissioner

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11 State House Station
Augusta, Maine 04333-0011
Tel.: (207) 287-8016; Fax: (207) 287-9058
TTY Users: Dial 711 (Maine Relay)

Tel. (207) 287-5672 Subsurface Wastewater Unit Fax (207) 287-4172

August 14, 2012

Anua
Attn.: Colin Bishop, REHS, RS
P. O. Box 77457
Greensboro, NC 27417

Subject: Revised Product Registration, Puraflo Peat Fiber Biofilter

Dear Mr. Bishop:

The Division of Environmental Health has completed a review of a request for a revised registration for your company's product. This information was submitted pursuant to Section 6.HH of the Subsurface Wastewater Disposal Rules for registration for use in Maine.

The Puraflo Peat Fiber Biofilter consists of a residential lift station which collects septic tank effluent, and a peat filtration module. The lift station provides effluent to upper portion of the filtration module. Filtrate is collected at the bottom of the module and disposed of in a separate disposal area, or it is disposed of via a stone layer beneath the module, at the designer's discretion. Modules are rated at 150 to 1,500 gallons per day, for models P150*1A through P150*10B, respectively. Multiple modules may be used for greater design flows.

According to the information you provided, the Puraflo Peat Fiber Biofilter has been certified by the National Sanitation Foundation (NSF) pursuant to ANSI/NSF Standard 40 for residential wastewater treatment systems.

You have requested that the separation distance from the seasonal high groundwater table and bedrock (limiting factors) be reduced to 12 inches when Puraflo Peat Fiber Biofilters are used.

On the basis of this information the Division has determined that the Puraflo Peat Fiber Biofilter is acceptable for use in the State of Maine, provided that it is installed, operated, and maintained in conformance with the manufacturer's directions and the following conditions:

1. The vertical separation between the seasonal high groundwater table or bedrock and the bottom of the disposal area may be no less than 12 inches when Puraflo Peat Fiber Biofilters are used.

2. The vertical separation to the limiting factor must be measured from the bottom of the stone layer underlying a filter module when such a design is proposed:

3. The disposal area size must be calculated as a stone bed, when the stone layer underlying a filter module option is proposed.

4. The disposal area size may be reduced pursuant to Table 4B of the Subsurface Wastewater Disposal Rules when Puraflo Peat Fiber Biofilters are used.

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 Puraflo Peat Fiber Biofilter. 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.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen
Project Manager, Webmaster
Division of Environmental Health
Drinking Water Program
Subsurface Wastewater Unit
e-mail: james.jacobsen@maine.gov

/jaj

xc: Product File

Jacobsen, James

From: Colin Bishop [colin.bishop@anua-us.com]

Sent: Monday, July 30, 2012 4:06 PM

To: Jacobsen, James

Subject: Puraflo Approval Revision

Attachments: Anua_Pflo_ME_Ltr_073012.pdf; Anua_Pflo_Update_Ltr_011712.pdf; NC_sampledata_ASAE2001.pdf; VA_sampledata_ASAE2001.pdf

Jim,

It was good to speak with you today. Please see attached letter and documentation. Also, I have attached a second letter from this past January for the name change from Bord na Mona to Anua (in case you didn't see it).

I will break it up into multiple emails with attachments. More to come...

Colin Bishop, REHS, RS
Director of Sales and Government Relations

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Bord na Mona p.l.c.

Registered Office: Main Street, Newbridge, Co.Kildare
Registered No: 297717

BORD NA MONA

ANUA

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July 30, 2012

RECEIVED
JUL 31 2012

James Jacobsen
Program Manager
Maine Division of Environmental Health
286 Water Street, 3rd Floor
Augusta, ME 04333

RE: Approval of Puraflo® Peat Fiber Biofilter with 12 inch separation to limiting zone

Dear James,

We are requesting revision of the Puraflo Peat Fiber Biofilter approval in Maine to allow 12 inch vertical separation to a limiting zone.

1. The Puraflo system was tested to ANSI/NSF Standard 40 in single pass (intermittent) mode at the National Sanitation Foundation (NSF) test facility in Waco, Texas between September 2005 to March 2006. The sampling average of BOD_5 and TSS was 2 mg/l and 2 mg/l, respectively. Note that no individual sample ever exceeded 10 mg/l for BOD_5 or TSS during testing. Puraflo successfully completed the Standard 40 test and is currently listed. The final results of this third-party certification are outlined in the table below.

TABLE I. Summary of Analytical Results

	Average	Std. Dev.	Minimum	Maximum	Median	Interquartile Range
Biochemical Oxygen Demand (mg/L)						
Influent (BOD_5)	240	81	74	530	230	190 - 270
Effluent ($CBOD_5$)	2	0.8	<2	9	2	2 - 2
Total Suspended Solids (mg/L)						
Influent	260	130	22	880	240	180 - 290
Effluent	2	0.6	<2	6	2	2 - 2
Volatile Suspended Solids (mg/L)						
Influent	220	100	42	700	210	160 – 240
Effluent	2	0.4	<2	5	2	2 – 2
pH						
Influent	-	-	6.3	7.3	6.8	6.6 – 7.0
Effluent	-	-	6.4	7.4	6.9	6.7 – 7.0
Temperature (°C)						
Influent	24	3	20	30	22	22 - 26
Effluent	22	4	15	32	20	18 – 24
Dissolved Oxygen (mg/L)						
Effluent	3.0	1.0	1.0	4.7	3.0	2.1 – 4.0

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2. The Puraflo system was tested in single pass (intermittent) mode at the Northeast Regional Correction Center (NERCC) near Duluth, Minnesota between July 1998 to December 2003. Initial results were presented in March of 2001 at the American Society of Agricultural Engineers *Ninth National Symposium on Individual and Small Community Sewage Systems* in Fort Worth, Texas. The sampling events over a five year period show the winter and summer geometric mean results of 531 and 28 cfu per 100ml respectively. The geometric mean of all samples was 113 cfu per 100ml. The final results of this third-party study are outlined in the table below (paper attached).

Table 15B. Performance (all years) of NERCC modular peat filter (using Irish Peat), 7/98-5/01 and 1/03-12/03.

NERCC modular peat filter using Irish Peat

	Winter (Nov. - Apr.)			Summer (May - Oct.)		
Parameter	Inflow[1]	Outflow[1]	% - Removal[2]	Inflow[1]	Outflow[1]	% - Removal[2]
Q (gal/d)	287			223		
BOD_5 (mg/L)	265 (75.1)	6.6 (7.7)	94	225 (76.1)	6.1 (11.1)	94
TSS (mg/L)	44.1 (15.2)	3.7 (4.6)	88	52.1 (17.8)	2.1 (2.7)	96
TP (mg/L)	14.0 (3.4)	12.4 (3.2)	10	14.3 (3.4)	14.0 (3.7)	0
TN (mg/L)	80.9 (24.8)	52.6 (16.4)	34	75.1 (27.9)	55.9 (17.8)	28
NH_4-N (mg/L)	74.2 (21.1)	15.8 (17.5)	79	65.9 (28.0)	2.6 (5.2)	96
NO_3-N (mg/L)	0.03 (0.03)	37.2 (16.8)	nitrification	0.18 (0.76)	52.9 (17.8)	nitrification
fecal coliforms[3]	$3.5x10^5$	531	99.8	$2.4x10^5$	28	99.99
EC25 (umhos)	1128 (322)	748 (216)		1136 (299)	759 (170)	
Temp. (°C)	12.5 (1.6)	4.1 (2.6)		17.3 (4.3)	16.1 (3.6)	
pH	7.3 (0.1)	6.4 (0.4)		7.2 (0.1)	5.9 (0.6)	
DO (mg/L)	0.4 (0.4)	4.8 (3.0)		0.3 (0.5)	3.1 (2.6)	

N=30 winter, N=34 summer
[1]average during the seasonal period (Standard Deviation);
[2] mean percent removal based on: ((inflow-outflow)/inflow) x 100 = % removed;
[3]geometric mean colony-forming units (cfu) per 100mL.

3. Twenty four Puraflo systems were installed and sampled as part of a third-party study conducted in Virginia for approval. The results of the third party study were presented in March of 2001 at the American Society of Agricultural Engineers *Ninth National Symposium on Individual and Small Community Sewage Systems* in Fort Worth, Texas. The fecal coliform average of the Puraflo effluent was 263 per 100ml. Twelve inches below the open bottom (bottomless) dispersal pad directly beneath the modules, the average was 154 per 100ml. See pages 390 and 391 of attached ASAE paper.

4. Four Puraflo systems were installed in North Carolina and sampled as part of a third-party study conducted North Carolina State University. The results of the third party study were presented in March of 2001 at the American Society of Agricultural Engineers *Ninth National Symposium on Individual and Small Community Sewage Systems* in Fort Worth, Texas. The fecal coliform geometric mean of the Puraflo effluent was 290 per 100ml. Within and below the

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open bottom (bottomless) dispersal pad directly beneath the modules, the geometric mean was <200 per 100ml. See pages 230 and 231 of attached ASAE paper.

Table 2. Geometric Mean for Fecal Coliform, and Average BOD_5 and Total Suspended Solids Data,

Prior to Puraflo

Directly after Puraflo

	Pump Tank Effluent	Sample Chamber	Trench	Below Trench	Up Gradient	Down Gradient	Background or Ditch
			Type A System (Site 2)				
Fecal Coliform (cfu/100 ml)	1.5×10^5	2.9×10^3	$<2 \times 10^2$	$<2 \times 10^2$	$<2 \times 10^2$	$<2 \times 10^2$	$<2 \times 10^2$
BOD_5 (mg l^{-1})	114	3	1	1	1	1	1
TSS (mg l^{-1})	143	7					

Table 3.: Average Nutrient and Chloride Data from the 4 Sites.

Prior to Puraflo

Directly after Puraflo

	Pump Tank Effluent	Sample Chamber	Trench	Below Trench	Up Gradient	Down Gradient	Background or Ditch
			mg l^{-1}				
			Type A Systems (Sites 2, 3, 4)				
TKN	28.8	1.0	1.1	3.3	0.6	3.4	1.5
NH_4-N	24.3	0.4	0.3	3.9	0.2	0.5	0.3
NO_3-N	0.4	22.1	5.9	0.8	2.1	0.3	0.2
Total PO_4-P	4.4	4.0	0.5	0.5	0.3	0.5	0.7
Ortho PO_4-P	3.7	3.8	0.5	0.4	0.3	0.4	0.5
Cl^-	50.9	45.3	70.8	48.9	30.6	76.9	74.4

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5. The Puraflo system has been reviewed by the Ohio Technical Advisory Committee and subsequently approved by the Ohio Department of Health. Because of Puraflo's ability to reduce pathogens, vertical separation to a limiting zone ***without*** disinfection in Ohio is 1-foot and 6 inches to seasonal high water table.

6. The Ohio EPA published an onsite sewage treatment system guidance document in December of 2008 titled, *Guidance Document for Drip Distribution Systems*. This document recommends pretreatment prior to the drip distribution system. The section on "Pretreatment" that starts on page 9 ends with the following statement (document attached):

Disinfection may be required for sites when the proposed drip distribution system has the potential to discharge into a usable aquifer or is located within a sensitive watershed. Disinfection may be considered on a case by case basis only and should not include chlorination because of the impact on the "good bugs" in the soil. Disinfection can be achieved by:

- UV
- Peat Biofilters

We feel the documentation provided is sufficient to allow the use of the Puraflo Peat Fiber Biofilter with 12 inch separation to a limiting zone.

We look forward to hearing from you and if you have any questions, please contact us at your earliest convenience.

Sincerely,

Colin Bishop, REHS, RS
Director of Sales and Government Relations

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January 17, 2012

Subsurface Wastewater Program
Division of Environmental Health
286 Water Street, 3rd Floor
Augusta, ME 04333-0011

RE: Puraflo Peat Fiber Biofilter

Dear SWP:

This letter is to inform you that Bord na Móna Environmental Products U.S. Inc. is now called Anua (name change only, no change in company ownership). Also, please update the manufacturer information for Puraflo to:

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Please let us know if you have any questions.

Sincerely,

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Director of Sales and Government Relations

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MEMORANDUM

TO: Class C Design Engineers
Class D Soil Scientists
Class E System Contractors

FROM: John G. Hayes Jr., Ground Water Discharges Section
Hilary Moore, Ground Water Discharges Section

SUBJECT: Peat Biofilter Design Criteria

DATE: August 8, 2005

This document was developed to aide in the siting and design of peat biofilters. The manufacturers of Bord Na Mona Puraflo Peat Biofilters, and Premier Tech Ecoflo Peat Biofilters were consulted during this process.

Effective September 1, 2005, persons siting, designing, and constructing peat biofilter treatment and disposal systems in Delaware must adhere to the requirements outlined below.

** *Some design considerations and the subsequent approval will be determined on a case by case basis.*

Scope of Use

- The guideline is intended for facilities generating residential strength wastewater with flows $\leq$ 2,500 gpd.

Siting Criteria:

- Peat biofilter systems are not the cure all remedy for problem sites, **do not prescribe as such.**
- Percolation rates are to be based on the most restrictive texture within the upper 60" of soil. See chart below for loading rate associated with a percolation rate.

- For **at-grade systems**, the tillage depths are to be 6-8", although slightly deeper depths may be necessary in the case of shallow thin plow pans or similar restrictive layers within 12" of the surface.
- Landscape position is also a necessary consideration; do not site within a closed depression or where water tends to pond during heavy rainfall events.

New Construction and Replacement Systems

Separation requirements;

- 12" from limiting zone
  - Standard installation = 18-22" limiting zone, 6-8" pad *(bed)depth / 10" trench depth
  - Surface installation (At-grade systems) = 12" limiting zone, **pads *only** (***See Design and Construction Notes for Site Preparation)***

Design and Construction Notes for Site Preparation

- Rope off proposed disposal area.
- Prepare disposal area when soil moisture is within a satisfactory range.
- Remove vegetation - sod, topsoil or rock.
  - Grass, shrubs, and trees must be cut as close to the ground surface as possible and removed, preferably by hand from the site.
  - For wooded lots, with excess litter, we recommend that it be raked from site.
- Chisel plow disposal area 6-8"deep, or as prescribed by soil scientist.
  - Preferred methods
  - Chisel teeth mounted on a backhoe bucket and pulled through surface
  - Chisel plow pulled behind a tractor
- To maintain positive drainage, additional cover on top may be necessary.

If in doubt, please call the GWDS at 739-9948, prior to beginning any construction procedures.

Design Considerations

- A septic tank must precede a peat biofilter system. All septic tanks must incorporate an effluent filter as specified by each individual manufacturer.
- The loading rates within this memo shall be utilized to determine disposal pad/trench size required.
- No additional area reductions shall be granted for the use of water saving fixtures or for the use of gravelless chambers.
- The use of a pad or trench for disposal shall be based on site characteristics and the individual design engineer.

- All pads and trenches shall be installed on contour.
- All pad areas underneath the open bottom units shall be designed such that the bottom pad area is level.
- Peat biofilter systems may be fed by gravity or timed dosed, depending upon site characteristics. System shall be designed to provide equal flow throughout.
- **All other design considerations shall utilize individual manufacturer's guidelines.**

* A pad system is synonymous with a bed system

Installation

- The installer shall be trained by the manufacturer or their designee to install the peat biofilter.

Delaware Residential Peat Biofilter Design Criteria

Soil Type	Permeability Rate (mpi)	Hydraulic Loading Rate (gpd/ft^2) Trench	Hydraulic Loading Rate (gpd/ft^2) Bed
S	5	2.033	1.597
LS	10	1.437	1.129
	15	1.174	.922
SL	20	1.016	.799
	25	.909	.714
SCL, L	30	.803	.652
	35	.768	.604
	40	.719	.565
	45	.678	.532
Si, SiL	50	.643	.505
	55	.613	.482
	60	.587	.461
	65	.564	.443
	70	.543	.427
CL, SiCL	75	.525	.412
	80	.508	.399
	85	.493	.387
	90	.479	.376
	95	.466	.366
	100	.455	.357
	105	.444	.349
	110	.433	.341
	115	.424	.333
SC, SiC, C	120	.415	.326

Notes:

1. For commercial and/or large systems, please contact the GWDS and the manufacturers for additional siting criteria.

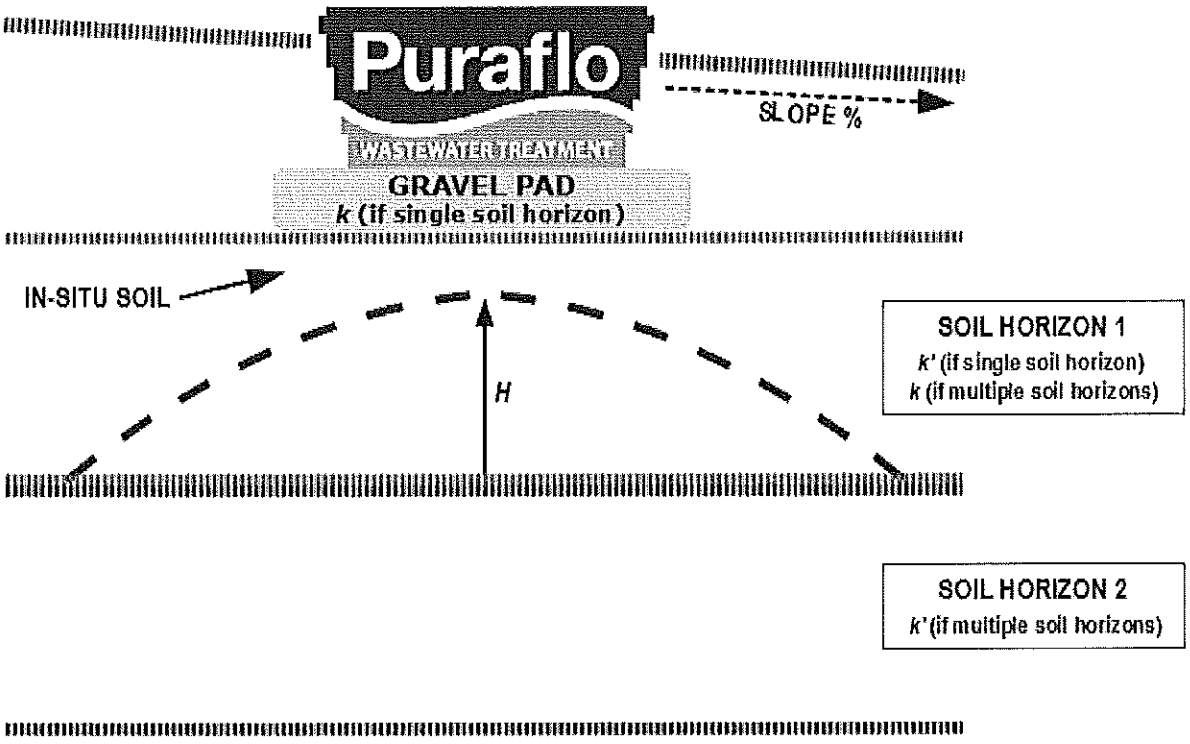
Dispersal Field Water Mounding Calculation Sheet

Directions: Fill-in applicable cells in GREEN. Answers appear in BLUE.

	Design Inputs		Project Info
# of bedrooms	3		
Flow per bedroom	150	gpd	
Puraflo effluent BOD_5 loading	10	mg/l	
Pad, mounded pad or trench?	Pad		
Pad, mounded pad or trench height, H	6	in	
Pad, mounded pad or trench length, L	100	ft	
Pad gravel, mounded pad sand or soil Ksat, k	3.29E+01	gpd/ft^2	
Soil Ksat, k'	8.48	gpd/ft^2	
Soil application rate (SAR)	0.80	gpd/ft^2	
Minimum vertical separation (MVS) distance	24	in	
Soil horizon 1 depth	30	in	
Site slope %	7%		

Design Values			
Total flow	450	gpd, *or*	60.2 ft^3
# of Puraflo modules req'd	3		
Flow per Puraflo module, Q	150	gpd, *or*	20.1 ft^3
Soil Ksat, k'	1.14	ft/d	
Basal radius per Puraflo module, R	2.37	ft	
Water mounding height, H	0.1	ft, *or*	1.2 in
Total MVS req'd	2.1	ft	25.2 in
Combined module basal area, A_b	53	ft^2	
Pad, mounded pad or trench area per SAR	563	ft^2	
Pad, mounded pad or trench area, req'd	563	ft^2	
Pad, mounded pad or trench dimensions	5.6	ft W	100 ft L
Hydraulic loading per linear foot	4.5	gpd/ft	
Absorptive area width (gpd/ft ÷ gpd/ft^2)	5.6	ft	
BOD_5 dispersal field loading	0.00007	$lbs/d/ft^2$	OK

Ksat Values	Rawls et al, 1998		VA AOSS Regulations, 2011	
	mm/h	gpd/ft^2	cm/d	gpd/ft^2
Sand	181.90	107.11	>17	>4.17
Fine Sand	141.30	83.20		
Loamy Sand	123.00	72.43		
Sandy Loam	55.80	32.86	10 to 17	2.45 to 4.17
Loam	6.20	3.65		
Silt Loam	14.40	8.48		
Sandy Clay Loam	7.70	4.53	4 to <10	0.98 to <2.45
Clay Loam	4.20	2.47		
Silty Clay Loam	4.90	2.89		
Sandy Clay	0.90	0.53	<4	<0.98
Silty Clay	1.80	1.06		
Clay	2.00	1.18		

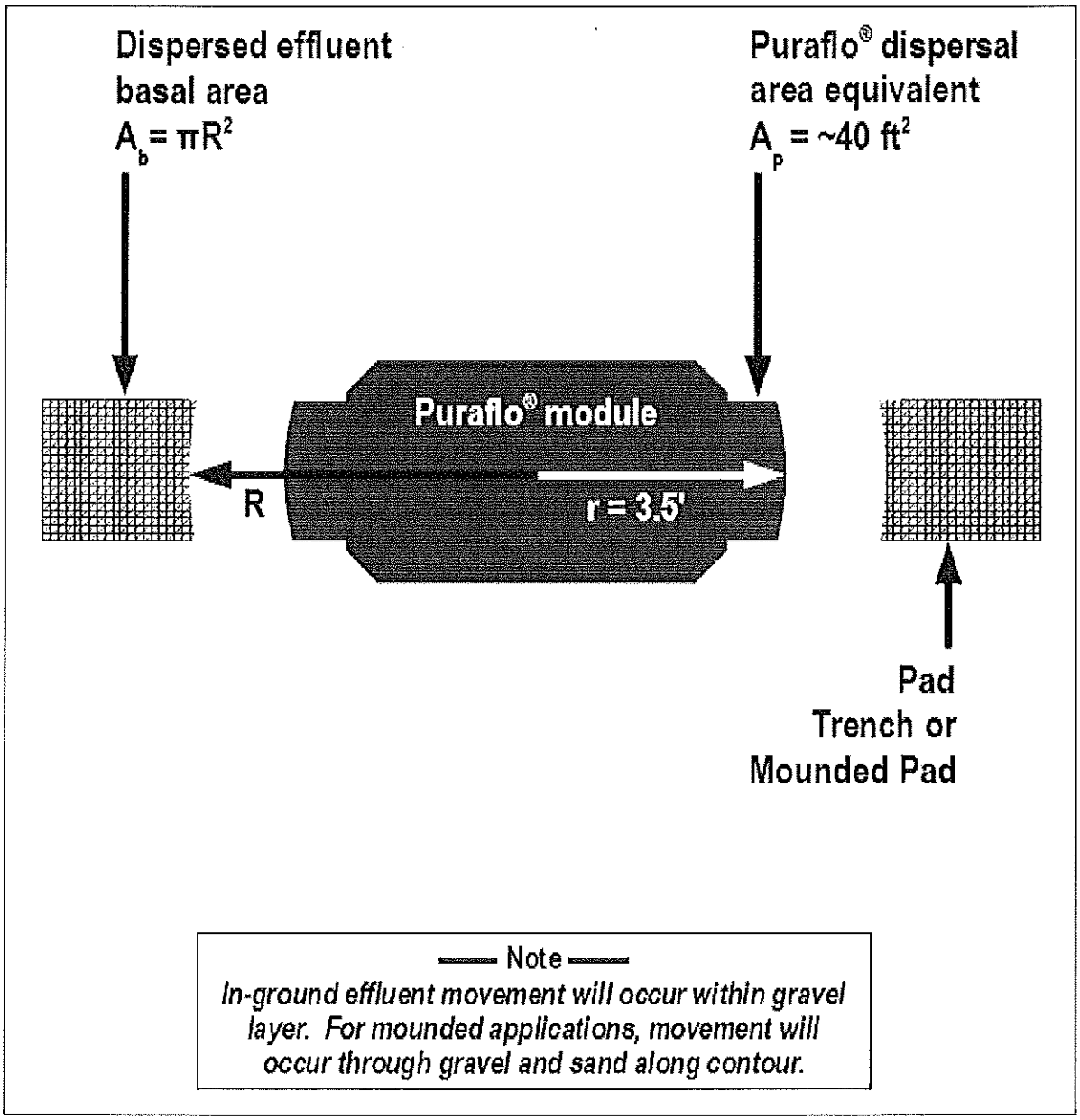

Puraflo
WASTEWATER TREATMENT
SLOPE %
GRAVEL PAD
k (if single soil horizon)
IN-SITU SOIL
H
SOIL HORIZON 1
k' (if single soil horizon)
k (if multiple soil horizons)
SOIL HORIZON 2
k' (if multiple soil horizons)

Kaplan, 1991 Formulas[1]
$R=\sqrt{Q/\pi k'}$ $H=\sqrt{Q^2/2kk'}$

[1]Kaplan, O. Benjamin (1991). *Septic Systems Handbook, 2nd Ed.* Lewis Publishers, Inc. Chelsea, MI.

Conversion Table - Hydraulic Conductivity (K)[2]			
m/d	cm/s	ft/d	gpd/ft^2
1	0.00116	3.28	24.5
864	1	2830	21200
0.305	0.000353	1	7.48
0.041	0.0000473	0.134	1

[2]USEPA (1993). *Wellhead Protection: A Guide for Small Communities. EPA/625/R-93/002. USEPA*. Washington, D.C.



Note

In-ground effluent movement will occur within gravel layer. For mounded applications, movement will occur through gravel and sand along contour.

ANUA

Puraflo® Peat Fiber Biofilter Design Package

Puraflo
WASTEWATER TREATMENT

Package Contents

Tab	
1	Puraflo & Dispersal Field Design Guide
2	Kaplan Sheet (based on equations in *Septic Systems Handbook*)
3	Distance to Finished Grade Calculation Sheet
4	TDH Calculations for Selecting System Pump (2" force main, 120 gpd module)
5	TDH Calculations for Selecting System Pump (2" force main, 150 gpd module)
6	TDH Calculations for Selecting System Pump (3" force main, 120 gpd module)
7	TDH Calculations for Selecting System Pump (3" force main, 150 gpd module)
8	Drawdown Test Calculation Sheet
9	Daily Flow Calculation per Panel Readings

ANUA

Puraflo®

Peat Fiber Biofilter

Design Guide
and
Installation Manual

Only modules bearing the NSF® logo
and designated P150N*XX
are certified to
NSF/ANSI Standard 40

Call: 336-547-9338 or visit: www.anua-us.com

Puraflo® Peat Fiber Biofilter Design Guide and Installation Manual

TABLE OF CONTENTS

1.0 General Description of System

The Puraflo peat biofilter is an advanced secondary treatment system that purifies septic tank effluent to an extremely high degree before final dispersal.

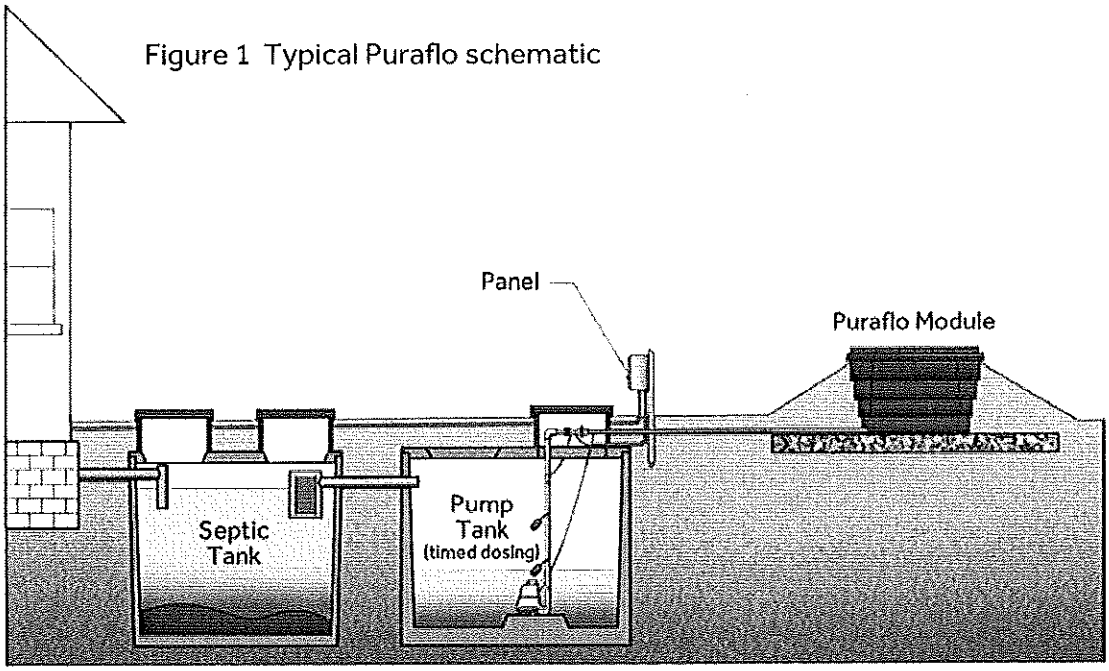
A typical Puraflo peat biofilter system consists of:

- Septic tank with a commercially-rated effluent filter, with 1/32" filtration, connected to the tank outlet pipe
- Dosing tank and effluent pump, or siphon, to accommodate dosing of the septic tank effluent onto the peat fiber media
- Biofilter modules where advanced treatment occurs due to the physical, chemical and biological processes that are optimized in the peat fiber media.
- Site specific, final effluent dispersal system

The filtered septic tank effluent is collected under gravity in the pump tank. A timed dosing system is activated by a programmable timer or a siphon-dose system triggers, which pumps the effluent through a flow splitting inlet manifold located at the base of the treatment modules. An orifice plate is located inside the top of each inlet manifold which allows the flows to be split equally and fed simultaneously to each biofilter module. The inlet manifold is connected to the base of the biofilter module and is fed upwards to a rectangular distribution grid located 6 inches below the top of lid. The effluent percolates laterally and vertically through the depth of the peat fiber treatment media and emerges as a clear, innocuous liquid from the base of the system. The treated effluent is then collected and dispersed.

The Puraflo peat biofilter system has been tested, certified and listed by the National Sanitation Foundation, International as meeting the requirements of NSF/ANSI Standard 40, Class 1. Puraflo is a modular system with each module rated for 150 gallons per day (gpd). The range and rated capacity of the system is therefore a multiple of the standard unit based on the 150 gpd per module. Model P150N*3B, incorporating 3 modules and rated at 450 gpd, was the treatment plant tested to NSF/ANSI Standard 40.

Figure 1 Typical Puraflo schematic



2.0 Process Fundamentals

2.1 Treatment Mechanisms

The Puraflo peat biofilter treatment technology is based on simple, passive biofiltration principles. The treatment of the effluent within the system is achieved by a combination of unique physical, chemical, and biological interactions between the effluent and the fibrous peat media. The residence period or contact time in the media at the design loading rate has been calculated and demonstrated to be somewhere between 36 and 48 hours by using tracer organisms.

Extensive scientific examination of the peat fiber media has revealed a complex structure which permits a number of separate treatment and attenuation processes to occur simultaneously. The treatment mechanisms within the fixed film media are summarized in **Table 1** below.

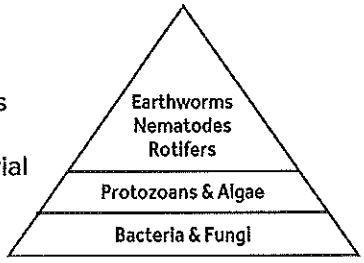
Table 1

Treatment	Characteristics	Significance
Physical	Surface Area	Greater the surface area, greater the contact between effluent, air and media
	Void Space	Open fibrous structure and large pore volume results in efficient transfer of air and effluent throughout the biofilter
	Bulk Density	Low bulk density media -- light open material resulting in large surface area and void spaces, characteristics attractive in respect to wastewater treatment.
Chemical	ph	Pathogenic bacteria in wastewater undergo significant die-off in peat due to the acidic conditions prevailing and the predation/competition from naturally occurring pH tolerant microfauna.
	Cation Exchange Capacity (CEC)	Peat particles tend to be negatively charged. This gives peat a great ability to absorb positively charged molecules. A high CEC means the peat can effectively hold positively charged molecules including ammonium, metals, pesticides, some organic molecules and possibly viruses.
	High Adsorptive Surface Area	The larger the surface area the greater the number of adsorption reactions taking place
Biological	Buffering Capacity	The ability of the system to withstand shock loadings
	Resistance to Degradation	Due to a high lignin content, peat fiber is resistant to breakdown or decay thus prolonging the life span of the media
	Beneficial organism growth	Biological treatment achieved by complex and diverse microflora which adhere to peat fiber media. Microflora largely composed of aerobic and facultative aerobic heterotrophic bacteria from different genera. Supports higher life forms : protozoans, rotifers, algae, insects, nematode and annelid worms.

2.2 Microbiology of the System

In a mature peat fiber unit the biological processes are known to be crucial in maintaining the treatment efficiency observed. The bulk of the treatment and assimilation processes are achieved by diverse microflora which adhere to the surface of the peat media. This microflora is largely composed of aerobic and facultative aerobic heterotrophic bacteria from a large number of genera. The most important bacteria genera represented include:

- Pseudomonas
- Aeromononas
- Bacillius
- Micrococcus
- Flavobacteria
- Alcaligenes
- Streptococcus



The total bacterial population recorded per gram of peat has been measured at $1x10^9$ cfu. Similarly, high numbers (up to $1x10^7$ cfu/g) of fungal organisms have been isolated from the Puraflo units. A wide variety of "higher life" forms have also been recorded within the media matrix (ranging from protozoans, rotifers, and algae to nematode and annelid worms, insects and their larvae). These organisms play an important role in keeping the bacterial population "in check" thereby maintaining balanced microflora and ultimately a stable ecosystem.

The larger numbers of heterotrophic bacteria are found in the upper portions of the filter media with nitrifiers becoming more prevalent at depths of 12" or greater. Therefore, the degradation and assimilation of the carbonaceous elements of the waste is affected within the upper portions of the filter bed with nitrification occurring at greater depths.

The peat fiber system is also very effective at eliminating enteric bacteria contained in the waste. The antimicrobial properties of the system can be classified under two broad headings:

Aggressive nature of the peaty media

The anti-microbial properties of the acidic peaty soils are developed through the low pH which directly affects the cell walls of the organisms in addition to limiting the amounts of nutrients available for uptake. Also, the trace amounts of phenols, bitumes and other complex hydrocarbons which are associated with peaty materials are directly toxic to certain bacteria, in particular enteric organisms which find themselves in a hostile environment (low temperature, high competition, etc.) and are already in a stressed condition. Finally, certain peaty soils have been demonstrated to contain a significant fungal species population (in addition to certain actinomycetes) which produce antibiotics and thus can adversely affect bacterial species in the zone of influence. It is important to note that the natural anti-microbial properties of the peat fiber media are only effective on the "stressed" enteric organisms contained in the primary wastewater. The indigenous microflora associated with the treatment media are largely unaffected by the properties described.

Microbial antagonism

The second means by which the enteric organisms are extinguished in the Puraflo system is by microbial antagonism. This simply means that the stressed micro-organisms within the primary wastewater are out competed by the indigenous microflora. The low temperature, low pH and production of certain microbial toxins within the peat fiber media adversely affects the "foreign" organisms. As such, they are largely ineffective in assimilating nutrients and other constituents, which are necessary for their survival. The large retention time in the peat fiber media ensures maximum lethality.

2.3 Treated Effluent Quality

When treating domestic strength wastewater (300 mg/l BOD_5 or less) up to the design flows and loads, a properly maintained Puraflo peat fiber biofilter system will exceed the performance requirements of NSF Standard 40 Class 1. Actual NSF test results established through analytical methods described in NSF/ANSI Standard 40 averaged 2mg/l $CBOD_5$ and 2 mg/l TSS.

The pH, $CBOD_5$ and suspended solids (TSS) concentrations demonstrated in this table will be attained within a few weeks of commissioning and will be consistently achieved over the lifetime of the peat fiber media.

Table 2

Parameter	NSF Std 40 Avg, 30-day	Puraflo Effluent Avg
$CBOD_5$ (mg/l)	25	2
TSS (mg/l)	30	2
pH (pH units) range	6 - 9	6 - 7.5

Also, the treatment efficiency in the peat fiber media is not subject to significant variation with ambient air temperature fluctuations.

3.0 Media Filters

3.1 System Features

The Puraflo peat fiber biofilter system has been part of numerous field studies and observations. Keys aspects of single pass media filters are:

- Primary treatment (septic tank)
- Septic tank effluent screening (effluent filter or screened pump vault)
- Timed-dosing in small, even increments
- Hydraulic loading
- Organic loading
- Air ventilation
- Media properties
- Media depth
- Media replacement or adjustment

Using the criteria listed above, the following table gives a technology summary. The Puraflo peat fiber biofilter (1 module) loading is 150 gpd and 300 mg/l BOD_5 (NSF Standard 40 maximum loading).

Table 4

Item	Puraflo Peat
Primary treatment (septic tank)	Yes
Effluent screening	Effluent filter 1/32" filtration
Timed-dosing (doses per day)	12
Air ventilation	Surface access (holes in side of module lid)
Area	26.93 ft^2
Hydraulic loading	5.57 gpd/ft^2
Organic loading	0.0140 lbs $BOD_5/ft^2/d$
Media depth	24"
Media void space	90 - 95%
Water holding capacity, % volume	50 - 55%
Media size	1 - 10mm
Media surface area	52,000 ft^2/ft^3
Media replacement	~15 years
Effluent BOD_5, typical	<10 mg/l
Effluent TSS, typical	<10 mg/l
Effluent fecal coliform range, geo mean	<1,000 - <10,000 per 100 ml

Some Table 4 values derived from:

1. Loudon, T.L., T.R. Bounds, J.R. Buchanan and J. C. Converse. "Media Filters Text." In (M.A. Gross and N.E. Deal, eds.) University Curriculum Development for Decentralized Wastewater Management. National Decentralized Water Resources Capacity Development Project. University of Arkansas, Fayetteville, AR. 2005.

3.2 Comparison of Puraflo & Single Pass Sand Filter Treatment

To review, the Puraflo Peat Fiber Biofilter and the Single Pass Sand Filter, employ three main treatment mechanisms:

- Biological
- Chemical
- Physical

The media properties dictate the level of treatment expected under each mechanism. Within a mature media filter (all types), biological treatment predominates, confirmed by the following statements:

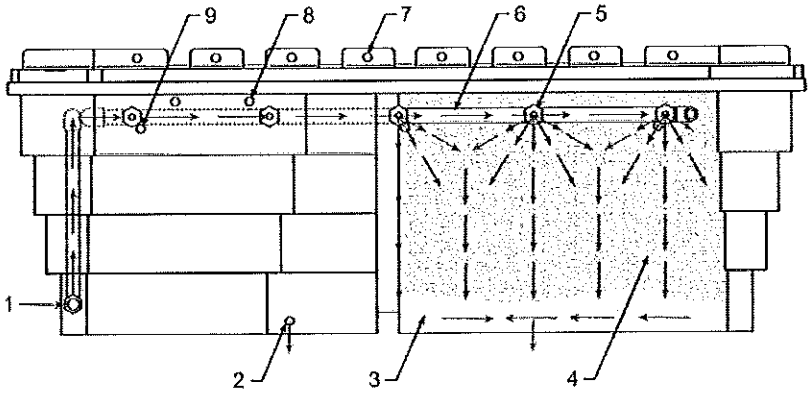
- The effluent from this sand filter during the experiments was purer than many drinking-water supplies, and the last published analysis. after the tank has been in operation 14 years, indicate that the sewage that was applied to it in 1901 was freed from 89 per cent. of its organic impurities. At first thought, this purification might be attributed to the fact that the sewage is strained through the sand. Such is not the case, however. Most of the organic impurities have been absolutely destroyed or transformed into other and inoffensive combinations, mainly through the action of bacteria (International Library of Technology 440, 1926).

- Treatment filters using sand or peat as media make effective attached growth systems. They can be designed as either single-pass or recirculating filters, meaning that the wastewater is run across the media more than one time. Regardless of the media, the process is generally the same–wastewater from the septic tank is allowed to run through a bed of media and collected from underneath. Treatment occurs as the bacteria grows on the media (NESC, 2004).

- As the wastewater passes through the sand filter, treatment is accomplished through physical and chemical means, but mainly by microorganisms attached to the filter media (NFSC, 1998).

- A biologically active film of organisms forms on the surface of the media. Microorganisms play an essential role in treating the wastewater as it flows over media surfaces. Certain bacteria known as primary colonizers attach (via adsorption) to the surfaces and differentiate to form a complex, multi-cellular structure known as a biofilm (Loudon, Bounds, Buchanan and Converse, 2005).

- The bulk of the treatment and assimilation processes are achieved by a diverse microflora which adhere to the surface of the peat media (Walsh and Henry, 1998).



Item	Description
1	Inlet
2	Outlet Port
3	#5 Stone
4	Peat Fiber Media
5	Distribution Orifice
6	Distribution Grid
7	Vent Holes
8	Rope Handle Holes
9	Stabilizer Bars

As shown, the Puraflo Peat Fiber Biofilter and the Single Pass Sand Filter have similar performance characteristics. The media employed within the Puraflo Peat Fiber Biofilter has some unique properties that enhance treatment and that are worth noting:

- Surface area: 52,000 ft^2/ft^3
- Void space: 90-95%
- Water holding capacity: 50-55%
- Retention time: 36-48 hours
- Cation Exchange Capacity (CEC): 125 mg/g

Patterson (2004) outlines the roles identified above in the treatment process:

- **Physical properties - filtration:** the small particulate matter (usually high in BOD_5) that passes through the septic tank treatment is captured within the interstices of the peat fiber, and does not percolate through the peat with the drainage water. Thus, the loading of BOD_5 and TSS at the top of the peat can be significantly higher than the quality from average septic tanks.

- **Biological properties – microbial decomposition:** the peat fibers support a significant population of microbes which consume organic matter in the incoming primary treated effluent in much the same way as the zoogleal film in a trickling filter consume the organic loading in a conventional sewage treatment works. In the peat system, the actual surface area of the peat fibres is many thousand times that of the trickling filter. This fact is borne out by the very high CEC of the peat that is a direct relationship with surface area. The 99.2% removal of fecal coliform without any external disinfecting agent indicates the efficacy of the peat as a disinfecting medium. The naturally high acidic properties of the peat also play a role in the disinfection process.

- **Biological properties – aerobic environment:** similar to an aerated wastewater treatment system, a highly developed population of aerobic bacteria is maintained within this environment. Laboratory results show that the peat can hold up to 300% of its own weight in water and maintain an air-filled capacity of more than 30% (about that of a soil at field capacity). This high aeration is confirmed by the ability of the peat to oxidize up to 96% of the ammonia-N in the STE.

- **Chemical properties:** the high CEC of the peat and its mineral content resulted in the changes to the cation ratios from the start of the trial to the end, reflected in the reduction in sodium adsorption ratio of the effluent in its transit through the peat. The loss of 74.6% of TP by adsorption is a highly significant reduction without further chemical additions. The reduction in salinity by 38% and the loss of 81.5% of alkalinity are further chemical changes induced by the peat environment. These losses are statistically significant.

Headley (2006) describes some aspects of chemical and physical treatment:

- Peat can be described as partially fossilized plant matter which accumulates in wet areas (wetlands) where there is a lack of oxygen and the accumulation of the plant material is more rapid than its decomposition (Couillard, 1994; Viraraghaven, 1993). Peat is a porous, complex material containing lignin and cellulose as major constituents. These constituents contain polar functional groups, such as alcohols, aldehydes, ketones, acids, phenolic hydroxides, and ethers than can be involved in chemical bonding (Viraraghaven, 1993). This polar nature gives peat a high specific adsorption capacity for suspended and dissolved solids, such as transition metals and polar organic molecules. The particulate and highly porous nature of peat also makes it an effective physical filter (Perez et al. 2005). Studies have shown that partially decomposed peat has a relatively high porosity of approximately 95% and a specific surface area of 200 m^2 per gram.

Kennedy and Van Geel (2000) make the following observation:

- Peat is an alternative filter medium for the treatment of various waste streams including septic tank effluent. The water holding capacity and adsorption capacity of peat make it a favorable filter medium over sand or gravel which are commonly used as the filter medium for the drainage field of septic systems.

4.0 SUMMARY

From the long history and wealth of studies done on peat biofilters it can be concluded that the treatment capability and performance is equivalent, or better, to a single pass sand filter.

Headley (2006) offered the following comments and comparisons:

- Peat filters offer significant potential as a relatively passive, low-maintenance and robust secondary treatment device for on-site systems in the Gisborne region. Experience with peat filters internationally indicates that they are highly effective at removing TSS and BOD, and are more effective at removing pathogen indicators than similar fixed-bed filters using other media, such as sand or gravel. Peat filters have also been shown to be highly effective at nitrifying domestic wastewater, and in many cases are capable of removing 30-50% of the total nitrogen load.

- Field evaluations of peat filters used in on-site systems indicate that they are relatively robust under the typically variable loadings experienced in domestic situations (Patterson. 1999). They also represent a relatively low maintenance and passive treatment system, especially compared to package aerated wastewater treatment systems which generally require at least quarterly servicing by a trained technician. For example, Patterson (1999) reported that a domestic peat filter required only two hours of active maintenance in over 13 years of successful operation (1986-1999).

5.0 SYSTEM DESIGN & SPECIFICATION

The Puraflo Peat Fiber Biofilter is a pre-engineered treatment system contained in factory pre-assembled molded polyethylene modules. It is a highly efficient system for the treatment of domestic strength wastewater and is designed to minimize site construction. Domestic quality primary effluent is evenly distributed over the specialized fibrous peat fiber media. One biofilter module (approx. 7.1 ft. long x 4.5 ft. wide x 2.5 ft. high) is designed to treat the wastewater from one bedroom, 2 people or a design flow of up to 150 gallons per day of domestic strength wastewater. Guideline hydraulic and organic loading rates per module are as follows:

- Maximum design organic loading per module 0.3755 lbs/d
- Maximum design hydraulic loading per module 150 gpd

5.1 System Configuration

The designer of a Puraflo system will be responsible for proper configuration and sizing of the components of the system, pump and other peripheral component specifications, timer settings, and construction details.

5.2 Design Flow & Number of Modules

Applicable regulations usually define the daily flow based on the number of bedrooms or the number of occupants with a defined flow per person per day. Anua research has determined that one module per bedroom or one module per 150 gallons is required to treat domestic strength wastewater.

5.3 System Configuration

The size and configuration of the septic tank shall be in accordance with the NSF listing (as applicable) or State or Local requirements. The septic tank shall have a usable volumetric capacity of at least 24 hours retention. The septic tank, risers and lids must be watertight.

A commercial effluent filter with 1/32 inch filtration must be specified. Acceptable commercial effluent filters are the Bear Onsite ML3-932, Zabel A300, BEST GF10-32 and Polylok PL-625 (alternatively, the Sim/Tech Pressure Filter STF-100 may be used where it is not possible to install a gravity effluent filter). The effluent filter is installed on the septic tank outlet pipe to prevent grease and solids carryover into the pump tank.

5.4 Timed Dose Pump Tank

Dosing is typically regulated by a control panel with programmable timer, low water cut-off float and high water alarm float. The low water cut-off should ensure that the pump remains covered at all times. Storage capacity above the high water alarm float equal to or greater than one quarter of the daily design flow must be provided. The flow equalization zone (between the low water cut-off and high water alarm floats) should be approximately half the daily flow to avoid nuisance alarms. **An override float or override capability must not be used.** A 750 to 1,000 gallon pump tank is usually adequate for a 3 to 4 bedroom residential home. A 500 gallon pump tank is the minimum (e.g., single room cabin or one bedroom home). The size and configuration of the pump tank shall be based on design flow and occupancy and per the NSF listing (as applicable) or State or Local requirements. The pump tank, risers and lids must be watertight.

The dosing *rate* should be between 7 to 12 gallons per minute per module. The dosing *volume* should be approximately 5 to 15 gallons per module per dose. For example, a 2 hour dosing interval for a 450 gpd, three module system would result in 12 doses at 37.5 gallons per dose. This equates to 12.5 gallons per module per dose. If the force main is set

up to drain back, the drain back volume should be factored into the dosing calculations. A sample pump tank drawdown test calculation is outlined in the table at right.

The diameter of the force main piping is typically 2 to 4 inches. The Puraflo inlet piping manifold diameter is typically 2 inches where 1 and 5 modules are installed or 4 inches where 6 to 10 modules are installed. The outlet piping manifold (were applicable) is typically the same diameter as the inlet piping manifold.

Buoyancy calculations for the septic tank and pump tank should be performed when necessary.

Table 5 Sample Drawdown Test Calculation

Tank	
Gallons per inch	20.00
Design flow (gpd)	450
Drainback volume (gals)	25
# Puraflo modules	3
# doses per day	12
Drawdown in tank (inches)	1.25
Time (seconds)	60
"ON" timer setting, secs	95
"ON" timer setting, mins	1.58
Dose volume per module	12.5

5.5 Biofilter Modules

Effluent from the force main is distributed to the modules via a flow splitting manifold with pressure equalizing orifice plates. Effluent is distributed over the peat fiber media by a pre-installed rectangular grid with large diameter openings that prevent clogging. The effluent charges the grid using the velocity generated by the orifice plates. It is not a pressurized distribution grid.

The site specific design will detail the final effluent dispersal method. Effluent may be either discharged directly to a pad installation or may have a piped outlet for discharge to trench, pressure system, point discharge system or other effluent dispersal method, as applicable.

Modules are pre-assembled depending on the final effluent dispersal method and can have:

Pad system:

- Weep-holes at the base for drainage to a pad system (Blue Module color code)
- Partial weep-holes with a piped outlet on the sealed end diverting effluent to a sample chamber (Green Module color code)

Other effluent dispersal methods:

- Piped outlet for connection to another dispersal system (White Module color code)

It is important to specify which modules are needed for a particular design. The type of module is designated by a painted circle on the module lid.

Green module(s) adjacent to a sample chamber have half of their effluent piped from one end of the base of the module through the sample chamber; therefore, there are no weep holes on the end of the module feeding the sample chamber. The chamber essentially provides access to the sample pipes for performance testing purposes. Any uncollected effluent exits the sample chamber through holes in the base or side of the sample chamber.

Models:

- "A" denotes modules with weep holes around the base for discharge directly into a dispersal pad or trench. "B" denotes modules with a set of two, 1" threaded-ports at the base for connection to collection piping that can be routed to a drainfield or to a pump tank/chamber.
- Each module is painted on one corner of the lid with a color-coded triangle. Coding table and diagrams provided below and at right.

TREATMENT UNIT MODEL NUMBER	
Model Number	**Rated Capacity** (Gallons/Day)
Puraflo Series	
P150*1A	150
P150*1B	150
P150*2A	300
P150*2B	300
P150*3A	450
P150*3B	450
P150*4A	600
P150*4B	600
P150*5A	750
P150*5B	750
P150*6A	900
P150*6B	900
P150*7A	1050
P150*7B	1050
P150*8A	1200
P150*8B	1200
P150*9A	1350
P150*9B	1350
P150*10A	1500
P150*10B	1500

Modules bearing the NSF® logo & designated P150N*XX are certified to NSF/ANSI Standard 40

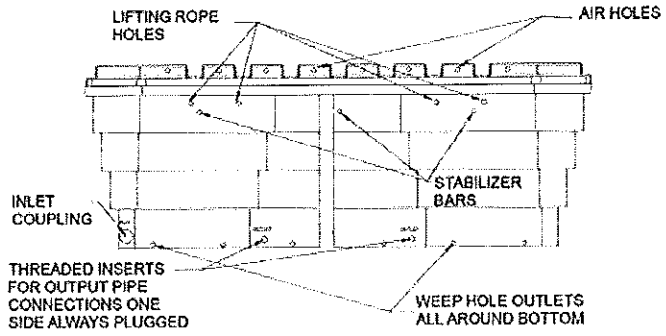
Module Color Coding

- Blue Coded Module: (20) 7/8" dia. holes around bottom area of module
- Green Coded Module: (16) 7/8" dia. holes around half of module for sampling requirements
- White Coded Module: Closed bottom area, no holes in module

3 Module Types

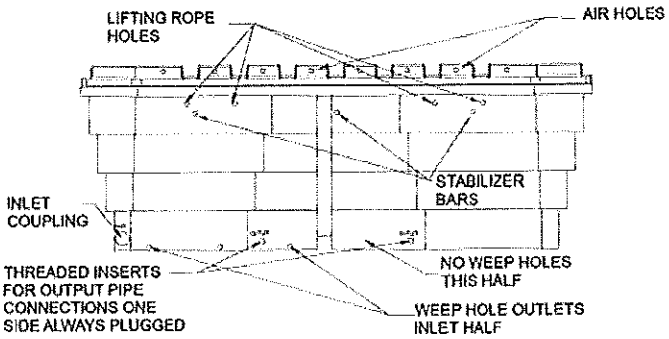
Blue Coded Module

Type A: Pad System



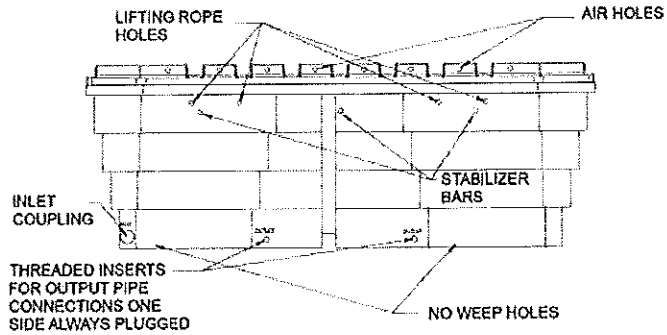
Green Coded Module

Type A: Pad System (for Sample Chamber)



White Coded Module

Type B: Trench System



5.6 Cold Weather Conditions

Certain precautions should be taken in extreme cold weather conditions. In particular, the force main should be designed to drain back after each cycle. Also, the module lids will come with foam insulation on the underside of the module lid. All systems must be verified for force main drain back and module lid insulation. Any other accepted standard practice for cold weather conditions should be used per State or Local requirements.

5.7 Life of the Peat Fiber Media

The effective life of the Puraflo peat fiber media is estimated to be 15 years under the following conditions:

- System has been operated at or under design flow and loadings
- System has been designed and installed in accordance with Anua guidelines
- System has been maintained in accordance with Anua guidelines, been operated under and ongoing service contract and is in compliance with all Administrative Authority permit conditions

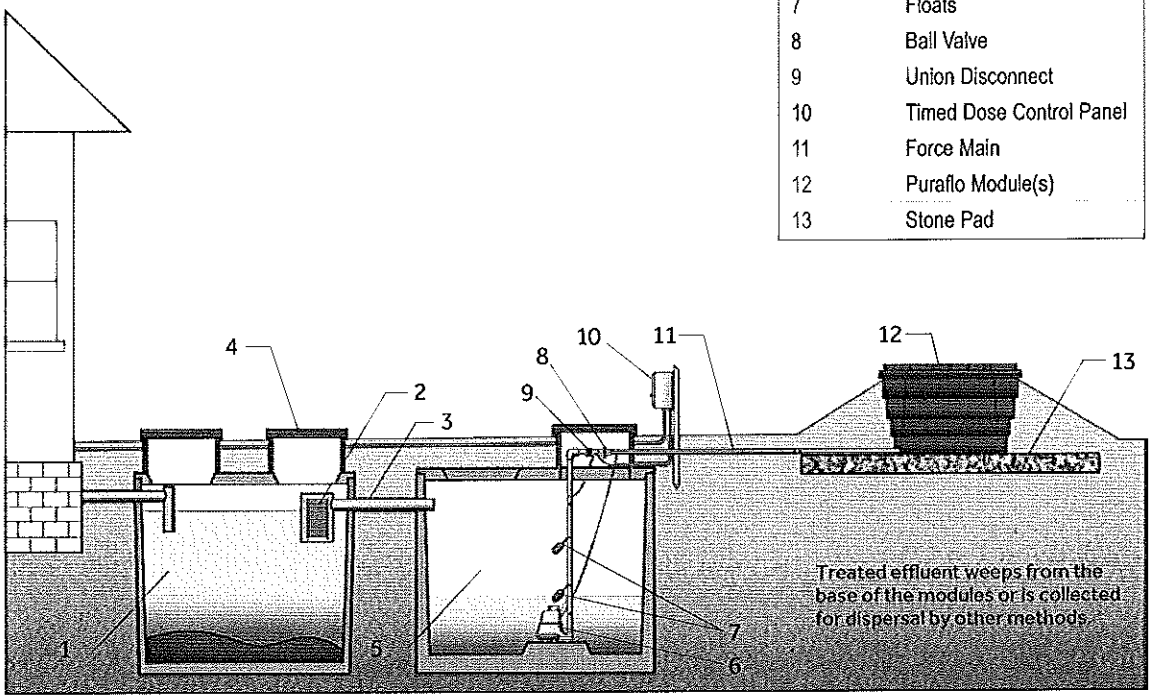
5.8 Final Dispersal System

The final dispersal system must be designed in accordance with State or Local regulations and Anua guidelines.

6.0 System Layout & Components

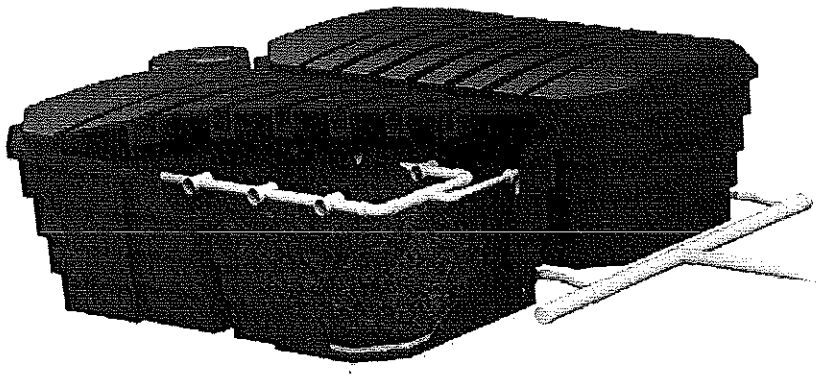
6.1 Schematic of Puraflo System Components

Part No.	Description
1	Septic Tank
2	Effluent Filter
3	Sewer Line
4	Riser and Lid
5	Pump Tank
6	Pump
7	Floats
8	Ball Valve
9	Union Disconnect
10	Timed Dose Control Panel
11	Force Main
12	Puraflo Module(s)
13	Stone Pad



6.2 Specification of Puraflo Module

Max Treatment Capacity per Module: 150 gpd
Module Length: 7' 1"
Module Height: 2' 6"
Module Width: 4' 6"
Module Weight: ~1800 lbs



7.0 Installation Requirements

Installation of the Puraflo system is straight forward and can usually be completed in less than a day.

- **Warning:**
- Use recognized, safe lifting techniques to off-load and set modules.
- Ensure all lifting equipment is clear of overhead obstructions such a power lines, trees, rooftops or any other construction.
- Place the lifting equipment on solid, stable ground.
- Use a four-point sling or equivalent (see Fig.2).

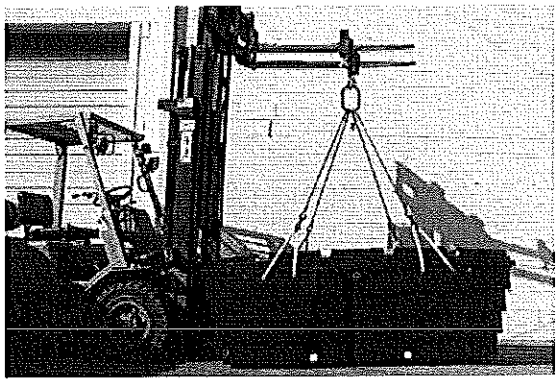
The contractor/installer is required to provide the following:

- Mechanical excavator (backhoe) with operator.
- An electrician or person qualified to undertake the work in accordance with State or Local regulations (the electrician will be required to connect the pump and alarm to the control panel, set timer as required, and connect the control panel/junction box with the main power supply). Provide and supervise the installation of the underground cable from the control panel/junction box to the main circuit board.
- Provide gravity and force main piping and fittings per design. Piping under pressure must be PVC Schedule 40 or equivalent.
- Clean stone (3/4 to 1-inch) as required.
- Additional/imported fill material (typically not sand) and topsoil as required.
- Labor as necessary to install the system.
- Necessary supervision to ensure the system is installed per design.

8.0 Electrical Requirements

An independent electrical circuit to power the control panel (115/230 volts and 20 amps typical) must be provided. These requirements may change by State or Local code or when a duplex panel, a larger pump or a high head pump is required per design. Please refer to site specific design to verify electrical requirements noting the requirement for 115 or 230 volts and the amps rating required for the controls and the pump.

Figure 2 Module Off-loading



9.0 Sequential Installation Procedure

9.1 Site Clearance

- Clear site vegetation as required (minimize site disturbance).
- Provide sufficient access to proposed system.

9.2 Septic Tank

- Supply and install septic tank and sewer pipe from the dwelling in accordance with applicable State or Local regulations. The septic tank must be watertight against ground and/or surface water infiltration and exfiltration.
- Install septic tank on stable, compacted ground and backfill with suitable material as recommended by the manufacturer.
- Fit an effluent filter (1/32" specification) on the outlet pipe.
- Install water tight risers over inlet and outlet access ports to provide access for filter maintenance, septage removal, etc.
- Backfill and grade around the septic tank to prevent infiltration of surface water.
- See Appendix 1: *Typical Septic Tank Detail.*

9.3 Pump Tank Installation

- Supply and install the pump tank in accordance with applicable State or Local regulations. The pump tank must be watertight against ground or surface water infiltration and/or exfiltration.
- Install pump tank on stable, compacted ground and backfill with suitable material as recommended by the manufacturer.
- Install gravity main from the septic tank to the pump tank in accordance with applicable State or Local regulations.
- Excavate a trench, typically 18 inches deep, from the pump tank to the location of the modules. In colder climates the force main may be buried deeper (below frost line).
- Place sufficient risers on top of the pump tank to reach slightly above grade level. It is extremely important to ensure a water-tight seal between the pump tank and the first riser and between individual risers.
- All connections/seals should be made water tight in accordance with manufacturer's recommendations.
- Backfill, compact and landscape around the pump tank inlet/outlet pipes and electrical cable points of entry. Ensure suitable backfill material is used in accordance with manufacturers instructions.

9.4 Pump Fittings and Piping

- Place the base of the pump 4 to 6 inches above the base of the pump tank.
- Glue required length of PVC force main into the fitting at the outlet of the pump. Install the required fittings (check valve, union, ball valve, etc. as required by the design). Note: in most cases a 2 inch forced main is specified so a bushing (11/2 inch x 2 inch) may be required to connect the internal pump tank piping to the pump. In some cases, the force main may be designed to drain back and a drain back hole will be required above the check valve. Install an air vent hole when required and an anti-siphon hole if the module grid is lower than the liquid level in the pump tank.
- Floats are generally used however other suitable level devices may be installed. Install on/off float typically at pump level (to ensure that the pump is kept submerged). Install alarm float with 1/2 day storage above the on/off float. Strap floats to force main or separate stand pipe or hang from bracket.
- Install the force main in the trench from the pump tank to the modules. Backfill trench once the line is correctly installed and connected. Be careful not to damage the installed force main line with heavy vehicle activity.
- See Appendix 1: *Typical Septic Tank Detail.*

9.5 Puraflo Installation

The site specific design will detail the final effluent dispersal method. Effluent may be either discharged directly to a pad installation or may have a piped outlet for discharge to trench, pressure systems, point discharge systems or other effluent dispersal methods, as applicable. The model numbers are identified as A for a pad installation and B for a piped outlet installation.

Type A – In-Ground Pad Installation
See Appendix 2:
Type A: In-Ground Pad Configuration

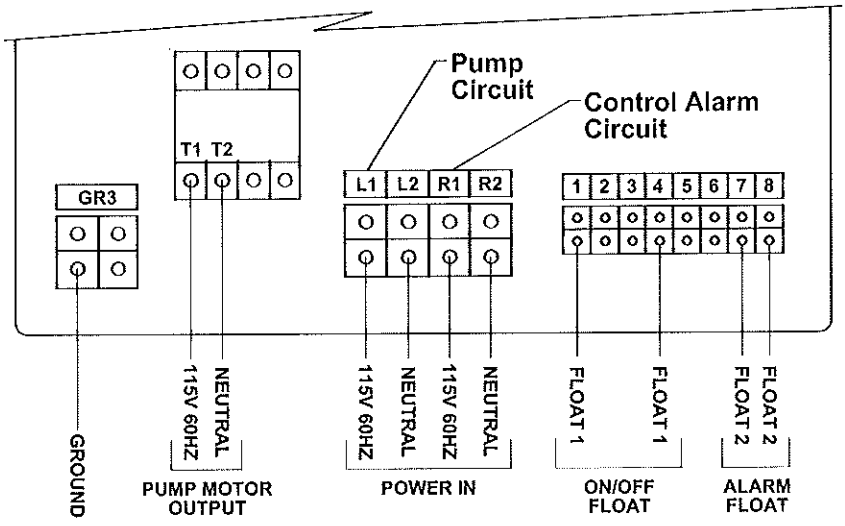
- Excavate a pad area (as specified in the design), making sure to maintain the required vertical separation distance between the bottom of the pad and any vertical restrictions such as seasonal high water table. The pad bottom must be level.
- Fill and level the excavated area with clean stone (3/4 to 1 inch, see Appendix 8) in accordance with the design, to a minimum depth of 6 inches.
- Position the modules on the stone pad area. Connect the force main to the module inlet coupling (incorporating a flexible pipe).
- Fit the sample chamber pipe to the outlet from the side of the green color coded module that does not have weep holes in the base. Insert the sample chamber pipe so that it extends 3 inches into the sample chamber and at least 5 inches off the base of the sample chamber. The sample chamber is pre-drilled with 3/4 inch holes in the base/side of the sample chamber to allow effluent to enter the pad foot-print area when samples are not being collected. The top of the sample chamber should be positioned at approximately the same level as the top of the modules.
- Backfill with stone around the modules to a height of 6 inches above the weep holes around the base of the modules when applicable.
- Cover the remaining exposed stone surface around the outside of modules with a suitable filter fabric. This prevents smaller soil particles from being washed into and subsequently clogging the foot-print area.
- Reinstate with suitable backfill and topsoil to finished design level.
- Ensure that the Puraflo lids are securely fastened.

Type B – Piped Outlet Installation
See Appendix 2: *Type B: Final Dispersal Separate from Module Configuration*

- For piped outlet installations the pad area's primary function is to level and support the modules.
- Excavate a pad area (as specified in the design). The pad bottom must be level.
- Fill and level the excavated area with clean stone (3/4 to 1 inch) in accordance with the design, to a minimum depth of 6 inches.
- Position the modules on the stone pad area. Connect the force main to the module inlet coupling (incorporating a flexible pipe). Construct the outlet pipework to the sampling chamber and to the final dispersal system in accordance with the design.
- Backfill with stone around the modules to a height of 6 inches above the drain holes on the side of the modules.
- Reinstate with suitable backfill and topsoil to finished design level.
- Ensure that the Puraflo lids are securely fastened.

9.6 Electrical Connections

- Select a location for the electrical control panel near the pump tank or home.
- Install the cable between the power source and the control panel in accordance with State or Local regulations.
- Place the electrical power cable(s) in the trench/conduit (do not stretch cable). Connect each cable coming from the equipment in the pump tank in accordance with the wiring diagram located on the door of the control panel (a typical wiring schematic is detailed below). The cable between the pump tank and the control panel is to be installed in conduit and include the appropriate conduit seal. Reinstate area.
- Connect the electrical power cable(s) to an independent electrical power supply of the specified voltage (usually 115 volts), terminating in a socket or junction box protected by an M.C.B. as required (usually 20 amps). If a duplex control panel or high head pump is required the voltage and amperage requirements may increase.
- Input timer settings in accordance with design.
- Test and commission pump operation, start/stop conditions and alarms.
- All electrical work shall be done in accordance with State or Local regulations and/or building codes.



Typical Wiring Schematic for a simplex pump system. Please refer to the inside of the Control Panel for the actual wiring diagram and specifications.

9.7 Spare Parts

Spare or replacement parts can be obtained from the manufacturer of the component or Anua if they need to be replaced.

9.8 Site Restoration

- The modules must be installed at grade or above grade with the ground landscaped to divert storm water away from the modules.
- Backfill around modules to a height just under the lid of the modules.

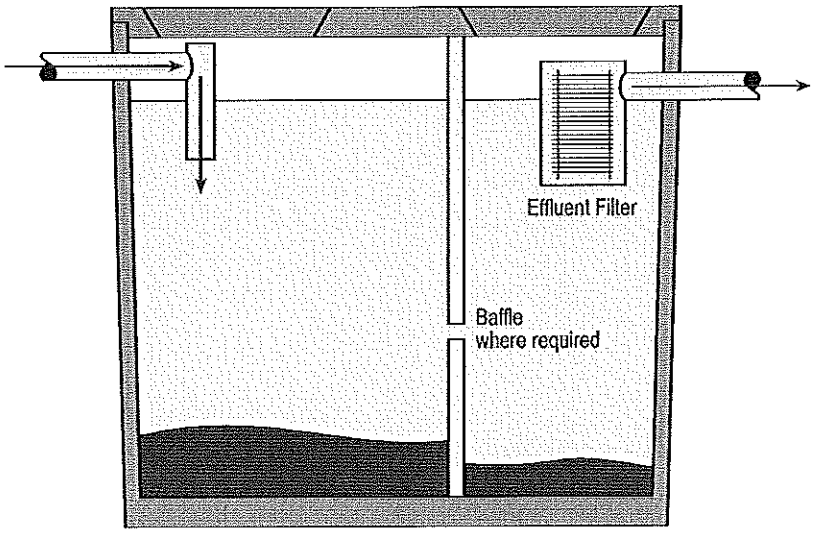
  Grade the backfill back to the existing ground level on a slope no steeper than 2:1.

  Backfill should be suitable, loose, workable material.

  Compact backfill sufficiently to counteract settlement.

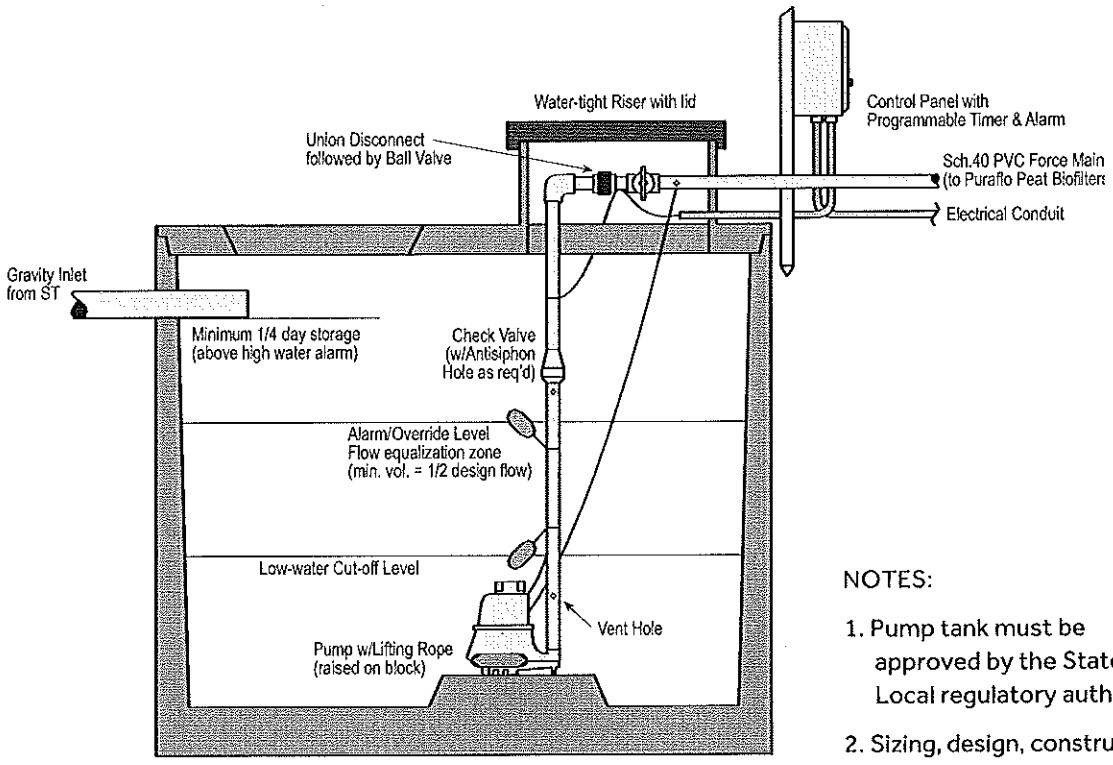
  Ensure a 6 inch minimum cover over drainfield stone where applicable. The final layer (6 inches) of fill material should be suitable topsoil capable of supporting vegetative growth.
- Grass seed and straw the sloped backfill area and any trench excavation lines with a suitable indigenous seed variety. In some cases, sodding for immediate stabilization may be specified.
- PROVIDE EROSION PROTECTION AS REQUIRED PER DESIGN PLAN.

Appendix 1 Typical Septic Tank & Pump Detail



NOTES:

1. Septic tank must be approved by the State or Local regulatory authority.
2. Sizing, design, construction and installation must conform to applicable regulations.

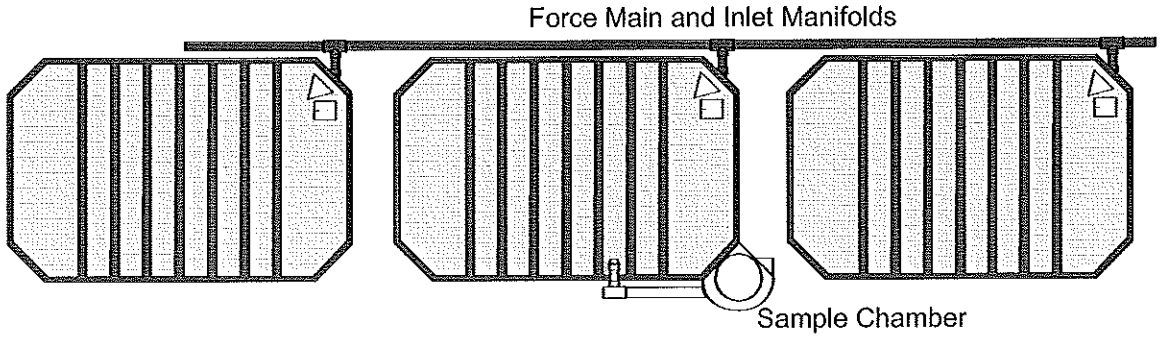


NOTES:

1. Pump tank must be approved by the State or Local regulatory authority.
2. Sizing, design, construction and installation must conform to applicable regulations.

Appendix 2 Type A & Type B Installation

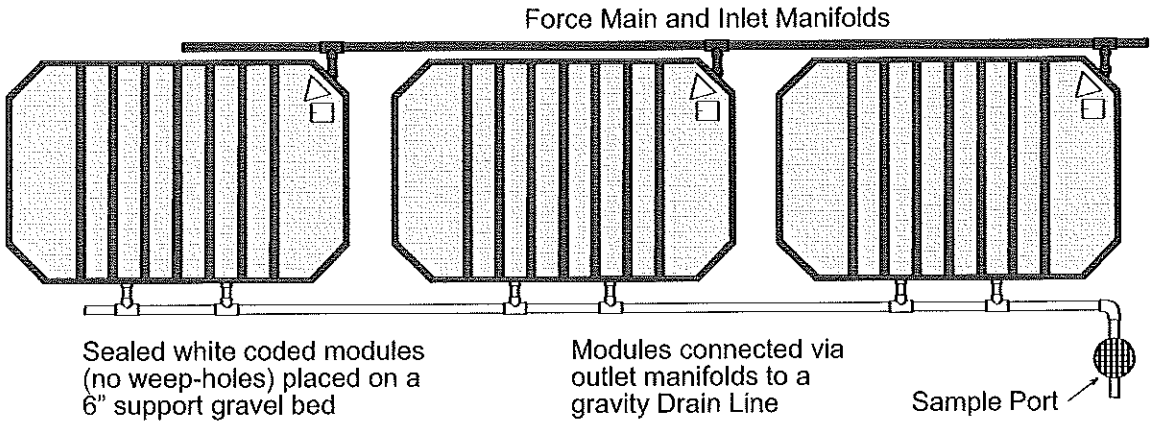
Type A – Pad Installation



Blue coded modules with weep holes and one green coded module with sampling chamber, drain into a stone pad for final treated effluent disposal.

Pad dimensions can be selected to match site conditions and modules can be installed side-by-side as well as end-to-end (as shown above)

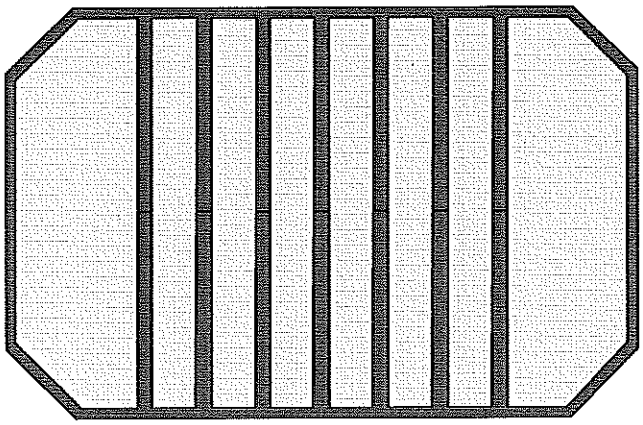
Type B – Piped Outlet Installation



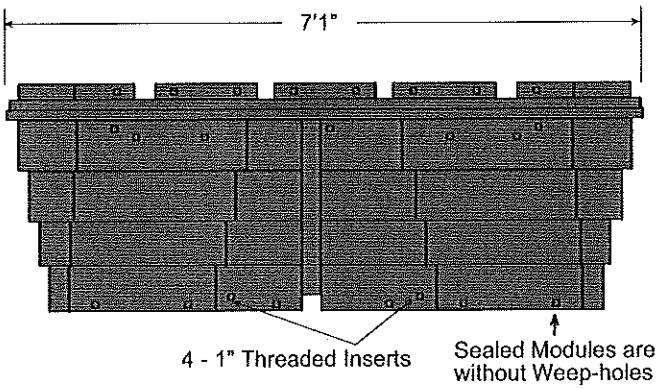
Sealed white coded modules (no weep-holes) placed on a 6" support gravel bed

Modules connected via outlet manifolds to a gravity Drain Line

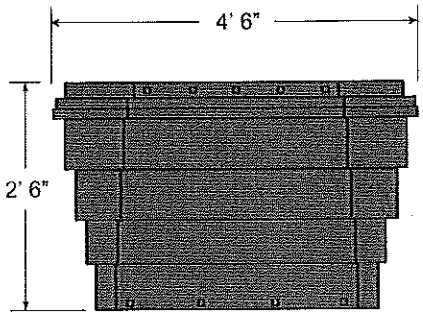
Appendix 3 Assembled Module Detail



Plan View



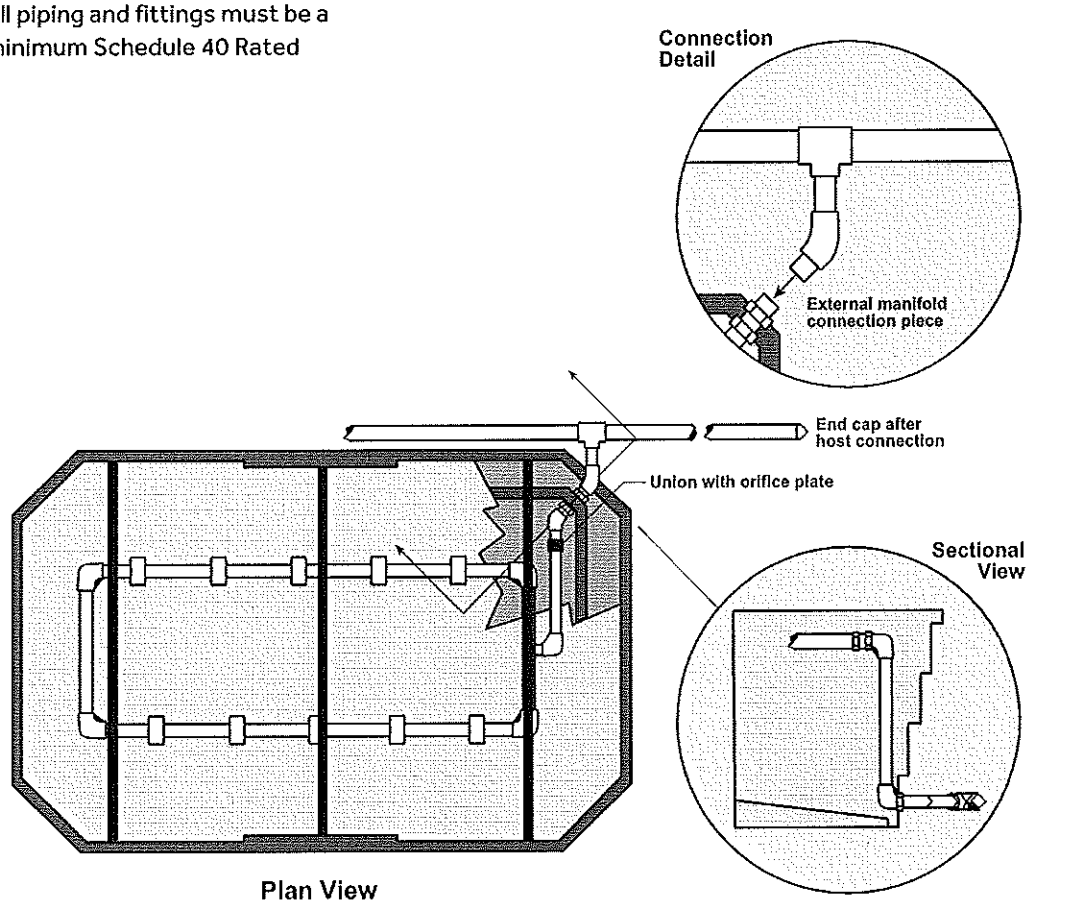
Elevation View

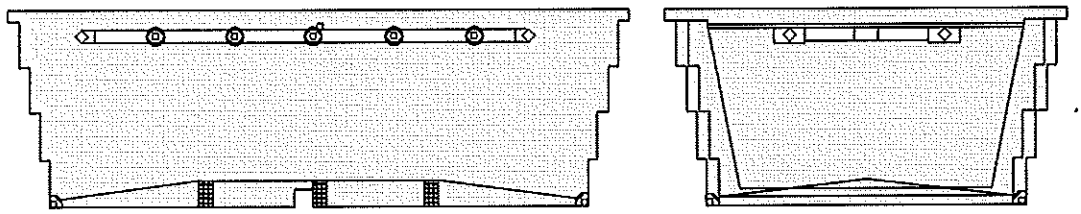


End View

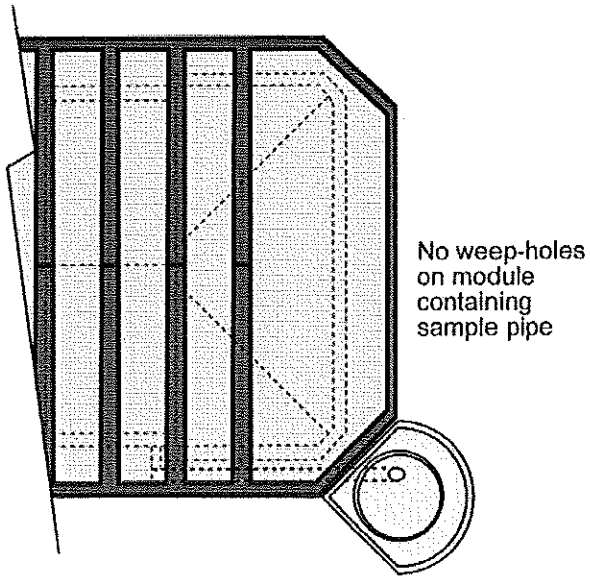
Appendix 4 Module Grid Detail

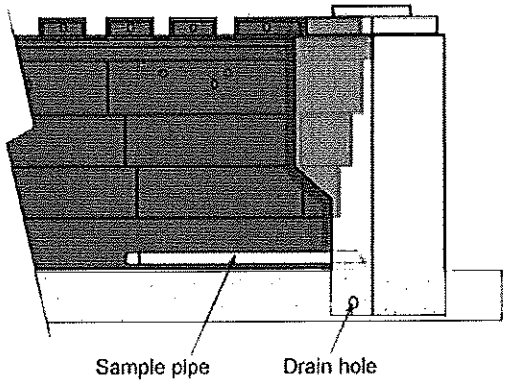
NOTE:
All piping and fittings must be a minimum Schedule 40 Rated

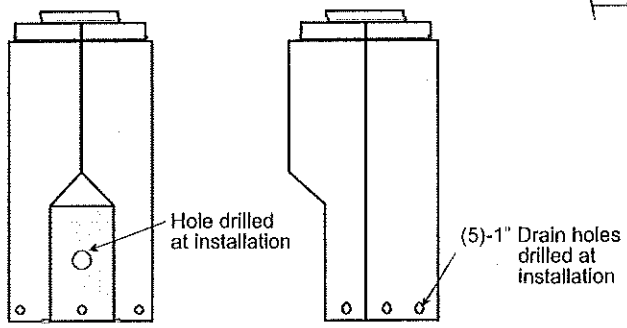




Appendix 5
Sample Chamber Detail

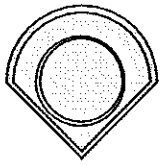






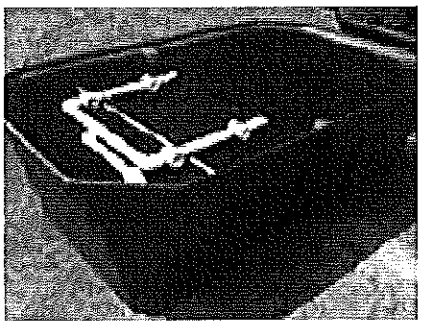
Elevation View

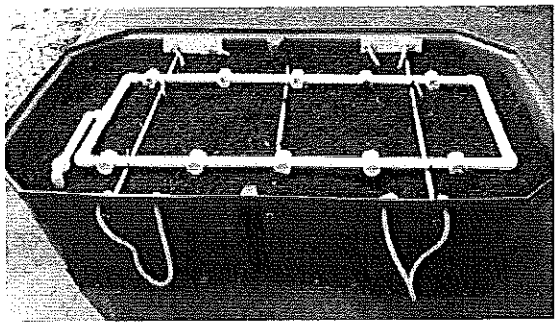
End View

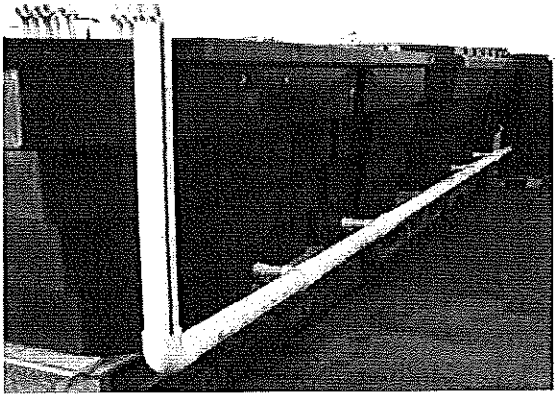


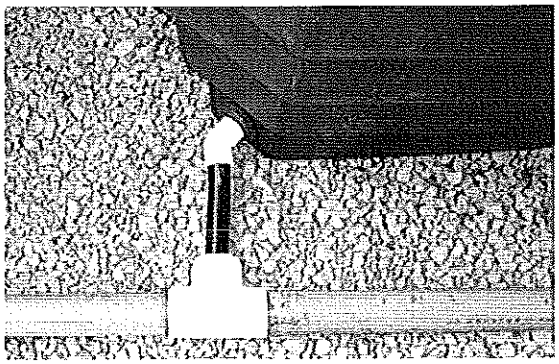
Plan View

Appendix 6 Module Pictures







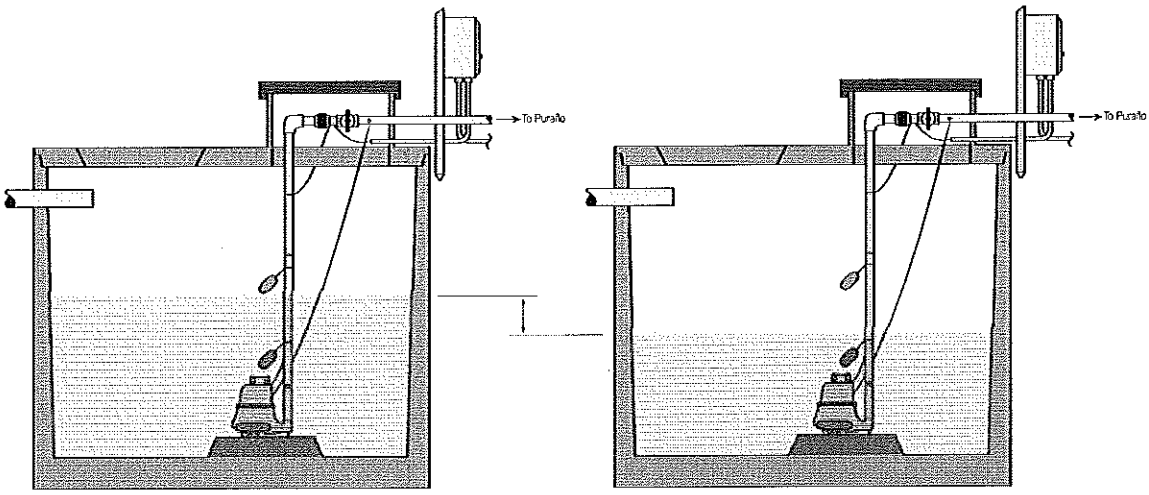


NOTE: Pipe is colored for emphasis

Appendix 7 Information Needed for the Drawdown Test

- Pump tank gallons per inch
- Design flow (gallons per day)
- Drainback volume (gallons), if applicable for cold weather situations
- # of Puraflo modules
- # of doses per day (typically 12)

Drawdown Test Procedures



STEP 1
1. Record water level
2. Record time
3. Turn pump "on"

STEP 2
1. Turn pump "off"
2. Record water level
3. Record time
4. Record water level difference and elapsed time

Timer Setting & Module Dose Volume Based on Drawdown Test

Example Parameters

Pump tank gallons per inch:	20 gallons
Design flow:	450 gpd (3 bedroom home)
Drainback volume, per dose:	5 gallons
# of Puraflo modules:	3 modules
# of doses per day:	12 doses
Water level difference:	2 inches
Elapsed time:	1 minute

Example Timer Setting Step 1

Multiple Drainback volume, per dose by # of doses per day — 5 gallons x 12 doses = **60**

Example Timer Setting Step 2

Add Design flow & Total from Step 1 — 450 gallons + 60 gallons = **510**

Example Timer Setting Step 3

Divide the Total from Step 2 by # of doses per day — 510 ÷ 12 doses = **42.5**

Example Timer Setting Step 4

Multiply the Total from Step 3 by Elapsed time — 42.5 x 1 minute = **42.5**

Example Timer Setting Step 5

Multiply the Pump tank gallons per inch by the Water level difference — 20 gallons per inch x 2 inches = **40**

Example Timer Setting Step 6

Divide the Total from Step 4 by the Total from Step 5 — 42.5 ÷ 40 = **1.06 minutes**

1.06 minutes for "on" timer setting or

1.06 minutes x 60 seconds/minute = **63.6 seconds (round-up to 64 seconds)**

Example Timer Setting Step 7

Divide the Hours in a day by the # of doses per day — 24 hours ÷ 12 doses = **2 hours for "off" timer setting**

Example Module Dose Volume Step 1

Divide the Design flow by the # of doses per day — 450 ÷ 12 = **37.5**

Example Module Dose Volume Step 2

Divide the Total from Step 1 by the # of Puraflo modules — **37.5 ÷ 3 = 12.5 gallons/dose per Puraflo module**

Appendix 8 Additional Effluent Dispersal Criteria

Type A System: Puraflo Modules Combined with IN-GROUND PAD Dispersal

- Refer to section 5 and 9 of this manual.
- All components used in conjunction with the Puraflo Peat Fiber Biofilter must comply with all applicable State or Local rules and codes.
- The septic tank shall be sized according to State or Local code.
- An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- The pump tank shall be sized according to State or Local code.
- Calculations can be done with the Microsoft Excel Design Sheet.
- The in-ground pad dispersal area shall be sized according to the soil texture hydraulic loading (BOD=30) in Table 4-3 of the USEPA 2002 Onsite Wastewater Treatment Systems Manual.
- The length and width can be sized using the Kaplan (1991) water mounding equations or linear loading rates in the Tyler (2001) Table ≤30 mg/l BOD_5.
- The bottom of the rock dispersal area shall maintain a minimum vertical separation distance from limiting conditions per State or Local code or 1 foot. In situ soil must be a minimum of 6 inches.
- The dispersal aggregate shall be clean stone (3/4 to 1 inch). The stone shall be washed with not more than 5% passing the No. 200 (75 ìm) sieve as determined by ASTM C117, "Test Method for Material Finer than 75-ìm (No. 200) Sieve in Mineral Aggregates by Washing" and shall be durable with a hardness of 3 or greater on the Moh's Scale of Hardness.
- The dispersal material shall be leveled to a depth of 6 inches.
- The Puraflo modules shall be placed on the dispersal material so that they are evenly spaced from the sides of the distribution bed and end of the distribution bed with even spaces between each module and the ends of the dispersal area. The minimum spacing from the end of the dispersal material to module end is 1 foot. For spacing calculation, see example below. The modules shall consist of one green coded module and the remainder blue coded (modules may be shipped from the factory as white coded that can be field modified to blue or green by drilling the appropriate number of 7/8" holes on predetermined spots on the modules). If modules are field modified it is the responsibility of the installer to change the color code on the lid of the module.

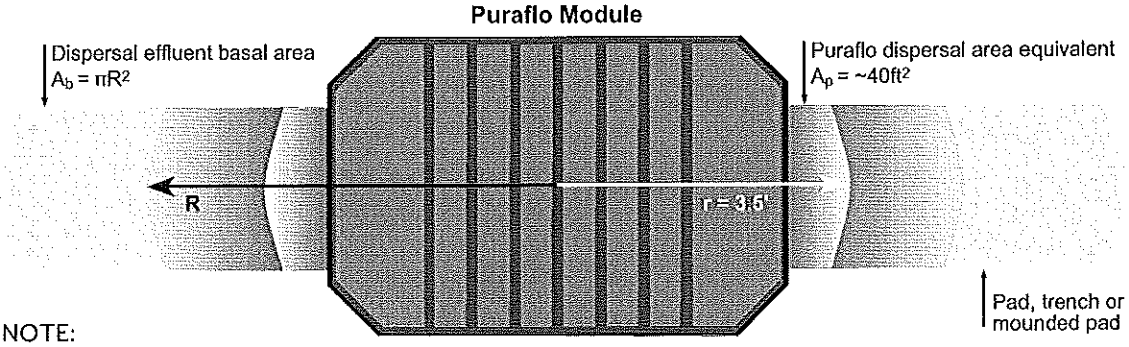
Sample spacing calculation

3 modules, each module is 4.58'W x 7.08'L
Dispersal pad is 10'W x 96'L
Total module L = 3 x 7.08' = 21.24'
Spacing between modules & ends = 96' - 21.24' = 74.76'
=74.76' / 2 (in-between modules) + 2 (ends) = 74.76' / 4
= 18.69' between modules & from ends

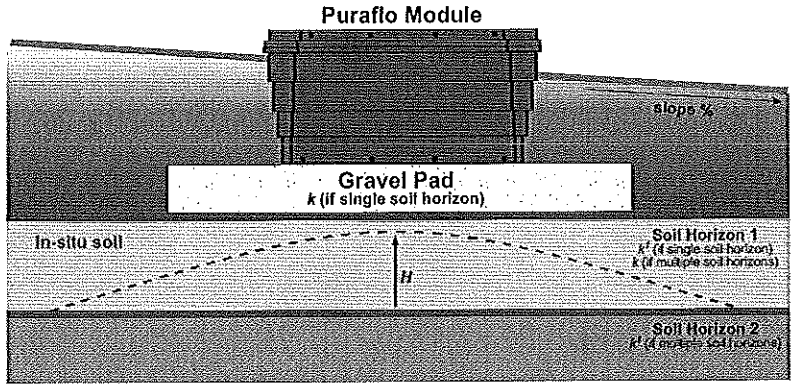
- The Puraflo modules shall be level from side-to-side and end-to-end.
- Connect the force main to the module inlet coupling (incorporating a flexible pipe). Note sizing requirements in Section 5.3 of this guide. The manifold connection shall be configured like the illustration in Appendix 2 and 4 of this guide and shall pass the last module by a minimum of six inches and be capped. It is recommended that a clean-out be brought to finished grade.
- Distribution media shall be placed at a level to completely cover the distribution holes on the side bottom of the Puraflo modules.
- An Anua specified sample chamber shall be placed on one of the outlet connections of a green color coded module for sampling of effluent.
- Once the Puraflo modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric.
- The system shall be backfilled with sandy to loamy soil material and topsoil to the bottom lip of the Puraflo modules.
- Additional design considerations:

  For slowly permeable soils, designers must use professional judgment to ensure effluent absorption into the soil and that other potential issues are mitigated, such as water mounding. For most soils, absorption and water mounding are not issues, even with as little as 1 foot of minimum vertical separation. Also, Converse and Tyler (2000) note, "The design loading rates are based on 150 gpd/bedroom resulting in 450 gpd for a 3 bedroom home. If the mound, as well as other soil based units, is loaded at 450 gpd on a regular basis, it will likely fail. The daily average flow is expected to be no more than about 60% of design or 270 gpd."

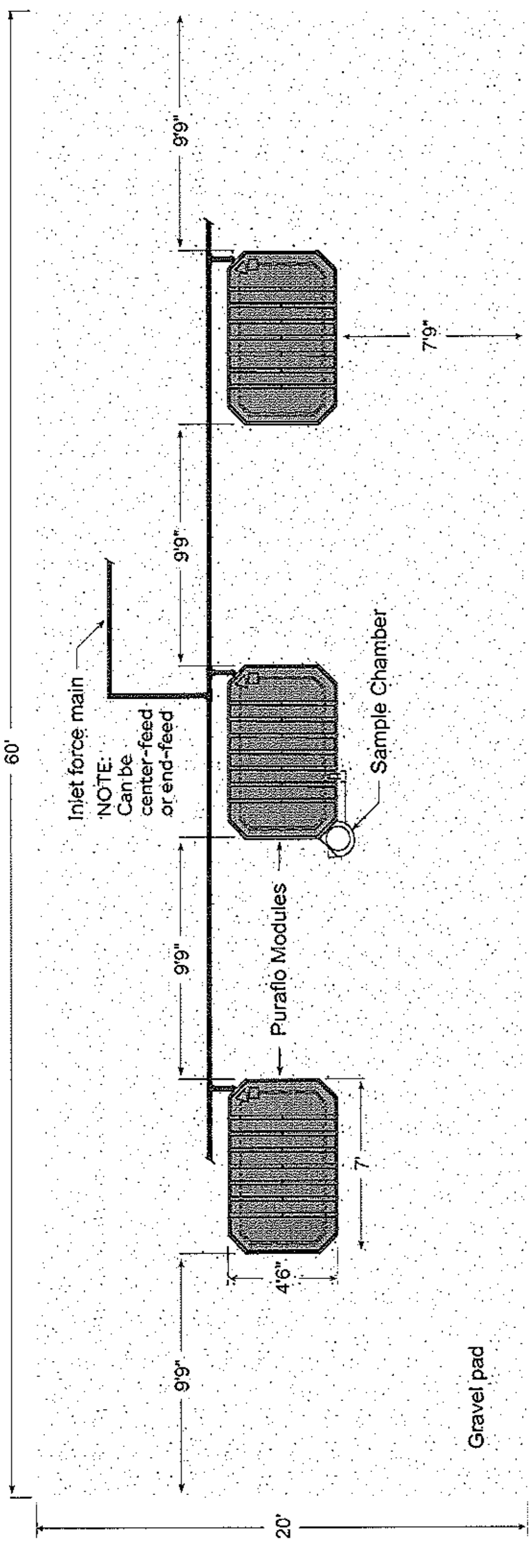
The effluent spread, as depicted in the diagram below, and water mounding height can be calculated using the Kaplan (1991) equations below:

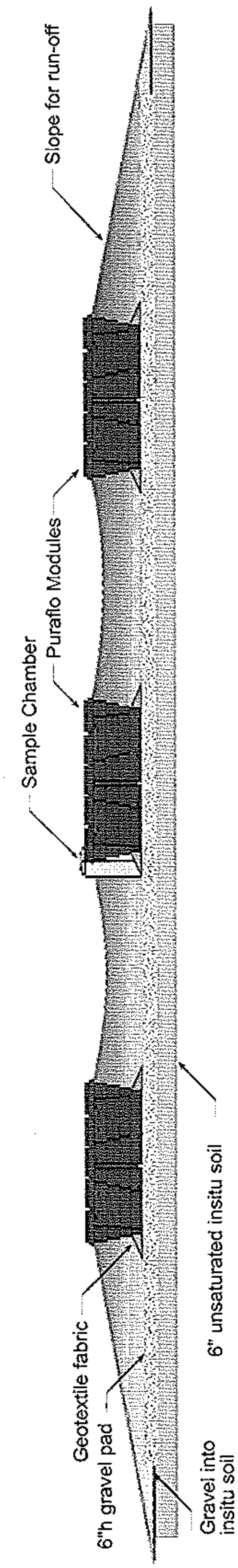


NOTE:
In-ground effluent movement will occur within gravel layer.
For mounded applications, movement will occur through gravel and sand along contour.



In-ground Pad System Diagram (typical)





Type A System: Puraflo Modules Combined with MOUNDED PAD Dispersal

Conditions

- Refer to section 5 and 9 of this manual.
- All components used in conjunction with the Puraflo Peat Fiber Biofilter must comply with all applicable State or Local rules and codes.
- The septic tank shall be sized according to State or Local codes.
- An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- The pump tank shall be sized according to State or Local codes.
- Calculations can be done with the Microsoft Excel Design Sheet.
- The bottom of the rock dispersal area shall maintain a minimum vertical separation distance from limiting conditions per State or Local code or 1 foot. In situ soil must be a minimum of 6 inches.

Site limitations and Modifications

- Mounded pads shall be oriented parallel to natural surface contours and shall be sited to avoid natural drainage features and depressions that may hold surface water. A design plan shall address surface water diversion as needed.
- An interceptor drain may be used upslope of a mounded pad soil absorption component to intercept the horizontal flow of subsurface water to reduce its impact on the down gradient mounded pad component.
- A mounded pad soil absorption component shall not be sited on a slope greater than 25 percent unless the design plan includes special installation criteria.
- Sites with boulders or numerous trees are less desirable for a mounded pad soil absorption component. Such conditions shall be avoided or the design plan shall increase the basal area to compensate for losses due to boulders or flush cut trees and shall include special instructions for the basal area preparation under such conditions.

Site and Soil Information

- Site information shall include a description of landscape position, slope, vegetation, drainage features, rock outcrops, erosion and other natural features; and documentation of any relevant surface hydrology, geologic and hydrogeologic risk factors for the specific site or in the surrounding area that may indicate vulnerability for surface water and ground water contamination.
- Soil Information shall include identification of depth to limiting conditions including but not limited to water table and rock strata, and a description of soil texture, consistence, and structure, including shape and grade.

Design Criteria

- The mounded pad basal area shall be sized according to the soil texture hydraulic loading (BOD=30) in Table 4-3 of the USEPA 2002 Onsite Wastewater Treatment Systems Manual.
- The length and width can be sized using the Kaplan (1991) water mounding equations or linear loading rates in the Tyler Table ≤30 mg/l BOD_5 Tyler (2001) Table.
- Location must be comply with State of Local codes.

Sand Fill

- The mounded pad sand fill depth shall be determined based on the depth to the limiting conditions. The sand fill depth shall not exceed two feet and shall not be less than four inches. The loading rate for the sand fill material shall not exceed 2.0 gpd/ft².
- Natural sand is defined as naturally deposited silica based sand not manufactured by mechanical processing such as the crushing of rock or coarse aggregates.
- Sand fill for the mounded pad must be concrete sand meeting the gradation requirements of ASTM C33 provided not more than 5% passes the No. 100 sieve and not more than 5% passes the No. 200 sieve as determined by ASTM C117, "Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing".
- A comparison of sand application rates from various regulatory authorities is in the table below.

Iowa	ASTM C33 or IDOT No.1	Sand fill must not have more than 20% (by weight) material that is greater than 2mm in diameter (coarse fragments), which includes stone, cobbles and gravel. Also, there must not be more than 3% silt and clay (<0.53 mm, 270 mesh sieve) in the fill.	0.15 – 0.3mm	4 – 6	2.0
Minnesota	ASTM C33	No spec for No. 100 sieve. No. 200 sieve 0-5% passing. Clean sand must also contain less than three percent deleterious substances and be free of organic impurities.	None Specified	None Specified	1.6
Washington	ASTM C33	No. 100 sieve prefer <4% passing. No. 200 sieve 0-3% passing.	None Specified	None Specified	2.0
Wisconsin	ASTM C33	None Specified	None Specified	None Specified	2.0
British Columbia	ASTM C33	No. 100 sieve 0-4% passing. No. 200 sieve 0-1% passing.	None Specified	None Specified	1.6 – 3.15
Manitoba	CSA A23.1 (ASTM C33)	No. 200 sieve 0-5% passing.	None Specified	None Specified	1.6 – 3.75

Distribution of Area Over Sand Fill

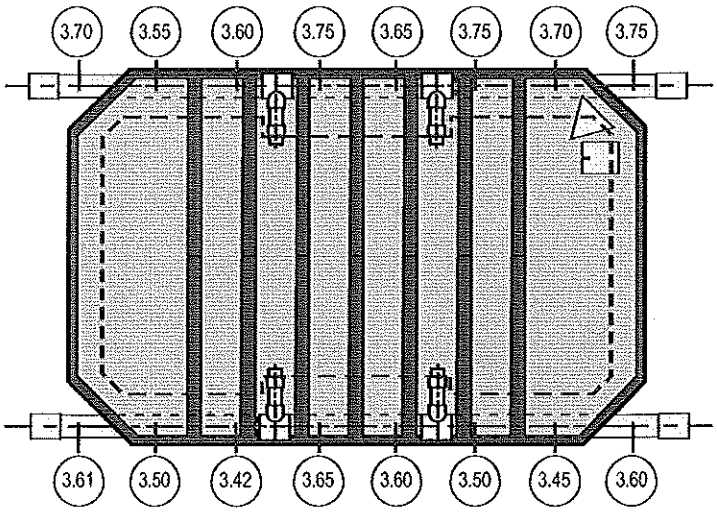
- The dispersal aggregate shall be clean stone (3/4 to 1 inch). The stone shall be washed with not more than 5% passing the No. 200 (75 µm) sieve as determined by ASTM C117, "Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing" and shall be durable with a hardness of 3 or greater on the Moh's Scale of Hardness. Plans may specify the use of other distribution area products or material such as gravelless and chamber products.
- The dispersal material shall be leveled to a depth of 6 inches.
- The Puraflo modules shall be placed on the dispersal material so that they are evenly spaced from the sides of the distribution bed and end of the distribution bed with even spaces between each module and the ends of the dispersal area. The minimum spacing from the end of the dispersal material to module end is 1 foot. For spacing calculation, see "Mounded Pad Design Example".
- The Puraflo modules shall be level from end-to-end.
- Connect the force main to the module inlet coupling (incorporating a flexible pipe). Note sizing requirements in Section 5.3 of this guide. The manifold connection shall be configured like the illustration in Appendix 2 and 4 of this guide and shall pass the last module by a minimum of six inches and be capped. It is recommended that a clean-out be brought to finished grade.

Distribution Network (if applicable)

Modules are typically Type A with weep holes; however, Type B modules with distribution network may be used as required by regulatory authority.

- The distribution network must be 2 inch PVC pipe with 3/8 inch orifices spaced between one to three feet. The orifices should be oriented in the 9 o'clock position.
- Each module must have an isolated lateral with clean-out brought to finished grade on each distal end.
- Each individual distribution lateral must be level within 1/4 inch +/- from module drain hole to lateral end.
- Testing was conducted by Anua to demonstrate the ability of the network to reasonably provided uniform distribution. Test results conducted on the network are shown in the diagram below (Each circle represents a collection bucket below a 3/8-inch orifice.)

Dose Volume = 60 Liters



Monitoring Components

- At least three inspection ports shall be spaced at intervals adequate for observation of the absorption area and any ponding at the sand fill surface. The ports shall be anchored and be accessible with at least a four inch opening and a removable watertight cap.
- Each module must have an isolated lateral with clean-out brought to finished grade on each distal end for flushing-out any materials, such as peat particles migrating to the lateral during initial operation of the system.

Mound Cover

- Once the Puraflo modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric used to prevent introduction of soil fines and allow for free movement of air and water.
- The soil cover shall be applied to allow for an approximate depth of six inches after settling, and the mounded pad shall be crowned to promote runoff.
- Soil cover shall be of a quality to allow for oxygen transfer and growth of vegetation.

Installation

- **Pre-Installation:** The full soil absorption area shall be free of any site disturbances. If any disturbance or damage has occurred, installation shall not proceed and the registered installer shall contact the owner and the board of health. Prior to installation the registered installer shall check all elevations in the design plan relative to the established benchmark including the surface contour and the flow line elevation of other components to assure proper flow through the system and freeze protection as applicable. Soil moisture conditions shall be evaluated and basal area preparation shall not proceed when there is risk of smearing or compaction.
- **Site Preparation & Installation:** The mound shall be installed according to the design manual and any referenced resource and shall comply with the following:

(1) All vegetation shall be cut close to the ground and removed from the site. Stumps, roots, sod, topsoil, and boulders shall not be removed.
(2) The force main should be installed from the upslope side. All vehicle traffic on the basal area and downslope area of the mounded pad should be avoided with installation work being conducted from the upslope side or end of the mounded pad basal area.
(3) The basal area of the mounded pad shall be prepared to provide a sand/soil interface and to improve infiltration if needed. The basal area preparation shall not reduce the infiltrative capacity of the soil surface. The degree of basal area preparation shall be determined on a site by site basis depending on soil conditions. Any basal scarification or other basal area preparation shall be conducted working along the contour. Sand may be incorporated into the basal area during the preparation process. Following basal preparation, a layer of sand fill shall be placed on the entire basal area to prevent damage from precipitation and foot traffic.
(4) The specified depth and sufficient amount of sand fill shall be placed to cover the basal area, form the absorption area, and shall not be steeper than 3 to 1 side slopes. The distribution area shall be formed to the specified dimensions and the sand surface of the distribution area shall be level.
(5) Construct and install all components, including the distribution laterals and observation ports.
(6) Once the Puraflo modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric.
(7) Field test the sand to verify quality with one of the methods outlined below.

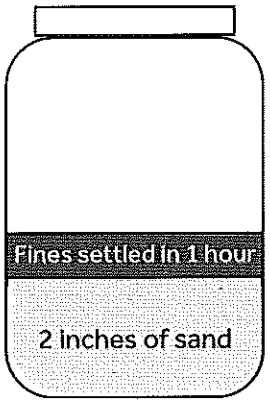
Minnesota Method

(from 1995 University of Minnesota "Onsite Sewage Treatment Manual")

Jar Test for Clean Sand for Mounds

Use a 1 quart Mason jar

If the fines that settle out in 1 hour is greater than **1/8 inch**, then the percentage of fines is too great and the sand **SHOULD NOT** be used for mound construction.



Manitoba Method

(from OWMS Jar Test revised April, 2010)

OWMS – Field Reference Guide Jar Test

Under some circumstances, it may be beneficial to perform a jar test for fines (silt or clay) on the sand when it is received or before it is purchased to determine if the sand supplied meets the specification of the sand ordered.

An 8 hour jar test must be conducted for best results.

The jar test is a "quick" method to determine if the sand contains too many fines. The jar test is not to be used as a replacement for sieve analysis; however the test can be used as a field method to determine that the sand meets CSA A23.1-04 (ASTM C33) specifications.

After settling for several hours, if the layer of fines that settle on top of the sand is thicker than 3.2mm (1/8 inch), the sand contains too many fines and is not suitable for use in a treatment mound. When in doubt the aggregate supplier should provide an aggregate analysis report to confirm that the product meets the sieve specification.

When a "check" in the sand is required, it is recommended that a sample of the sand be obtained prior to construction and the 8 hour jar test be conducted.

Jar test procedure is as follows:

- Place approximately 2 inches of sand in a glass quart jar.
- Fill the jar with water.
- Shake the jar vigorously to mix the sand and water.
- Set the jar on a level platform and allow to settle for 4–8 hours.
- Upon settling, after 4–8 hours, the layer of fines that settle on top of the sand layer should not be thicker than 3.2mm (1/8 inch).

Tips:

- Take a sample from the middle of the pile.
- It may be necessary to jar test a composite sample.
- It may be necessary to conduct two jar tests.
- When in doubt, obtain the sieve analysis report from the aggregate supplier or send a sample to the laboratory. Be sure to ask the laboratory to include the No. 200 sieve size.

Completion

(1) The area around the mound system shall be protected from erosion through upslope surface water diversion and provision of suitable vegetative cover, mulching, or other specified means of protection.
(2) Installer documentation shall include the drawdown test, as specified in Appendix 7, as baseline measure for future O&M and monitoring. Documentation shall be provided to the local health district to be included in the permit record.
(3) The system shall be backfilled with sandy to loamy soil material and topsoil to the bottom lip of the Puraflo modules.

Mounded Pad Operation and Maintenance

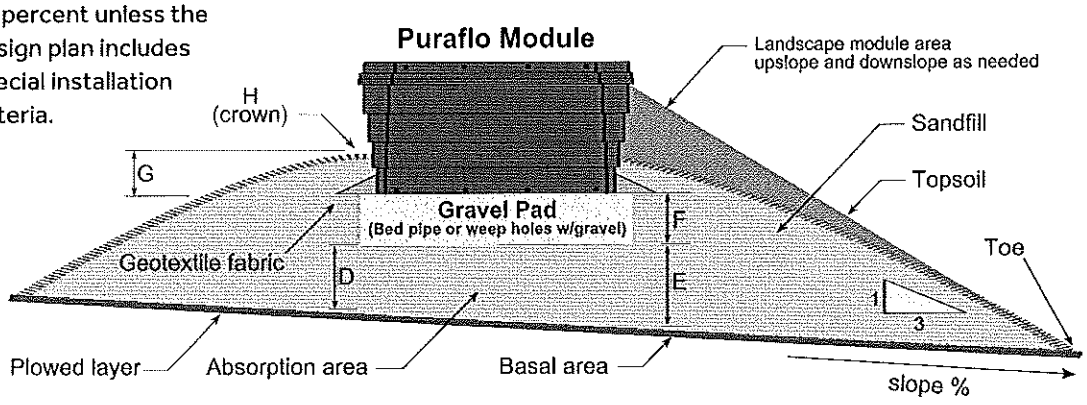
- The mounded pad system shall be operated, maintained, and monitored as outlined in the "Operation and Maintenance Manual" and per requirements of the regulatory authority.

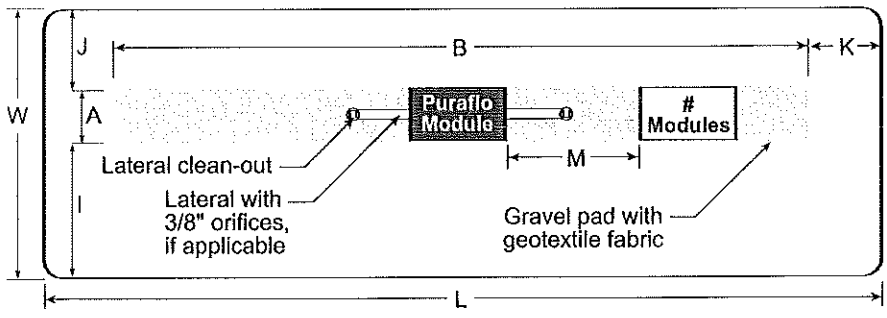
- The O&M of a mound soil absorption system shall include but is not limited to:

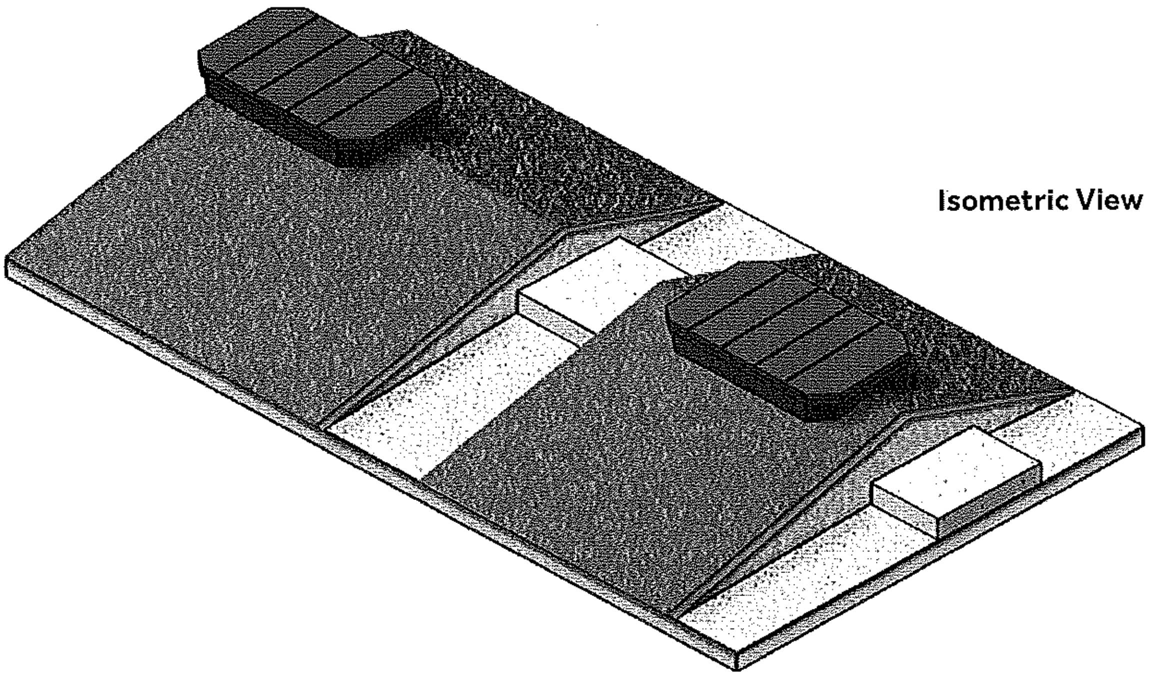
(1) Checking the mounded pad vegetative cover for erosion or settling and any evidence of seepage on the sides or toes of the mounded pad.
(2) Flushing of distribution laterals.
(3) Checking for ponding in the distribution area.
(4) Monitoring the dose volume to the Puraflo modules and performing the drawdown test as outlined in Appendix 7.
(5) Checking for any surface water infiltration or clear water flows from the dwelling or structures into the system components or around the mounded pad soil absorption area.

Mounded Pad System Diagram (typical)

NOTE:
A mounded pad soil absorption component shall not be sited on a slope greater than 25 percent unless the design plan includes special installation criteria.







Isometric View

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Type B System: Puraflo Modules Combined with SEPARATE Dispersal

- Refer to section 5 and 9 of this manual.
- All components used in conjunction with the Puraflo Peat Fiber Biofilter must comply with all applicable State or Local rules and codes.
- The septic tank shall be sized according to State or Local codes.
- An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- The pump tank shall be sized according to State or Local codes.
- Calculations can be done with the Microsoft Excel Design Sheet.
- The bottom of the rock dispersal area shall maintain a minimum vertical separation distance from limiting conditions per State or Local code or 1 foot. In situ soil must be a minimum of 6 inches.

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