VERMONT

GeoMat™ Leaching Systems

Design Manual for
Pressure and Gravity Applications

VERMONT
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Drinking Water & Groundwater Protection Division
THIS IS SUBJECT TO PROVISIONS
OR CONDITIONS LISTED IN PERMIT
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GEOMATRIX

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Introduction

The GeoMat Flat Leaching System ("GeoMat"), is a low profile leaching system designed for maximum treatment and infiltration of wastewater into soil. GeoMat is nominally 1 inch thick and available in widths of 6, 12, and 39 inches. It is comprised of an entangled filament core covered by a hygroscopic membrane with an incorporated distribution pipe.

Due to the shallow burial depth and the high surface area to void space ratio in the GeoMat, gas exchange has been shown to be significantly greater in GeoMat than in other leach field technologies. This increased oxygen transfer rate results in increased removal of pathogens, BOD, TSS, and nutrients such as nitrogen and phosphorus in a shallower soil profile.

The combination of the highly transmissive core and hygroscopic membrane draw the water between the application points and uniformly apply the water to the surrounding soil. The soil then draws the water away from the surrounding membrane through capillary action. This results in a much more uniform application of water to the soil and minimizes the point loading associated with other low profile systems.

In general, GeoMat can be used in many different configurations; please check with your regulatory agency or contact Geomatrix for the configurations that may be available in your area. GeoMat can be installed in trench and bed layouts and function with gravity, pump to gravity, and pressure distribution (PD) system configurations. GeoMat with 6 inches of ASTM C33 sand beneath it can be configured to achieve NSF Standard 40 treatment levels. GeoMat can also be used for subsurface irrigation and nutrient reuse.

Geomatrix products are the result of intensive research and development, including in house and third-party testing. Test reports are available by contacting Geomatrix, LLC.

Patents at www.geomatrix systems.com.

Designing a GeoMat System

GeoMat shall be designed in accordance with **all State and local regulations.**

Leach fields are designed based on a peak design flow measured in gallons per day (GPD) set by Local or State Agencies. The peak factor is typically 1.5 to 2 times the average water consumption over a 30 day period. Leach fields are not designed to be loaded at the peak design flow for an extended period of time. Leach fields that are loaded at the peak design for an extended period without sufficient time to rest may experience premature failure. Designers of GeoMat must take care to understand the intended use of the GeoMat system and design in accordance with both the regulatory design flow and the intended use.

Systems with high peak loading events can benefit from time dosing.

The designer is responsible for specifying the diameter of the distribution pipe used (typically 1 inch – 2 inch), the spacing of the orifice holes, and for calculating frictional losses. Distal head should be a **minimum** of 2.3 feet and a **maximum** of 6 feet of residual head (static pressure) at the end of each drainfield distribution lateral.

Design software for pump, lateral line, transport pipe, manifold, orifice size and associated frictional losses is available by emailing request to info@geomatrixsystems.com.

GeoMat in a Sand Bed

A minimum of 6 inches of ASTM C33 sand must be placed beneath the GeoMat and 2 inches of this specification of sand should be placed over the GeoMat fabric membrane.

GeoMat must be designed and installed utilizing the following parameters:

- GeoMat with less than 4 inches separation use the rating without 4 inches spacing on page 4 and Tables 3-8 on pages 6-11 for recommended GeoMat sizing.
- GeoMat with a minimum of 4 inches apart use the rating with 4 inches spacing on page 4 and Tables 3-8 on pages 6-11 for recommended GeoMat sizing.
- Gravity or pressure distribution may be used.
- A minimum of 12 inches of sand should surround the perimeter of the GeoMat in a bed configuration.

GeoMat in Trench Configuration

GeoMat in trench configuration may be installed directly in or on top of suitable native soils. GeoMat in trench configuration may also be installed with six inches of ASTM C33 sand beneath. GeoMat installed on six inches of ASTM C33 sand is approved for filtrate effluent treatment credit.

When GeoMat is installed directly in or on top of native soil, ASTM C33 sand can be placed under and around the GeoMat when soil conditions result in flow through structural pathways. The sand helps preserve the structural pathways and prevents translocation of fines into these beneficial pathways.

GeoMat, when installed in trench configuration, should be designed, and installed utilizing the following parameters:

- Trenches shall be separated, sidewall to sidewall, from adjacent trenches by a minimum of 4 feet. Tables 3-8 below are used for recommended GeoMat calculation.
- Gravity or pressure distribution may be used.
- Multiple laterals of GeoMat may be placed in the same trench. Laterals may be placed edge to edge or evenly spaced within the trench. Tables 3 - 8 provide the appropriate length of GeoMat.

GeoMat Sizing

GeoMat is approved for use in the State of Vermont at the loading rates in Table 1.

Table 1

GeoMat Loading Rate

Texture	Structure*	Application Rate	Minimum Bed Area (ft2)				Max System Slope
			2 Bedroom 280 gpd	3 Bedroom 420 gpd	Add'l Bedrooms 70 gpd	Non-Residential Rate 100gpd	
Very Coarse Sand or Coarser	SG	2.4					20%
Coarse Sand, Sand	SG	2.4	117	175	29	42	
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	SG	1.6	175	263	47	63.5	
	MA/PL	0.8	350	525	88	83	
	PR/SBK/ABK/ GR	1.2	233	350	58	83	
Sandy Loam, Coarse Sandy Loam	MA/PL	0.8	350	525	88	125	
	PR/SBK/ABK/ GR	1.2	233	350	58	83	
Fine Sandy Loam, Very Fine Sandy Loam	MA/PL	0.8	350	525	88	125	
	PR/SBK/ABK/ GR	1.0	280	420	70	100	
Loam	MA/PL	0.8	350	525	88	125	
	PR/SBK/ABK/ GR	1.0	280	420	70	100	
Silt Loam, Silt	MA/PL	0.4	700	1050	175	250	10%
	PR/SBK/ABK/ GR	0.6	467	700	117	167	15%
Sandy Clay Loam, Clay Loam, Silty Clay Loam	MA/PL	0.4	700	1050	175	250	10%
	PR/SBK/ABK/ GR	0.4	700	1050	175	250	

*SG- single grain, MA- massive, PL- platy, PR- Prismatic, SBK- subgranular blocky, ABK- angular blocky, GR- granular

GeoMat rating (square foot per lineal foot) is set forth in Table 2:

Table 2

GeoMat Square Foot per Lineal Foot

	Rating – square foot per lineal foot without 4" spacing	Rating – square foot per lineal foot with 4" spacing	Total Storage Volume – gallons per lineal foot	Max dose volume (50% of void space)– gallons per lineal foot per dose
GeoMat 600	0.50	0.67	0.32	0.16
GeoMat 1200	1.00	1.17	0.64	0.32
GeoMat 3900	3.25	3.42	2.02	1.01

System sizing is inherently related to cost. While more surface area is always beneficial, the cost per acre of land, additional construction costs, septic fill, septic tank/pretreatment efficiency, leaching system components, etc. must be balanced against the type of use, useful life, and performance of the system.

Ultimately what and how much the user puts down the drain will determine the ultimate system lifespan and performance. Performance testing, national standards and government regulations do not necessarily address all situations/users.

When a leaching system is not being used (i.e. not being dosed with wastewater), the organic matter that has accumulated over time can dry out and breakdown in a process similar to composting. Zoned systems can be used to run and rest portions of the system and facilitate this resting process if the use pattern of the system will not naturally facilitate it. Inorganic materials that are put down the drain will be unaffected and not breakdown.

The installation of an air introduction point is advisable to allow rejuvenation of the system should this be necessary at some point in the future.

A frank, honest discussion between the designer and the property owner about how the system will be used is the best way to determine what type of design, specific components and what sizing/safety factor is best to apply to any given design. Geomatrix encourages the designer and property owner to make the system as big as possible; but any final design is ultimately a compromise between cost, performance, and longevity. If cost is not an issue...designing as conservatively as possible is encouraged.

As there are many variables affecting septic systems performance, when possible, increasing surface area is beneficial. Designing at the highest approved hydraulic loading rate, just because it is allowed, may not be in the property owners best long-term interest.

Leach fields are typically designed based on the following standard residential wastewater effluent strength from a primary septic tank BOD_5[(1)] of <300 mg/l, TSS[(2)] <100 mg/l and FOG[(3)] <10 mg/l. When effluent exceeds typical residential wastewater strength, the leach field surface area needs to be increased to allow a greater soil surface area (sq.ft) to effluent (gpd) ratio to ensure increased oxygen transfer. Failure to increase the square foot area will result in premature leach field failure.

1. Biochemical Oxygen Demand (BOD)-determines the approximate of oxygen required to treat wastewater; is a proxy measure for the amount of organic matter in a system.
2. Total Suspended Solids (TSS) – determines the amount of solids that do not settle out in the tank and can pass through to the leach field.
3. Fat, Oil, and Grease (FOG) – the portion of wastewater constituents that are less dense than water; can cause maintenance issues and increased clogging of the leach field and interferes with the biological action of the treatment process.

Leach fields are designed based on a peak design flow measured in gallons per day (GPD) set by Local or State Agencies. The peak factor is typically 1.5 to 2 times the average water consumption over a 30 day period. Leach fields are not designed to be loaded at the peak design flow for an extended period of time. Leach fields that are loaded at the peak design for an extended period may experience premature failure. It is important to repair leaking water fixtures promptly and, if the system is designed for residential uses, high water uses such as laundry needs to spread out throughout the week instead of doing several loads in one day.

GeoMat is typically sold in 100 foot rolls.

For all applications other than single family residential applications, contact Geomatrix or a Geomatrix certified design professional for assistance.

When possible, Geomatrix recommends that the following Tables 3 - 8 be used for system design.

Step 1. Determine GeoMat model and configuration.

Step 2. Determine recommended lineal feet of GeoMat using Tables 3 – 8 below. Ensure that you are using the correct table based on GeoMat model used, whether minimum 4 inch spacing between adjacent rows is present, and effluent quality. If sufficient space for recommended GeoMat is not available, the designer should use input from the system owner/user to design a system based on the approved loading rates and minimum bed sizing that will be effective based on site and use conditions.

Table 3

Lineal Feet of GeoMat 600 on 6” of Sand

				Septic Tank Effluent						**Secondary Treated Effluent**				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add’l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add’l Bedroom Add**
600	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	239	358	478	597	119		144	216	288	360	72
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	418	627	836	1045	209		246	369	492	615	123
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	557	836	1114	1393	279		334	501	669	836	167
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	836	1254	1672	2090	418		572	859	1145	1431	286
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	320	480	640	800	160		193	290	386	483	97
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	560	840	1120	1400	280		329	494	659	824	165
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	747	1120	1493	1867	373		448	672	896	1120	224
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	1120	1680	2240	2800	560		767	1151	1534	1918	384

Table 4

Lineal Feet of GeoMat 600 on Native Soil

				Septic Tank Effluent						**Secondary Treated Effluent**				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**
600	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	699	1048	1397	1746	349		349	524	699	873	175
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	887	1330	1773	2216	443		443	665	887	1108	222
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	1101	1652	2203	2754	551		551	826	1101	1377	275
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	1343	2015	2687	3358	672		672	1007	1343	1679	336
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	936	1404	1872	2340	468		468	702	936	1170	234
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	1188	1782	2376	2970	594		594	891	1188	1485	297
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	1476	2214	2952	3690	738		738	1107	1476	1845	369
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	1800	2700	3600	4500	900		900	1350	1800	2250	450

Table 5

Lineal Feet of GeoMat 1200 on 6" of Sand

				Septic Tank Effluent						**Secondary Treated Effluent**				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**
1200	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	137	205	274	342	68		83	124	165	206	41
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	239	359	479	598	120		141	211	282	352	70
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	319	479	638	798	160		191	287	383	479	96
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	479	718	957	1197	239		328	492	656	820	164
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	160	240	320	400	80		97	145	193	241	48
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	280	420	560	700	140		165	247	329	412	82
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	373	560	747	933	187		224	336	448	560	112
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	560	840	1120	1400	280		384	575	767	959	192

Table 6

Lineal Feet of GeoMat 1200 on Native Soil

				Septic Tank Effluent						**Secondary Treated Effluent**				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**
1200	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	400	600	800	1000	200		200	300	400	500	100
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	508	762	1015	1269	254		254	381	508	635	127
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	631	946	1262	1577	315		315	473	631	788	158
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	769	1154	1538	1923	385		385	577	769	962	192
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	468	702	936	1170	234		234	351	468	585	117
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	594	891	1188	1485	297		297	446	594	743	149
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	738	1107	1476	1845	369		369	554	738	923	185
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	900	1350	1800	2250	450		450	675	900	1125	225

Table 7

Lineal Feet of GeoMat 3900 on 6" of Sand

				Septic Tank Effluent						**Secondary Treated Effluent**				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**
3900	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	47	70	94	117	23		28	42	56	71	14
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	82	123	164	205	41		48	72	96	120	24
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	109	164	218	273	55		65	98	131	164	33
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	164	246	327	409	82		112	168	224	280	56
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	49	74	98	123	25		30	45	59	74	15
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	86	129	172	215	43		51	76	101	127	25
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	115	172	230	287	57		69	103	138	172	34
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	172	258	345	431	86		118	177	236	295	59

Table 8

Lineal Feet of GeoMat 3900 on Native Soil

				Septic Tank Effluent						Secondary Treated Effluent				
				Lineal Feet of GeoMat Per Bedroom						Lineal Feet of GeoMat Per Bedroom				
GeoMat Product	**Spacing**	**Texture**	**Structure**	**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**		**2**	**3**	**4**	**5**	**For Each Add'l Bedroom Add**
3900	With Min 4" Spacing	Very Coarse Sand or Coarser	SG	137	205	274	342	68		68	103	137	171	34
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	174	261	347	434	87		87	130	174	217	43
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	216	324	432	539	108		108	162	216	270	54
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	263	395	526	658	132		132	197	263	329	66
	Without 4" Spacing	Very Coarse Sand or Coarser	SG	144	216	288	360	72		72	108	144	180	36
		Fine Sand; Very Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam; Loam	SG/PR/SBK/ ABK/GR	183	274	366	457	91		91	137	183	228	46
		Fine Sand; Ver Fine Sand; Loamy Fine Sand; Loamy Very Fine Sand; Sandy Loam; Coarse Sandy Loam; Fine Sandy Loam; Very Fine Sandy Loam	MA/PL	227	341	454	568	114		114	170	227	284	57
		Silt Loam; Silt; Sandy Clay Loam; Clay Loam; Silty Clay Loam; Sandy Clay; Clay; Silty Clay	MA/PL/PR/ SBK/ABK/ GR	277	415	554	692	138		138	208	277	346	69

Tables 3 -8 apply only to single family residential properties. Contact Geomatrix or a Geomatrix certified design professional for all other applications.

Basic Design Considerations

If the system is configured for gravity distribution, dosing volume does not inherently apply.

In gravity systems, internal GeoMat pipe will be Geomatrix 2 inch perforated pipe or SDR35 3 or 4 inch perforated pipe.

Cover depth shall maintain a minimum of 6 inches above the GeoMat distribution pipe. Use clean sandy fill and topsoil suitable for growing grass.

Minimum perimeter sand fill beyond the GeoMat on a sand bed shall be 12 inches. The GeoMat cover material should be finial graded to a 2% pitch over the GeoMat system and for 24 inches beyond the outermost edge of the GeoMat. If the cover material over the GeoMat is above the original grade, it shall maintain the 2% pitch for a minimum of 24 inches beyond the outermost edge of the GeoMat and then run at a 3:1 slope to original grade.

Remember to follow these design parameters when designing and installing GeoMat:

- Preservation of the native soil between trenches and minimizing its disruption and compaction during construction is essential to maintaining soil structure and therefore water and gas movement in the soil around the trenches. For this reason, construction is to be trench-by-trench when possible unless a C33 sand layer is used as a continuous base beneath, around and covering the GeoMat;

- Keep the bottom of the GeoMat shallow (8-20 inches below existing and finish grades);

- Separation from the bottom of the GeoMat in native soil to the seasonal high water table is 3 feet and separation to bedrock is 4 feet, unless otherwise approved; GeoMat installed on 6 inches of sand shall have a separation distance from the bottom of the GeoMat of 1.5 feet to the seasonal high water table and 2 feet to bedrock;

- Keep the bottoms of the individual GeoMat laterals level;

- Do not over-dig the width or depth of the drainfield trenches unless specified sand is used as fill;

- Avoid working soils that are moist or wet because they can easily smear and compact;

- Scarify the drainfield base before installing components.

When first reviewing a site and developing a design, position the GeoMat laterals parallel to ground surface contours whenever possible. This will help make it easier to keep drainfield base elevations uniform. Designing perpendicular to a surface contour will mean that the down

gradient end of the drainfield trench will be shallow-placed, whereas the up gradient end will be much deeper. Systems that are perpendicular to the surface contours also result in a smaller hydraulic window.

When pressure distribution is used, within reason, small frequent doses of effluent to the GeoMat are preferred over fewer larger doses; however, rest/reaeration intervals must also be provided; 4 – 8 doses a day is typical (minimum 4 doses under Vermont rules). Pump chambers should preferably be designed with float switches controlling high water alarm, pump on/off, and low water/redundant off. An event counter is recommended. Time dosing can also enhance performance.

GeoMat Excavation Requirements

The soil between the dispersal trenches shall remain undisturbed when possible. If the presence of boulders or other obstacles make trench construction impractical, the entire leach field area may be excavated as necessary, backfilled with a suitable sand fill such as ASTM C-33 or other approved sand to the design elevation of the bottom of trench and the GeoMat constructed and backfilled in C33 sand.

Gravity Distribution Design Parameters

Gravity GeoMat laterals shall not exceed 50 feet.

Parallel distribution shall be used whenever possible.

Laterals for gravity systems can either be SCH40 2 inch or SDR35 3 or 4 inch pipe with a minimum of two rows, at 5 and 7 o'clock, of ½ inch perforations on 5 inch centers.

It is recommended that an effluent filter be used.

Pressure Distribution Design Parameters

Generally, the pressure transport pipe from the septic tank or treatment unit to the GeoMat is 1-½ to 3 inch schedule 40 PVC pipe. The actual pipe size will depend upon such factors as distance, pump head, scour velocity, frictional losses, and desired pressure at the distal orifices. The transport pipe should be sloped either back to the pump basin or toward the GeoMat to drain the line after each dose. In some cases, it may be better to slope the transport line in both directions. This should be done to prevent freezing in cold weather. An anti-siphon device should be used where any chance of siphoning water from the pump tank may occur.

GeoMat distribution manifolds are typically 1 ½ to 3 inch schedule 40 PVC. Distribution laterals are typically 1 inch to 2 inches schedule 40 PVC. Size will vary depending on design and site conditions. Distribution laterals should have flow equalization valves installed to provide equal

flow of effluent to all rows when GeoMat laterals are at varying elevations. Flow equalization valves are often installed in the pump chamber for easy operation, protection from damage and prevention of freezing. A disconnect/throttle valve should be installed downstream of the pump to throttle and/or shut off flow to the GeoMat piping.

Designs should account for a minimum of 2.3 feet of distal head and a maximum of 6 feet at the distal end of each GeoMat distribution lateral.

Design software for pump, lateral line, transport pipe, manifold, orifice size and additional head losses is available by emailing request to info@geomatrixsystems.com.

Based on the system design a series of orifice holes are drilled downward (six o'clock position) and spaced according to the dosing requirements of the system. Orifice sizing is typically ⅛ – 3/16" I.D.; with the smaller sizes used for pretreated effluent and the larger sizes for septic tank effluent. During construction/fabrication of the distribution lateral a new/sharp drill bit should be used to assure as smooth an orifice as possible. All drill shavings and burrs must be removed from the piping with a slug and/or brush. Geomatrix GeoGuard™ orifice shields must be used or the GeoMat warranty is void. Orifice shields must be installed over the orifice holes and glued in place with PVC primer and glue.

Schedule 40 PVC,sweep elbows, or two 45-degree elbows (also called turn ups) shall be attached to the distal end of each GeoMat distribution lateral to facilitate setting and measuring distal head, maintenance, and inspection. A standard ninety elbow should not be used because it will interfere with maintenance activities. The open end (upward end) of the turn up needs to be closed off with either a ball valve or threaded plug or cap. These turn ups also serve as distal head ports for measuring and setting distal head on GeoMat laterals at different elevations.

The installation of a pressure filter, approved by Geomatrix, is recommended between the pump and the laterals on pressure distribution systems. The Sim/Tech STF-100 is preapproved.

Zoned Drain Fields and Trenches at Different Elevations

Smaller pumps can be used on larger drainfields and result in acceptable frictional losses by using automatic sequencing valves such as manufactured by K-Rain. These valves automatically direct flow to each respective zone or distribution lateral, in a prescribed order.

Site conditions may not facilitate installing drainfield trenches at the same elevation. In these situations, distribution valves can be used to provide uniform wastewater distribution; alternatively throttle valves can also be used to the same effect. Access points must be installed for each valve. Valves can be located in the pump tank or in valve boxes.

Drain Field Cover

When covering the system, construction staples can be used to temporarily hold down piping components and the GeoMat until soil cover can be placed on them, but they should not penetrate the top fabric. Drainfield cover shall be a minimum of 6 inches. Uniform cover depth over the drainfield results in uniform oxygen transfer to the entire system. The final grade over and around the drainfield should direct storm water sheet flow away from the drainfield. The area over the drainfield and extending out from the outermost edge of the GeoMat, for a minimum distance of 24 inches, shall be finial graded at a 2% slope. If the GeoMat system is elevated above the original grade, the slope beyond the area requiring the 2% slope shall be graded no steeper than a 3:1 slope. Care should be exercised to keep a minimum of 6 inches of cover material over the system before operation of low ground pressure equipment. Excavation equipment should not exceed 10 psi ground pressure. Turning excavation equipment on top of the GeoMat should be avoided. Take care to not operate excavation equipment in the same location as this can compact this region relative to other areas.

The area directly above and adjacent to any septic drainfield should be protected from heavy vehicle traffic and excess weight loads before, during and post construction.

On all new construction, it is recommended that the proposed drainfield location be staked and flagged/fenced to prevent encroachment during construction. If vehicle encroachment is expected to be a problem after construction, a structure, such as garden timbers, railroad ties, fences or walls should be used to protect the drainfield area. If the GeoMat drainfield will be subject to traffic, contact Geomatrix for design assistance. The drainfield area should be free of debris and planted with grass. Impermeable materials and structures should not be installed or stored over the drainfield. Trees and shrubs should be kept a minimum distance of ten (10) feet from the drainfield unless a root barrier is used. Roots from nearby moisture loving trees such as willow, black locust and red maple may cause problems with roots clogging drainfield. Greater setback distances are recommended for these tree species without use of a root barrier.

Maintenance Requirements

Overtime, biosolids or slime can accumulate in GeoMat lateral pipes and orifices and create uneven wastewater distribution along the lateral. To unclog the orifices, locate the distal port valve boxes and open the turn ups on the end of each lateral line. Manually engage the pump to purge any loose solids. Once all noticeable solids are purged, shut off the pump. A bottle brush (of the same size of the lateral pipe) attached to a small plumber's snake is then pushed down each lateral line. With the bottle brush removed, manually engage the pump again to flush out any loose solids in the lateral line. To increase the flushing action and velocity, before and after bottle brushing, open only one equalization valve at a time. Alternatively, a small jetter may be used to clean the lines.

It is recommended that low pressure lateral lines be serviced, typically, annually. If being used in conjunction with a pressure filter it may be possible to extend this service frequency. An indication of orifice clogging is distal head pressure increasing by more than 20% or pump run times increase by greater than 20% relative to number of doses.

The septic tank and treatment system should be pumped, maintained, and operated according to the requirements of the manufacturer and applicable regulatory agency.

Rejuvenating failed or stressed systems

Generally speaking, a failed septic system is a system that no longer treats and disperses wastewater; however, regulatory agencies may have specific definitions that differ. Signs of a failed system are water breakout at the soil surface or back up into the building pipes. Failed systems, especially those that include surface break out of wastewater, can be a human and environmental health hazard and should be dealt with as soon as possible. Stressed systems are those that have not failed, but may have limited treatment or are approaching failure. Signs of a stressed system include slow, smelly, or gurgling drains, bright green patches of grass and softening of soil over the drainfield.

While there are a number of possible causes for a failed or stressed septic system, the most common cause of drainfield failure is the formation of a clogging "biomat". Clogging biomats can occur if improper materials are discharged into the system or if a system is overused and/or undersized with no dry periods to oxidize the organic matter build up. System owners can work in cooperation with operation and maintenance providers to identify and remedy the cause of failure or stress and to potentially rejuvenate the system.

Systems that are failing or stressed because of an inorganic material addition (such as water treatment discharge or paint) will likely not be as easily remediated as those clogged with organic matter. In these cases, the owner and maintenance provider should work collaboratively to identify the source of the inorganic material and cease addition; the replacement of some or all components may be required[1]. If, however, the cause of failure or stress is system overuse or a high level of organic matter in the waste stream, introducing oxygen will likely rejuvenate the system. However, if the factor that caused the clogging is not directly addressed, the problem may likely reoccur. The following are potential oxidation remediation procedures that the homeowner may explore with the operation and maintenance provider to attempt and reduce a clogging biomat:

- Pump the septic tank, clean the effluent filter (if present) and snake or jet the GeoMat lateral lines
    - A clogged effluent filter or clogged lateral orifices can cause water to drain slowly or backup into the building pipes
    - Ensure all drains in the building are off and watch for water entering the septic

[1] If the failed or stressed system is connected to a water discharge system (water softeners, dehumidifiers, or drain lines) the system should be replumbed to discharge to a drainfield separate from the septic system.

tank to rule out leaking toilets or drains that can overload the drainfield
    - Measure the time it takes to refill the septic tank to determine actual loading rate and if necessary, address potential overuse of water
    - Pumping the septic tank forces a drying period in the drainfield which may reduce or eliminate a clogging biomat if left dry long enough
- Use proprietary Geomatrix oxidation solution formulated to reduce organic matter and increase infiltration rates
    - Please contact Geomatrix for information on sourcing our oxidation solution and for proper application protocol[2]
    - Use of any additive or solution not approved or supplied by Geomatrix will result in voiding of the GeoMat Standard Limited Warranty

Consistent maintenance and appropriate use are vital parts of preventing failures and extending the life of septic systems. Owners who want to avoid problems that lead to the need for remediation and replacement should sustain maintenance, monitoring water use, and avoid any septic tank additives. While additives are marketed to break down solids and reduce or eliminate the need for pumping there is no peer-reviewed research to support these claims and septic tank additives are generally considered a waste of money. Both organic and inorganic additives should be avoided as they can cause or exacerbate clogging biomats and potentially void the GeoMat Standard Limited Warranty.

System remediation can save significant costs if system replacement can be avoided. Care must be exercised to ensure that the factor that caused the problem has been addressed or it will likely return.

[2] Regulatory agency approval may be necessary.

Septic System Do's and Don'ts

It is important that system designers consider the following Do's and Don'ts when designing a GeoMat system and provide this information to system owners and users to help ensure function and maximum life of the system.

Do:

- Generally, systems should be designed at 1.5 to 2 times peak design flows as set by the responsible state agency.
- Understand expected peak design flows for the specific system and design system to meet demand.
- Instruct users to conserve water to reduce the amount of wastewater that must be treated and disposed.
- Instruct users to repair any leaking faucets and toilets.
- Instruct users to only discharge biodegradable wastes into system.
- Instruct users to restrict garbage disposal use; and consider garbage disposal use in system design.
- Ensure downspouts and other surface water is diverted away from the drain field & tanks.
- Keep the septic tank cover accessible for tank inspections and pumping.
- Instruct users to have the septic tank pumped regularly and checked for leaks and cracks.
- Provide information to user to enable them to call a professional when problems are suspected.
- Instruct user to compost garbage.

Don't:

- Discharge water softeners, dehumidifiers, drain lines, storm water, or other water discharging devices into the system; these devices should be discharged to a separate drain field.
- Use septic system additives; there are plenty of microorganisms present in wastewater and the surrounding soil for treatment to occur.
- Flush sanitary napkins, tampons, condoms, cigarette butts, diapers, wipes, and such products into your system.
- Dump solvents, oils, paints, paint thinner, disinfectants, pesticides, or poisons down the drain.
- Dig in the drain field or build anything over it.
- Plant anything other than grass over the drain field.
- Drive over the drain field or compact it in any way.

GeoMat Schematics

Figure 1

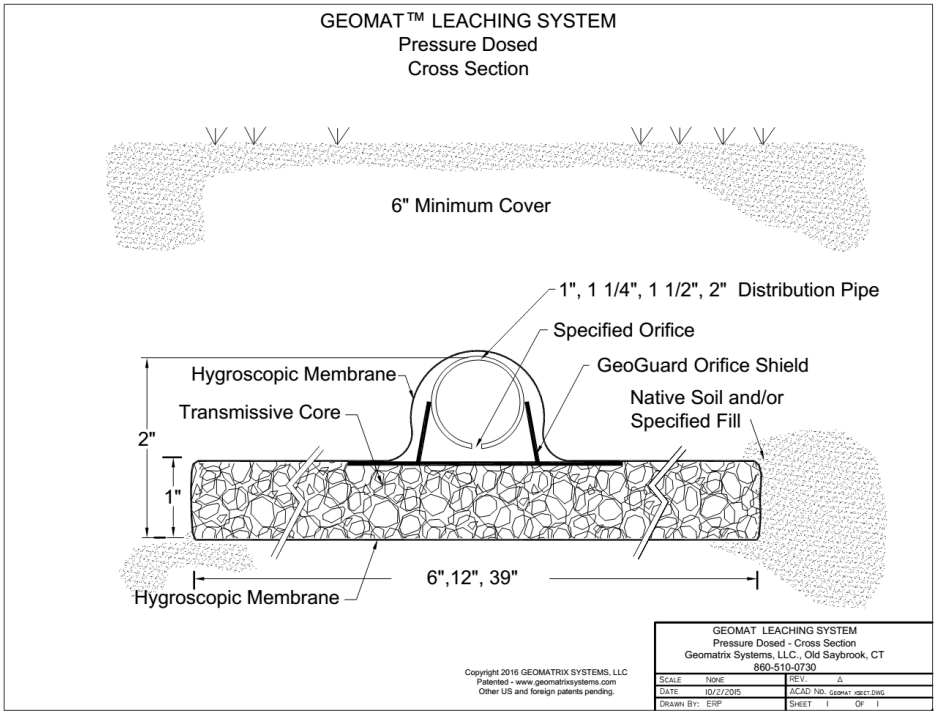
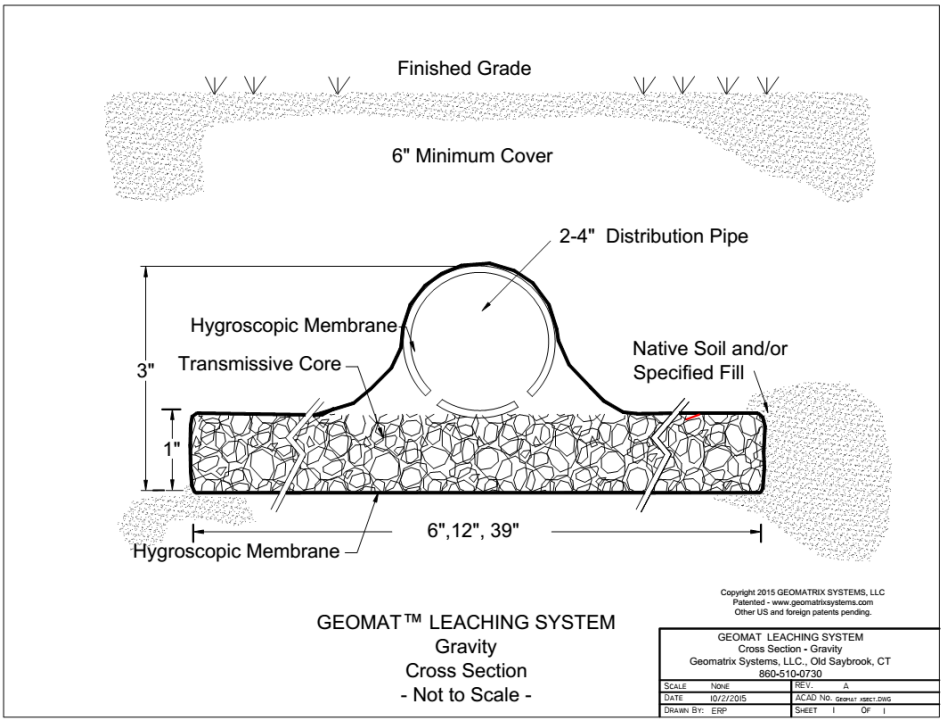


Figure 2



GeoMat Schematics (continued)

Figure 3

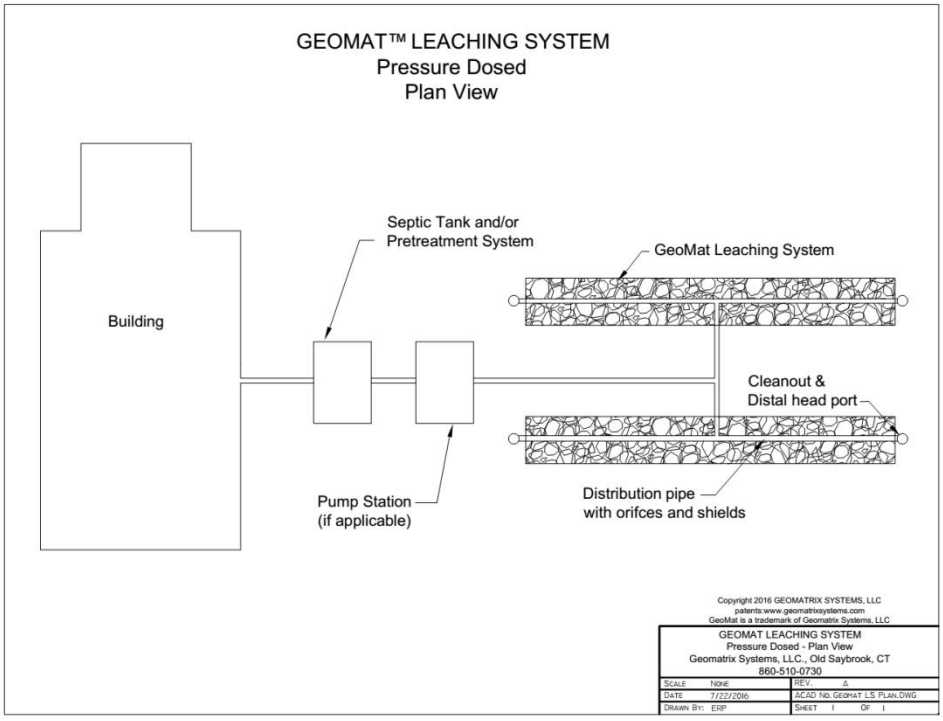
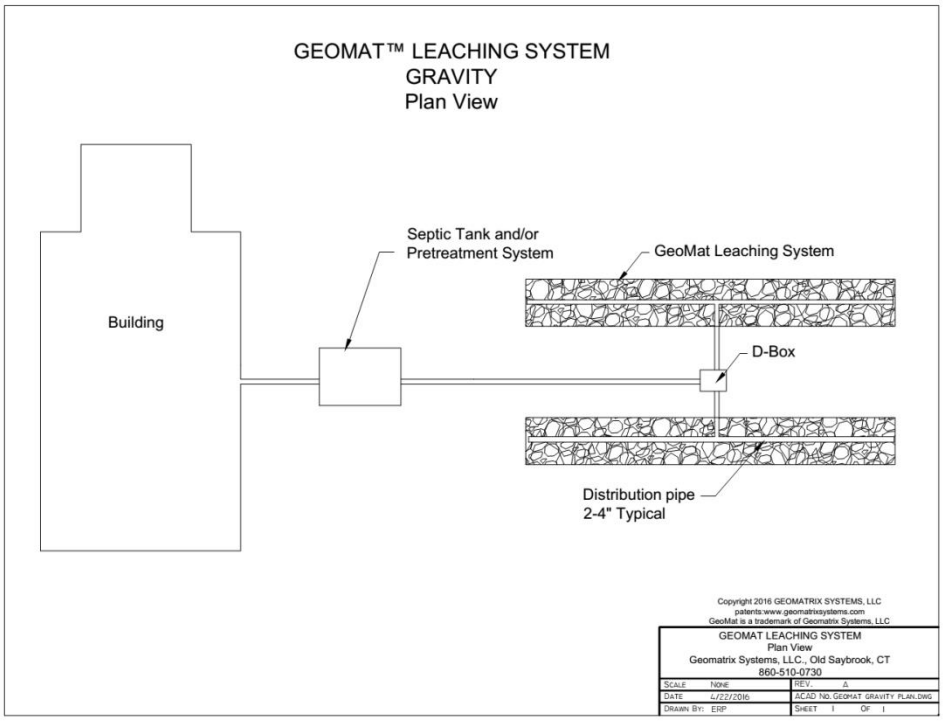


Figure 4



GeoMat Schematics (continued)

Figure 5

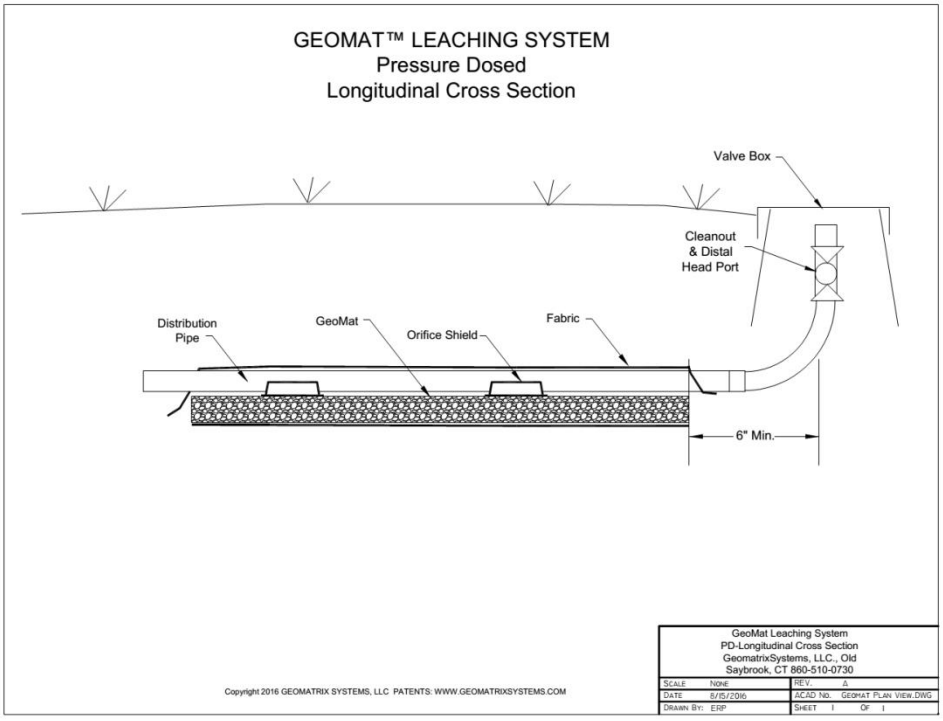
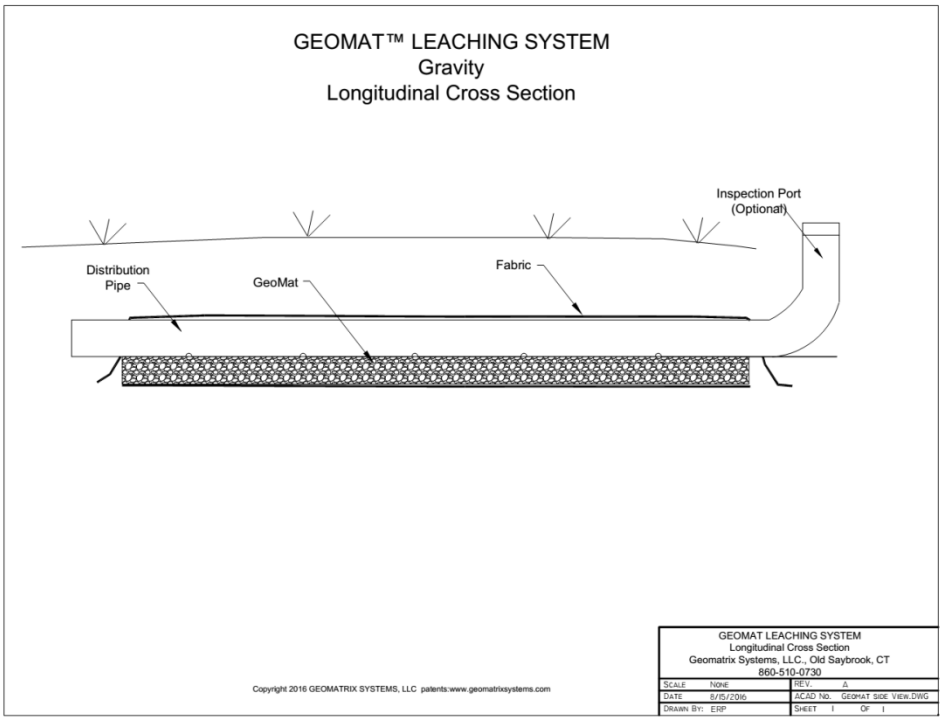


Figure 6



Distal Port & Flow Equalization Valve Schematics

Figure 7

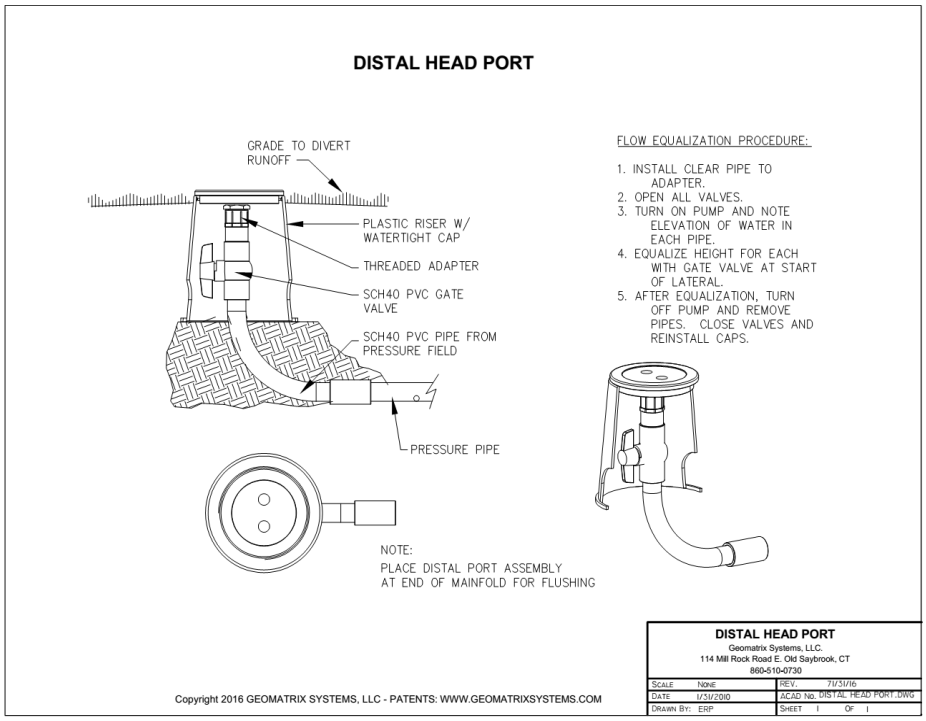
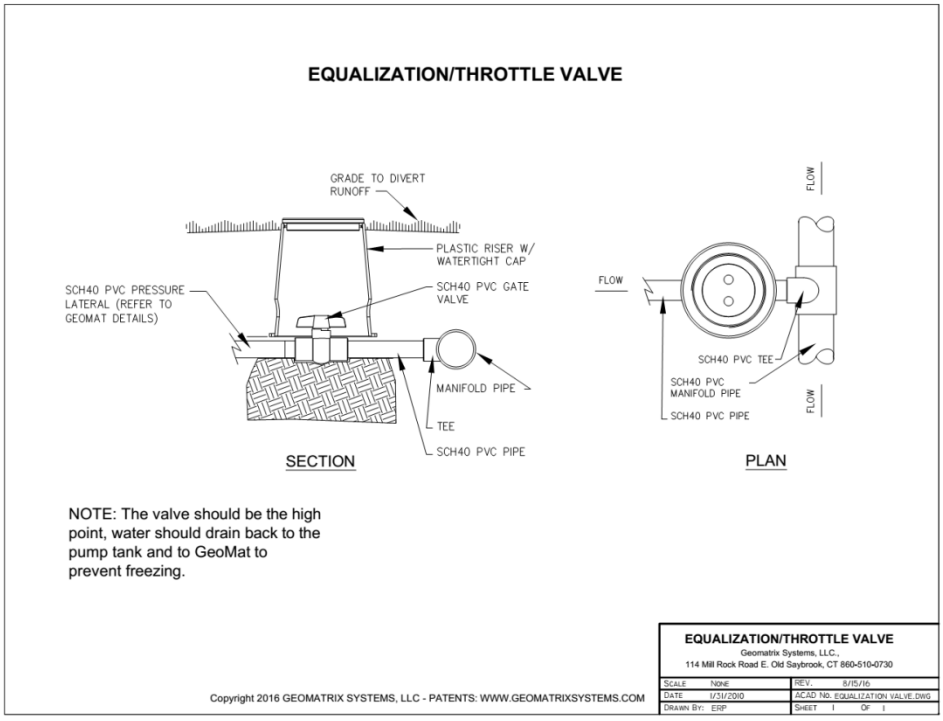


Figure 8



GeoMat System Design Examples

Figure 9

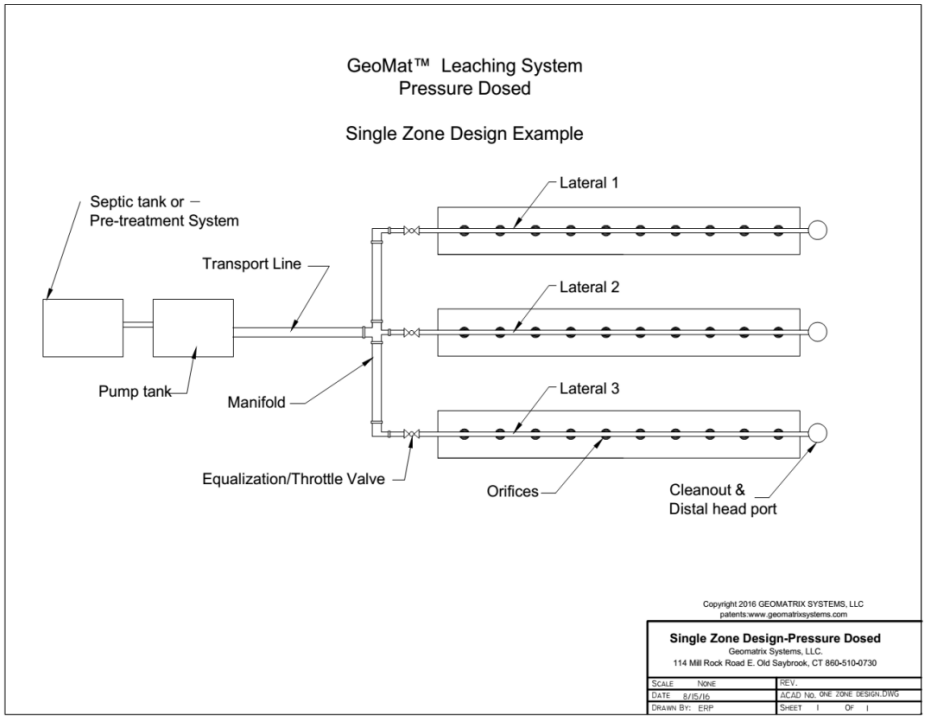
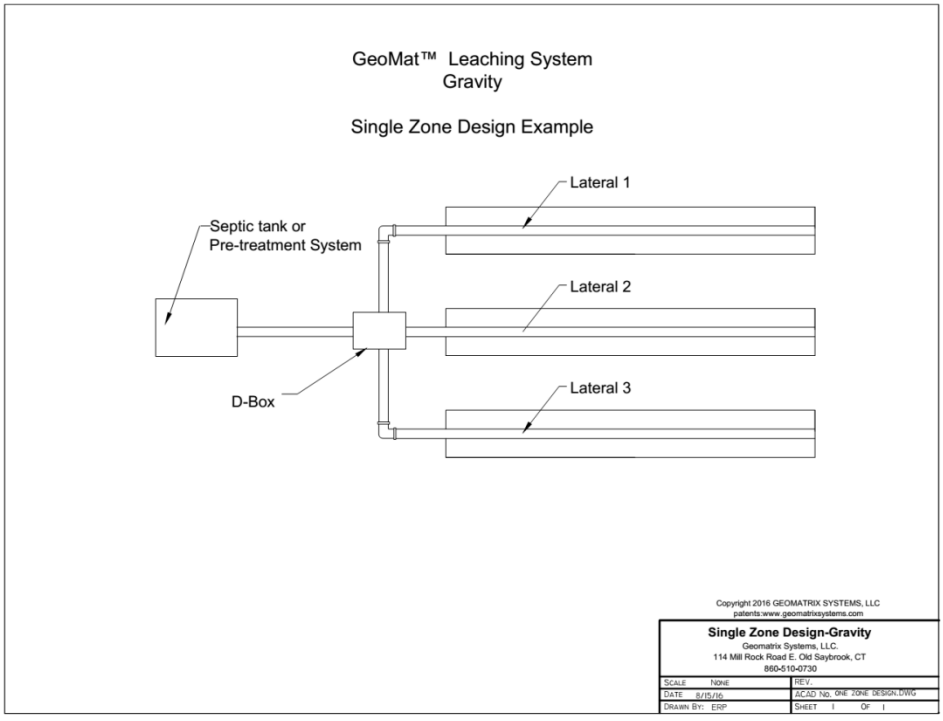


Figure 10



GeoMat System Design Examples (continued)

Figure 11

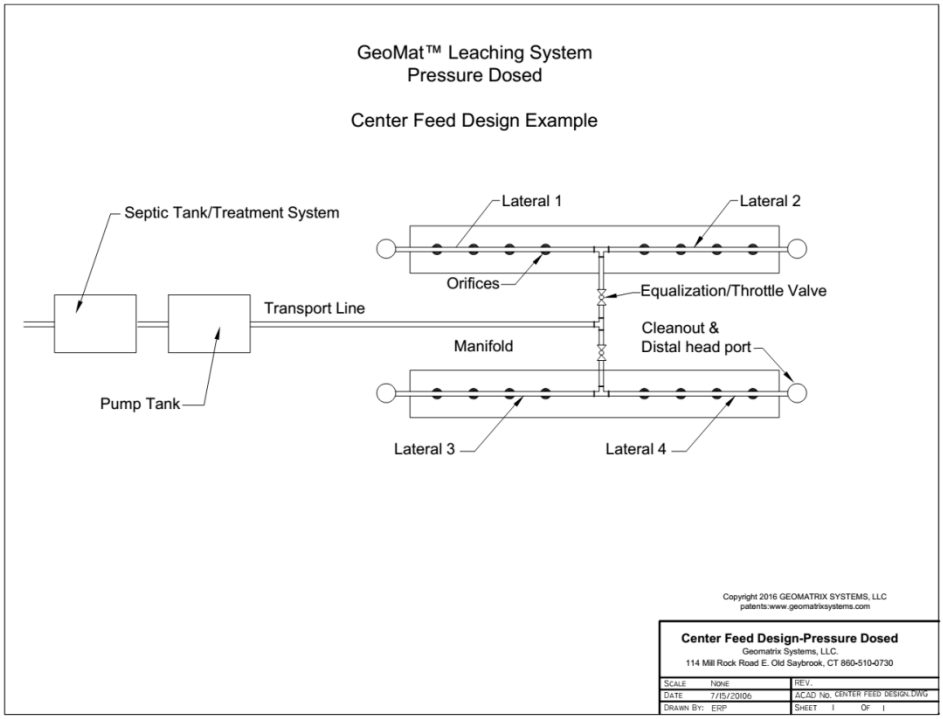
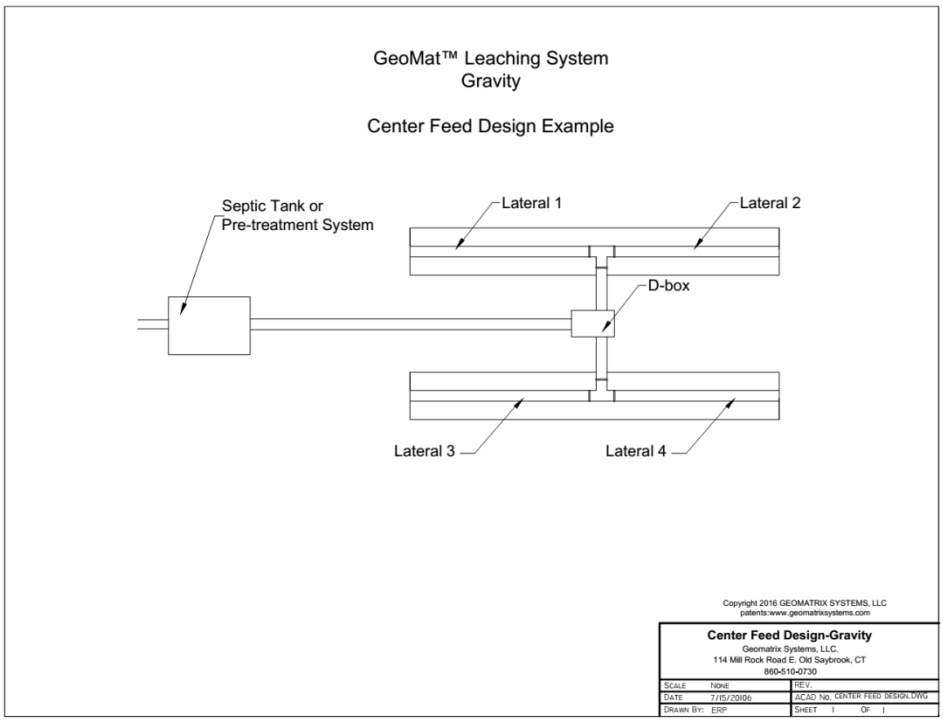


Figure 12



GeoMat System Design Examples (continued)

Figure 13

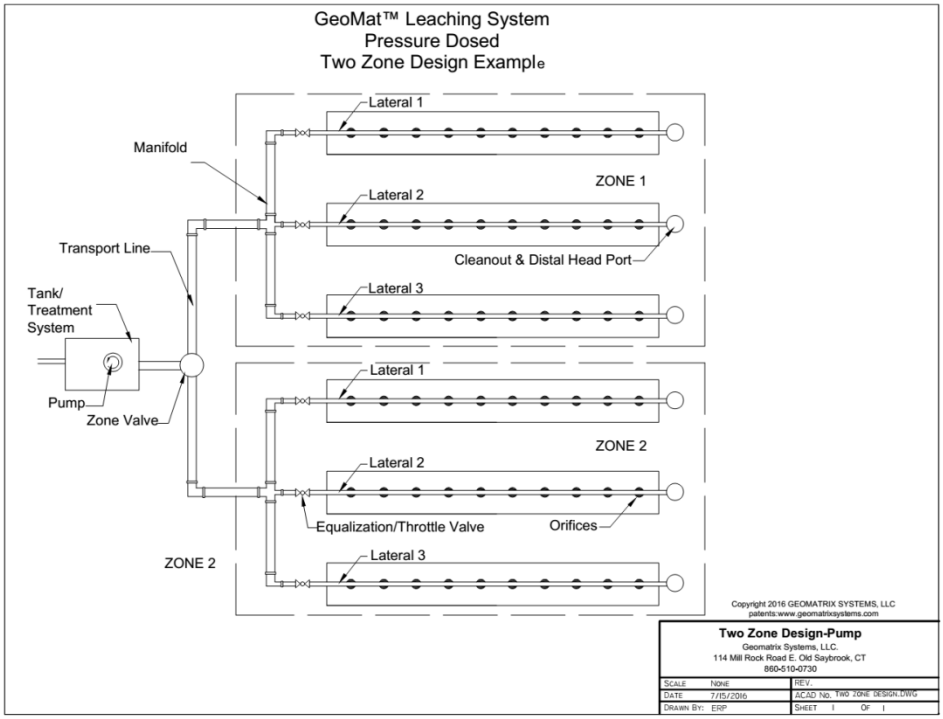
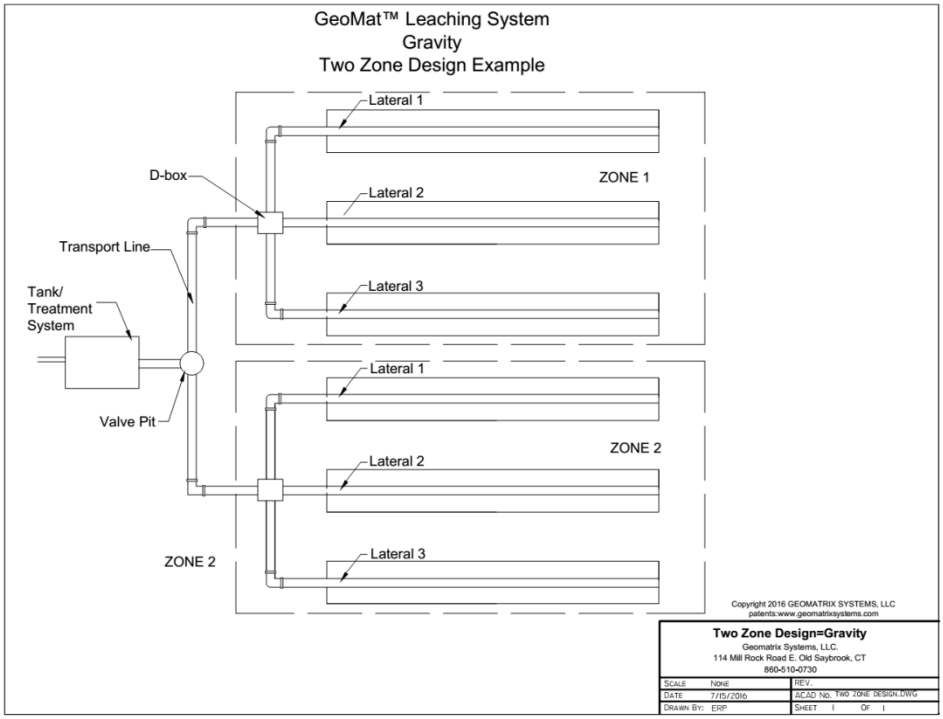


Figure 14



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