GSF®

Geotextile Sand Filter

New Hampshire Design & Installation Manual

eljen CORPORATION

Innovative Onsite Products & Solutions Since 1970

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Glossary of Terms

B43 Module 48” x 36” x 7” (L x W x H)

Cover Fabric The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.

Design Flow The estimated peak flow that is used to size a GSF system is 150 gallons per day per bedroom (gpd). Private residences start at 300 gpd and is increased 150 gpd for each bedroom over 2. For commercial applications reference Env-Wq 1008.01, Table 1008-1 for design flow requirements.

Flow Dial/Equalizer Special insert placed in the end of distribution pipes within the distribution box to compensate for possible unlevel installation and promote favorable flow to the distribution pipes.

GSF The Eljen Geotextile Sand Filter Modules and the 6-inch sand layer at the base and along the sides of the modules.

GSF Module The individual module of a GSF system. The module is comprised of a cuspated plastic core and geotextile fabric.

High Strength Effluent High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (CBOD) and total suspended solids (TSS) in excess of two-hundred and fifty (250) mg/L. Contact Eljen for all High Strength system designs, 800-444-1359 or info@eljen.com.

Specified Sand To ensure proper system operation, the system MUST be installed using ASTM C33 Sand. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

ASTM C33 Sand will have less than 10% passing the #100 Sieve and less than 5% passing the # 200 sieve.

TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS

ASTM C33 SAND SPECIFICATION		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
3/8 inch	9.52 mm	100
No. 4	4.76 mm	95 - 100
No. 8	2.38 mm	80 - 100
No. 16	1.19 mm	50 - 85
No. 30	590 µm	25 - 60
No. 50	297 µm	5 - 30
No. 100	149 µm	0 - 10
No. 200	75 µm	0 - 5

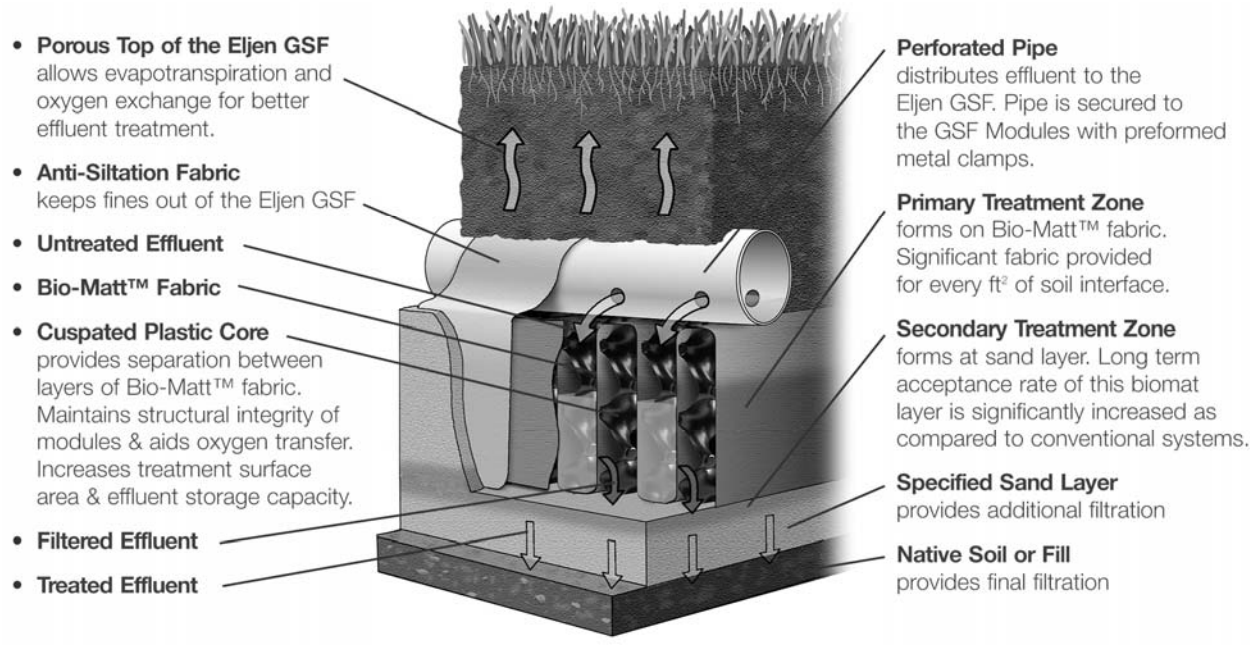
Primary Treatment Zone

- Perforated pipe is centered above the GSF module to distribute septic effluent over and into corrugations created by the cuspated core of the geotextile module.
- Septic effluent is filtered through the Bio-Matt fabric. The module's unique design provides increased surface area for biological treatment that greatly exceeds the module's footprint.
- Open air channels within the module support aerobic bacterial growth on the modules geotextile fabric interface, surpassing the surface area required for traditional absorption systems.
- An anti-siltation geotextile fabric covers the top and sides of the GSF module and protects the Specified Sand and soil from clogging, while maintaining effluent storage within the module.

Secondary Treatment Zone

- Effluent drips into the Specified Sand layer and supports unsaturated flow into the native soil. This Specified Sand/soil interface maintains soil structure, thereby maximizing the available absorption interface in the native soil. The Specified Sand supports nitrification of the effluent, which reduces oxygen demand in the soil, thus minimizing soil clogging from anaerobic bacteria.
- The Specified Sand layer also protects the soil from compaction and helps maintain cracks and crevices in the soil. This preserves the soil's natural infiltration capacity, which is especially important in finer textured soils, where these large channels are critical for long-term performance.
- Native soil provides final filtration and allows for groundwater recharge.

FIGURE 1: GSF SYSTEM OPERATION



1.0 System Preconditions

1.1 REQUIREMENTS: Eljen GSF systems must meet all State and/or local rules and regulations except as outlined in this manual. The New Hampshire Code of Administrative Rules and the local regulations will be referred to as the *Guidelines* in this manual. The sizing table and formulas in Table 1 apply to most commercial and residential systems. The number of GSF modules required is the same for trench or bed systems.

Please contact Eljen's Technical Resource Department at 1-800-444-1359 or info@eljen.com for design information on commercial systems or other technical questions.

1.2 WATER SOFTENER BACKWASH: At no time should water softener backwash be disposed of in the septic system. Water softener backwash should be discharged to a separate dry well per Env-Wq 1000.
Note: Public water supply sometimes requires discharge to the septic - unless required by other state regs. If discharge is required to the GSF System, then the field will need to be increased. Calculate the total amount of backwash in GPD, multiply by 3, and add this amount to the daily design flow when determining the field and septic tank sizing.

1.3 GARBAGE DISPOSALS: The use of a garbage disposal is not recommended as they can cause septic system problems by generating an increase of suspended solids, grease, and nutrients.

However, if such units are proposed to be used, other measures should be taken to mitigate the increased nutrients to the field. Eljen recommends a dual compartment tank or tanks in series.

Design drawings shall include a note: If a garbage grinder is or will be used in the structure served by the septic tank, the size of the septic tank shall be increased by 50% in accordance with Env-Wq 1010.01(f). An appropriate septic tank filter must be installed. The designer may increase the number of GSF modules by 30% for any increased biological load.

NOTE: Eljen requires the use of septic tank outlet effluent filters on all systems. Filters with higher filtration are recommended for systems with garbage disposals.

1.4 ADDITIONAL FACTORS AFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water usage may consider increasing the septic tank volume as well as incorporating a multiple compartment septic tank. Consideration for disposal area may be up sized for expected higher than normal water use.

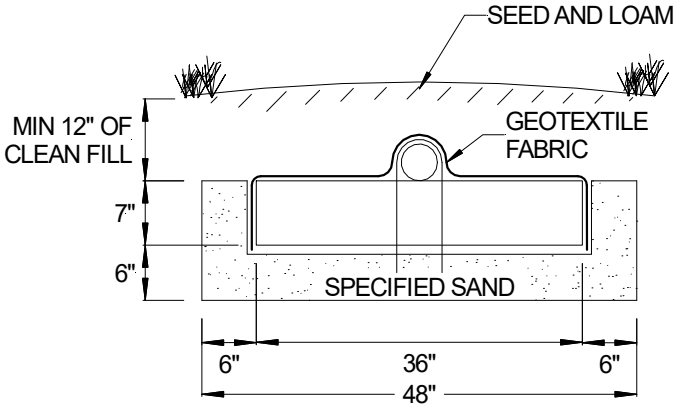
For example:

- Luxury homes, homes with a Jacuzzi style tubs, and other high use fixtures.
- Homes with known higher than normal occupancy.

1.5 SYSTEM PROHIBITED AREAS: All vehicular traffic is prohibited over the GSF system. GSF systems shall not be installed under paved or concreted areas. If the system is to be installed in livestock areas, the system must be fenced off around the perimeter to prevent compaction of the cover material and damage to the system.

1.6 ELJEN INSTALLER CERTIFICATION: All installers are required to be trained and certified by an authorized Eljen representative. Please contact Eljen's Technical Resource Department at 1-800-444-1359 or info@eljen.com for training information.

FIGURE 2: TYPICAL B43 CROSS SECTION



B43 MODULE (L x W x H) 48” x 36” x 7”

All systems are required to have a minimum of:

- 6 inches of Specified Sand is at the edges of the GSF module.
- 6 inches of Specified Sand is at the beginning and end of each GSF Row.
- 6 inches of Specified Sand is directly below the GSF module.
- Minimum 12 inches of cover above the module.

2.0 Design and Installation

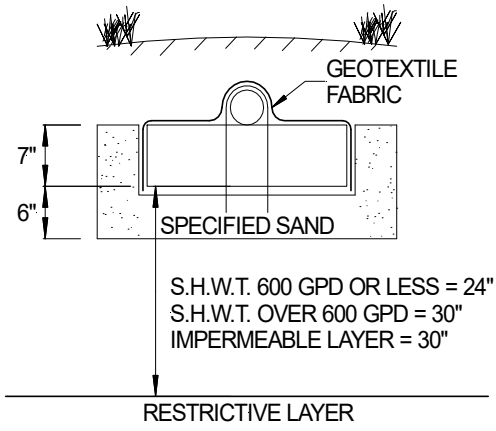
2.1 SEPTIC TANK: Septic tanks shall meet state sizing standards. Many designers are now specifying dual compartment tanks for all their systems. Eljen supports this practice as it helps to promote long system life by reducing TSS and BOD to the effluent disposal area. Eljen recommends septic tank pump outs to be performed every three years or on an as needed basis.

2.2 SEPTIC TANK FILTERS: An effluent filter is ***REQUIRED*** for use with Eljen GSF products. Effluent filter sizing should be based on effluent filter manufacturers recommendations.

Septic tank effluent filters are used as a means of preventing solids from leaving the tank and entering your system. Effluent filters should be cleaned from time to time. Cleaning requirements should be based on the type or make of the effluent filter installed.

2.3 VERTICAL SEPARATION TO LIMITING LAYER: Depth to the Seasonal High-Water Table (SHWT) or Restrictive Layer is measured from the bottom of the GSF module to the SHWT or Restrictive Layer.

FIGURE 3: VERTICAL SEPARATION DISTANCE



2.4 SAND SPECIFICATION FOR GSF SYSTEMS: The sand immediately under, between rows and around the perimeter of the GSF system must meet ASTM C33 Sand Specification, ***WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 5% PASSING A #200 SIEVE.*** Please place a prominent note to this effect on each design drawing. See Table 1 for more information on the sand and sieve specifications.

2.5 FILL FOR RAISED SYSTEMS: Fill material below the 6" sand specified in Section 1.3 for raised bed systems must be clean bank run sand per latest NH Rules. Fill must be consolidated in lifts to prevent differential settling. Refer to Env-Wq 1021.03 for detailed fill specification.

2.6 PLACING GSF MODULES: The "painted stripe" on the GSF modules indicates the top of the module and is not intended to indicate the location of the distribution pipe. With the painted stripe facing up, all rows of GSF modules are set level, end to end on the Specified Sand layer. No mechanical connection is required between units.

2.7 DISTRIBUTION: Gravity, pump to gravity or pressure distribution are acceptable when using the GSF System. Piping shall meet the requirements guidelines; however, Eljen strongly recommends the use of SDR 35 pipe and fittings or equivalent as to prevent crushing during backfill. All distribution piping must meet a minimum 2,500-pound crush test specification for polyvinyl chloride (PVC) drain, waste, and vent pipe.

All systems require a perforated 4" diameter pipe centered on top of the GSF modules unless the system is curving. The distribution pipe continues along the entire length of all modules in a trench or row. Holes are set at the 4 and 8 o'clock position and secured by the Eljen provided wire clamps.

When using pressure distribution, a pressure manifold is placed inside the 4-inch distribution pipe. Section 7.0 of this manual goes into details of how to construct the distribution network. All piping must meet state and local regulations, refer to Env-Wq 1019.

2.8 CONNECTIONS AND FITTINGS: Connections of lines to tanks and distribution boxes must be made using watertight seals.

2.9 DISTRIBUTION BOX: Set the gravity system D-box outlet invert a minimum of ⅛ inch drop in elevation per linear foot to the top first module in the row. For dosed systems set the D-Box invert height 2" higher than the invert for the distribution pipe over the GSF modules. Ensure that the distribution box and pipes feeding the system are placed on compacted soil. Flow Dials may be used in either Gravity or Dosed installations. A manifold can be used in place of a distribution box.

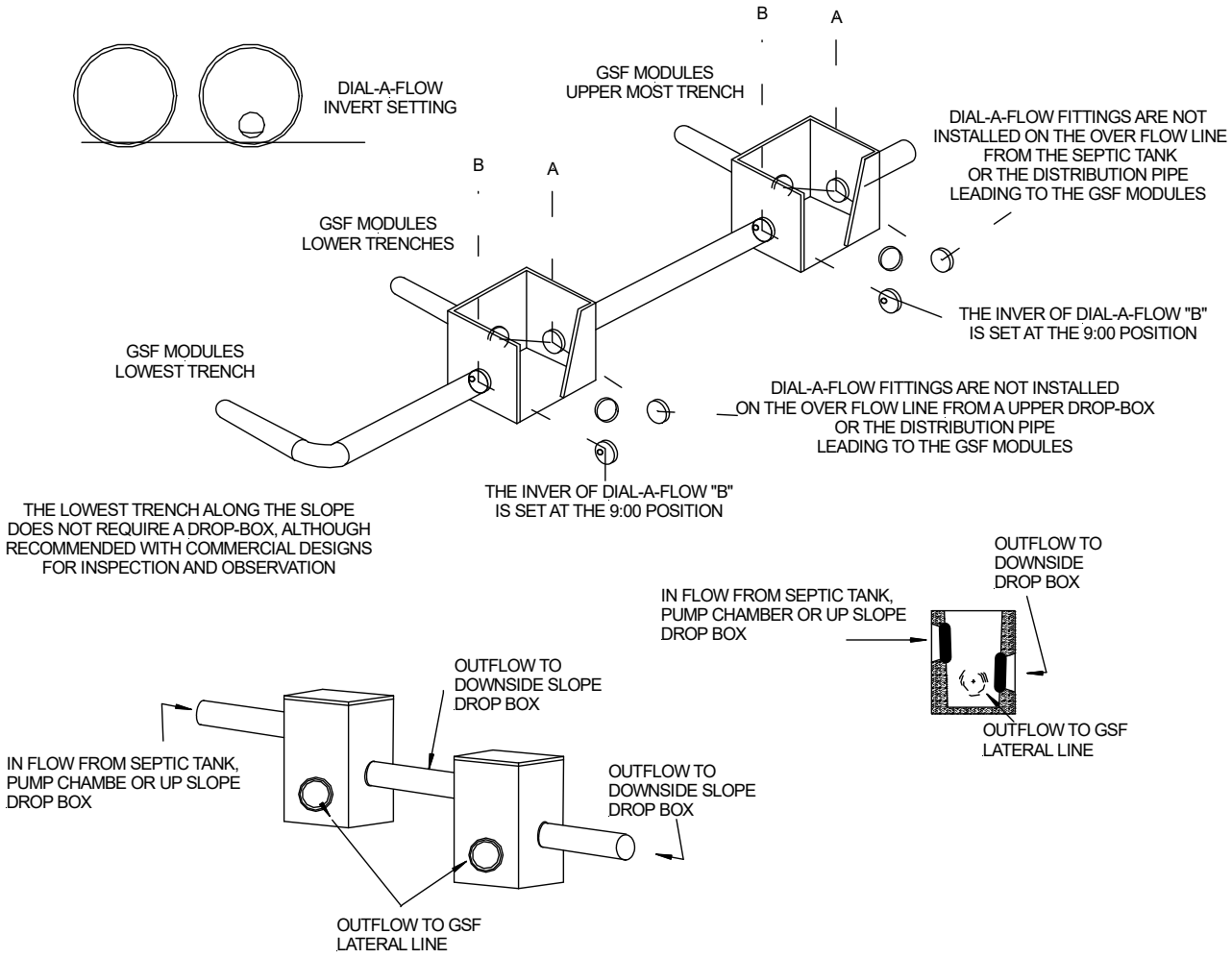
2.10 EQUAL DISTRIBUTION: Parallel distribution is the preferred method of dosing to a gravity or pump to gravity system. It encourages equal flows to each of the lines in the system. It is recommended for most trench systems.

2.11 SERIAL DOSED LOADING: Serially dosed GSF systems may be used on sloped sites. Limit a single serial line to 900 gallons per day.

2.12 SLOPED ROW SPACING: Systems with up to 6" elevation drop between adjacent rows use 12" minimum spacing. If over 6" drop, use 2 times the elevation drop as minimum spacing between module rows.

2.13 SEQUENTIAL DISTRIBUTION: Sequential Distribution using a distribution box will fully utilize the uppermost section of the system prior to spilling effluent into a lower row of modules. This is for use on any site with greater than 0.5% slope when not using parallel distribution.

FIGURE 4: SEQUENTIAL DISTRIBUTION DROP–BOX DETAIL



2.14 COVER FABRIC: Geotextile cover fabric is provided by Eljen Corporation for all GSF systems. It is placed over the top and sides of the module rows to prevent long term siltation and failure. **Cover fabric substitution is not allowed.** Fabric should drape vertically over the pipe and must *not* block holes in the distribution pipe or be stretched from the top of the pipe to the outside edge of the modules. "Tenting" will cause undue stress on fabric and pipe.

2.15 SYSTEM VENTING: It is required to vent all systems that are more than 18" below finished grade and systems beneath any surface condition that would not allow for surface air exchange with the system such as patios. See Section 8.0 for a more detailed explanation of venting GSF products.

2.16 BACKFILL & FINISH GRADING: Complete backfill with a minimum of 12 inches of clean, permeable fill measured from the top of modules. Use well graded sandy fill that is clean, porous, and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing, or shifting of pipe assembly. Divert surface runoff from the system absorption area. Finish grade to prevent surface ponding. Seed and loam system area to protect from erosion.

2.17 SYSTEM GEOMETRY: Design systems as long and narrow as practical along site contours to minimize ground water mounding especially in poorly drained low permeability soils. If possible, design level systems with equal number of modules per row. **Serial piping in level systems is not allowed.**

2.18 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of five (5) B43 modules per bedroom. See Table 2 for more information on systems sizing. Contact Eljen for all High Strength system designs, 800-444-1359 or info@eljen.com.

2.19 SYSTEM SIZING: Table 2 below shows the units required based on design flow and percolation rate. Choose the more restrictive percolation rate if the actual percolation rate falls between the given percolation rates.

TABLE 2: GSF UNITS REQUIRED

Percolation Rate Minutes per Inch	2 Bedroom 300 gpd	3 Bedroom 450 gpd	4 Bedroom 600 gpd	Each Additional Bedroom 150 gpd
2	10	15	20	5
4	11	16	22	6
6	12	17	23	6
9	13	19	25	7
13	14	21	28	7
19	15	23	30	8
30	17	25	33	9
40	18	27	35	9
50	19	29	38	10
60	20	30	40	10

2.20 SYSTEM DETERMINATION:

- Laterals with >2' of separation measured from edge to edge of the module or >5' measured from the center of the rows must follow trench installation outlined in Env-Wq 1000.

- Laterals with <2' of separation measured from edge to edge of the module or <5' measured from the center of the rows must follow bed installation guidelines outlined in Env-Wq 1000.

Trench Example:

House size:	3 Bedrooms
Design Flow:	450 gpd
Percolation Rate:	18 mpi
Absorption Field Type:	Trench

Determine Number of Units Required

Lookup units required from Table 2:

Percolation Rate Minutes per Inch	2 Bedroom 300 gpd	3 Bedroom 450 gpd	4 Bedroom 600 gpd	Each Additional Bedroom 150 gpd
13	14	21	28	7
19	15	23	30	8

Units Required: 23 B43 Units

Determine Units per Row:

2 Rows:

23 B43 ÷ 2 Rows = 11.5, round up to 12 Units per Row

3 Rows:

23 B43 ÷ 3 Rows = 7.6, round up to 8 Units per Row

Determine Trench Row Length:

Trench Length = (Units per Row x 4 ft per unit) + 1 ft

2 Rows:

(12 Units x 4 ft per unit) + 1 ft = **49 ft**

3 Rows:

(8 Units x 4 ft per unit) + 1 ft = **33 ft**

Determine Trench Width: 4 ft

Final Dimension Layout

(Note: System layout and number of rows will vary based on site constraints)

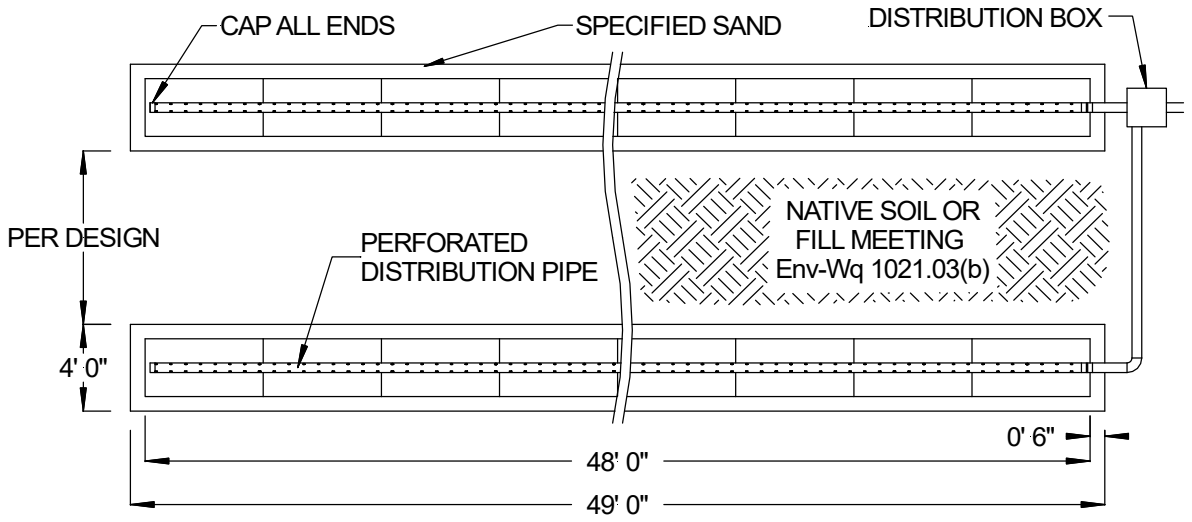
2 Rows:

Trench Length:	49 ft
Trench Width:	4 ft
Number of Modules:	24 B43
Basal Area:	392 ft^2

3 Rows:

Trench Length:	33 ft
Trench Width:	4 ft
Number of Modules:	24 B43
Basal Area:	396 ft^2

FIGURE 5: PLAN VIEW –TRENCH SYSTEM EXAMPLE



(*2 Rows of 12 B43's shown in Figure 5)

FIGURE 6: SECTION VIEW – TRENCH SYSTEM EXAMPLE – LEVEL SITE

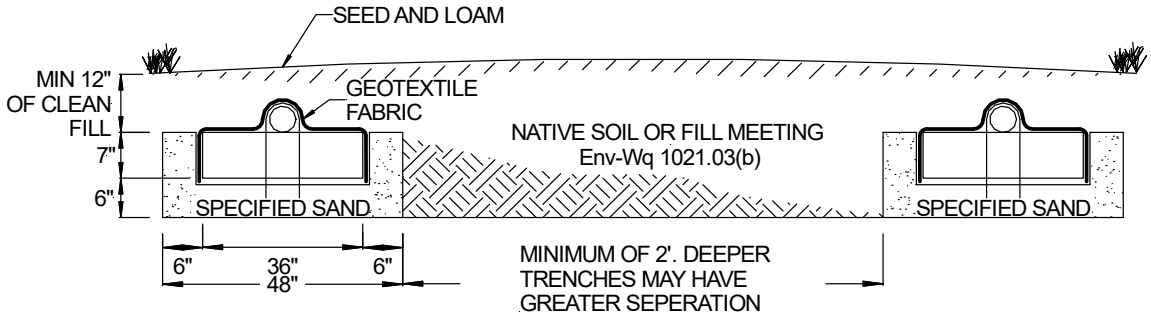
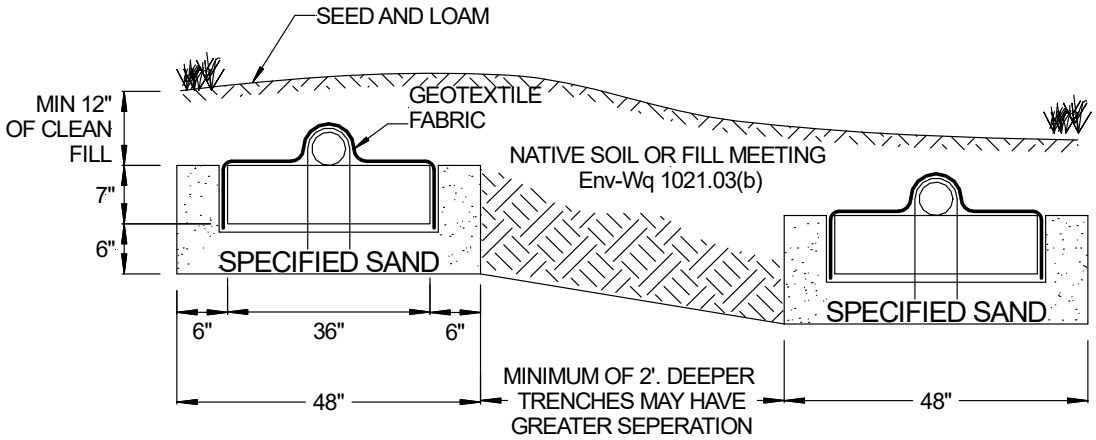


FIGURE 7: SECTION VIEW – TRENCH SYSTEM – SLOPING SITE



3.0 Trench Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the number of GSF Modules required using the trench sizing example.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Excavate the trench; scarify and prepare the receiving layer to maximize the interface between the native soil and specified sand.

6. Minimize walking in the trench prior to placement of the specified sand to avoid soil compaction.

7. Place specified sand in a 6” lift and stabilize by foot, a hand-held tamping tool or a portable vibrating compactor. The minimum stabilized height below the GSF module must be level at 6”.

8. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

9. A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o’clock position.

10. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.

11. (Pressure Distribution Systems) Insert a pressure pipe (size per design and code) into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 11. Each pressure lateral will have a drain hole at the 6 o’clock position. Each pressure lateral shall include sweeping cleanouts at the terminal ends and be accessible from grade. The distribution pipe is capped at both ends with a hole cut throw to allow the pressure pipe through.

12. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the trench, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight (tenting). The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

13. Place the sand extensions along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each trench.

14. Complete backfill with a minimum of 12 inches of clean, permeable fill measured from the top of the module. Backfill exceeding 18 inches requires venting at the far end of the trench. Use well graded native soil fill that is clean, porous, and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing, or shifting of pipe assembly.

15. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

Bed Example:

House size:	3 Bedrooms
Design Flow:	450 gpd
Percolation Rate:	18 mpi
Absorption Field Type:	Bed

Determine Number of Units Required

Lookup units required from Table 2:

Percolation Rate Minutes per Inch	2 Bedroom 300 gpd	3 Bedroom 450 gpd	4 Bedroom 600 gpd	Each Additional Bedroom 150 gpd
13	14	21	28	7
19	15	23	30	8

Units Required: 23 B43 Units

Determine Units per Row:

2 Rows:

23 B43 ÷ 2 Rows = 11.5, round up to 12 Units per Row

3 Rows:

23 B43 ÷ 3 Rows = 7.6, round up to 8 Units per Row

Determine Row Length:

Row Length = (Units per Row x 4 ft per unit) + 1 ft

2 Rows:

(12 Units x 4 ft per unit) + 1 ft = **49 ft**

3 Rows:

(8 Units x 4 ft per unit) + 1 ft = **33 ft**

Determine Bed Width:

Bed Width = Rows x 4 ft per row

2 Rows:

2 Rows x 4 ft per row = **8 ft**

3 Rows:

3 Rows x 4 ft per row = **12 ft**

Final Dimension Layout

2 Rows:

Bed Length:	49 ft
Bed Width:	8 ft
Number of Modules:	24 B43
Basal Area:	392 ft^2

3 Rows:

Bed Length:	33 ft
Bed Width:	12 ft
Number of Modules:	24 B43
Basal Area:	396 ft^2

FIGURE 8: PLAN VIEW – BED SYSTEM

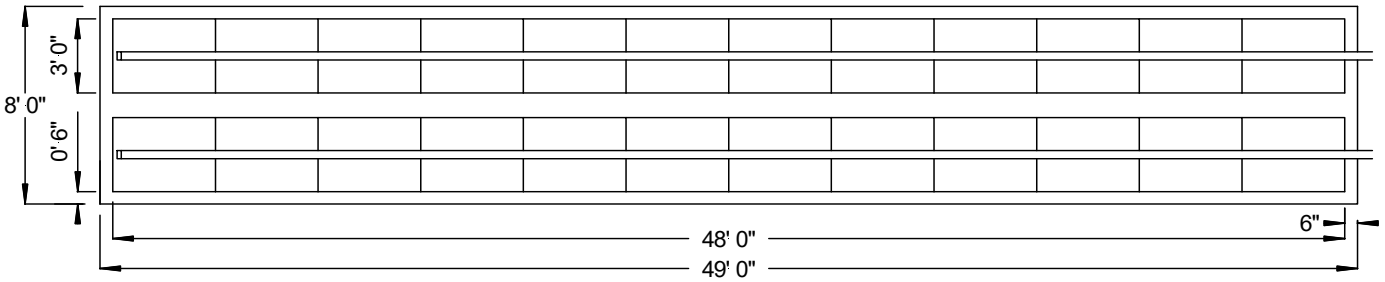


FIGURE 9: SECTION VIEW – BED SYSTEM

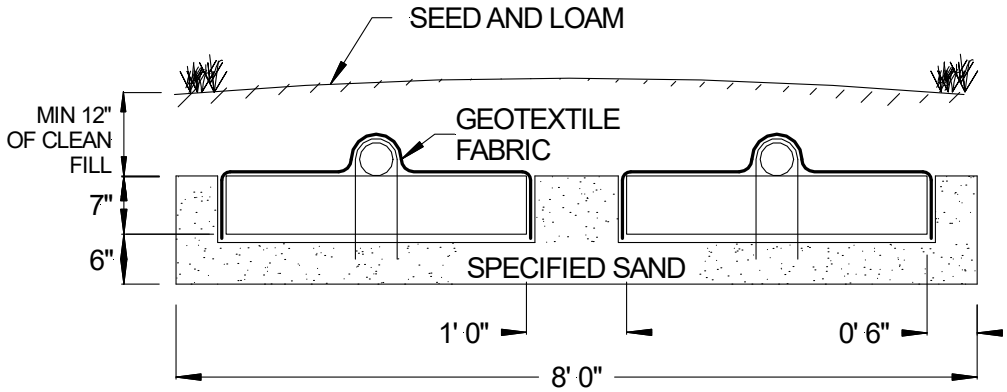
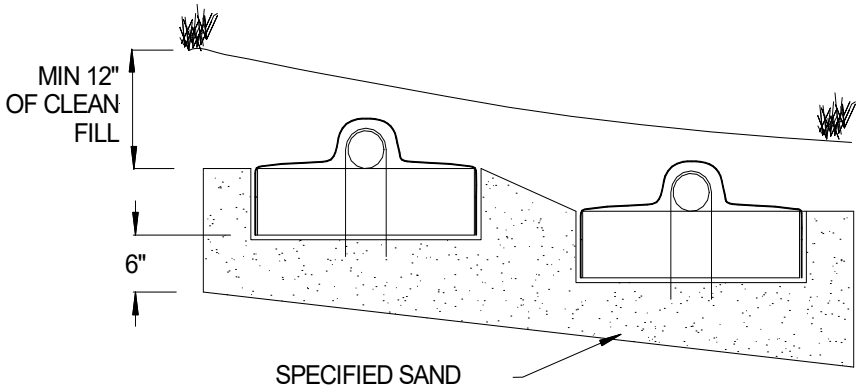


FIGURE 10: SECTION VIEW – SLOPING BED SYSTEM



4.0 Bed Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the number of GSF Modules required using the bed sizing example.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Excavate the bed absorption area; scarify the receiving layer to maximize the interface between the native soil and specified sand.

6. Minimize walking in the absorption area prior to placement of the specified sand to avoid soil compaction.

7. Place specified sand in a 6" lift, stabilize by foot, a hand-held tamping tool or a portable vibrating compactor. The minimum stabilized height below the GSF module must be level at 6".

8. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

9. A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock position.

10. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.

11. (Pressure Distribution Systems) Insert a pressure pipe (size per design and code) into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 11. Each pressure lateral will have a drain hole at the 6 o'clock position. Each pressure lateral shall include sweeping cleanouts at the terminal ends and be accessible from grade.

12. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the row, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

13. Place 6 inches of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each module row. A minimum of 12 inches of Specified Sand is placed in between module rows.

14. Complete backfill with a minimum of 12 inches of clean, permeable fill measured from the top of the module. Backfill exceeding 18 inches requires venting at the far end of the bed. Use well graded native soil fill that is clean, porous, and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

15. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

5.1 EDA REFERENCE: The following guidelines provide an overview for raised Effluent Disposal Area design and construction. Raised EDA distribution can be gravity, pump to gravity or pressurized. 3' fill extensions are required on all raised EDA's measured from the edge of the outer most module rows. The 6" of sand required around the modules can count towards the 3' sand extension. For slopes >10%, add 3' fill extension to the downslope side of the EDA. 3:1 slopes are preferred however 2:1 slopes may be used when necessary. Follow raised EDA construction rules outlined in Env-Wq 1000.

FIGURE 11: SECTION VIEW – RAISED EDA SYSTEM

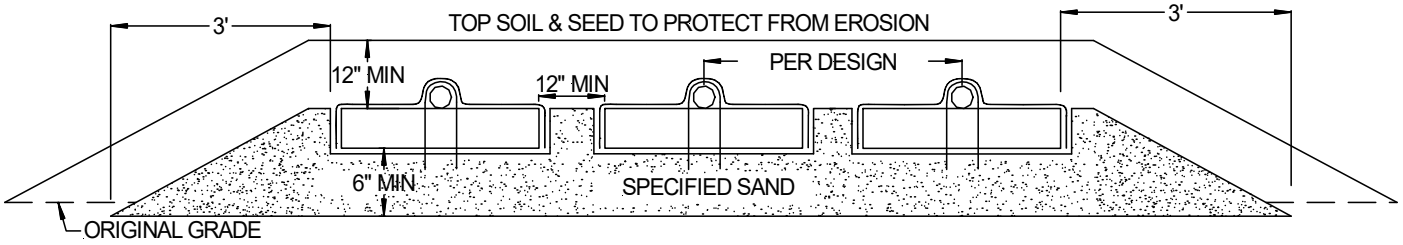
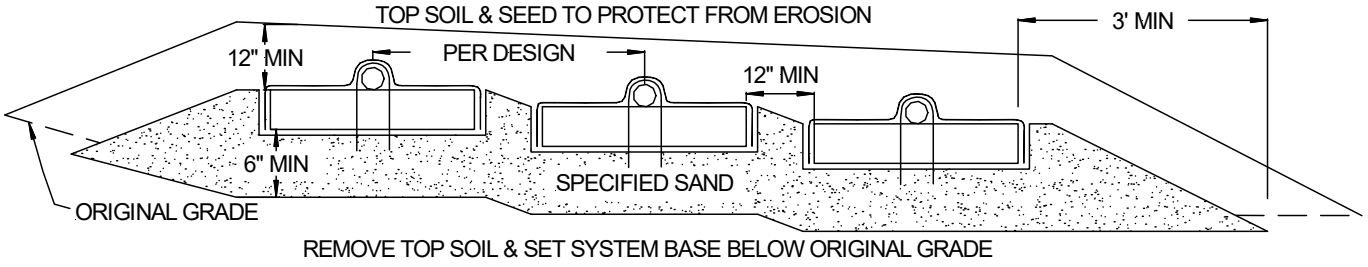


FIGURE 12: SECTION VIEW – SLOPED RAISED EDA SYSTEM



5.0 Raised EDA Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the number of GSF Modules required using the sizing formula.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during preparation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Remove the organic soil layer. Prepare the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the absorption area prior to placement of the Specified Sand to avoid soil compaction.

6. Place fill material meeting local requirements (or Specified Sand requirements) onto the soil interface as you move down the excavated area. Place specified sand in a 6" lift, stabilize by foot, a handheld tamping tool or a portable vibrating compactor. The stabilized height below the GSF module shall meet the EDA design requirements.

7. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

8. A standard perforated 4-inch distribution pipe is centered along the modules 4-inch length. Orifices are set at the 4 & 8 o'clock position.

9. All distribution pipes are secured with manufacturers supplied wire clamps, one per module.

10. (Pressure Distribution Systems) Insert a PVC Sch. 40 pressure pipe (size per design and code) into the standard perforated distribution pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 14. Each pressure lateral will have a drain hole at the 6 o'clock position. Each pressure lateral shall include sweeping cleanouts at the terminal ends and be accessible from grade.

11. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the row, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

12. Ensure there is 6 inches of specified sand surrounding the GSF modules in the EDA. Slope the sand away from the EDA as described on the plan.

13. Complete backfill with a minimum of 12 inches of cover material measured from the top of the module. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

14. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

6.0 Dosing Distribution Guidance

6.1 DEMAND DOSED GUIDANCE: Specify a distribution box for pumped systems. Provide velocity reduction in the D-box with a tee or baffle if necessary. If the absorption area is installed deeper than 18 inches, the system must be vented.

6.2 DOSING DESIGN CRITERIA: Dosing volume must be set to deliver a maximum of **4 gallons per B43 Module** per dosing cycle. Head loss and drain back volume must be considered in choosing the pump size and force main diameter.

7.0 Pressure Distribution Guidance

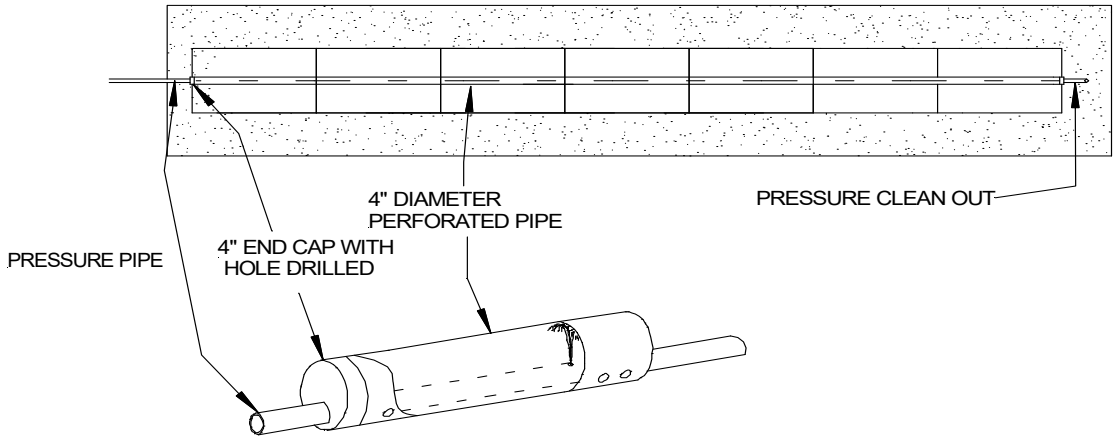
7.1 PRESSURE DISTRIBUTION: Dosing with small diameter pressurized laterals is acceptable for GSF systems. The pipe networks must be engineered and follow principles established for pressure distribution. Flushing ports are required to maintain the free flow of effluent from orifices at the distal ends of each lateral. Contact Eljen's Technical Resource Department at 1-800-444-1359 or info@eljen.com for more information on pressure distribution systems.

Standard procedures for design of pressure distribution networks apply to the GSF filter. Minimum orifice and lateral pipe size are based on design. A drain hole is required at the end of each row at the 6 o'clock position of each pressure lateral for drainage purposes. The lateral pipe network is placed within a standard 4-inch perforated pipe. The perforation in the 4-inch outer pipe is set at the 4 and 8 o'clock position, the drilled orifices on the pressure pipe are set to spray at the 12 o'clock position directly to the top of the 4-inch perforated pipe as shown below.

The use of orifice shields is acceptable.

GSF Pressure Distribution trench placed on a contour or winding trenches to maintain horizontal separation distances may also be used in Dosed or Gravity system by removing the pressure pipe and using the 4-inch diameter perforated distribution pipe as shown in Figure 13.

FIGURE 13: PRESSURE PIPE PLACEMENT



PRESSURE PIPE CROSS SECTION FOR ALL APPLICATIONS

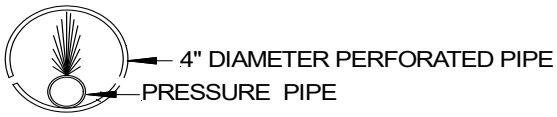


FIGURE 14: PRESSURE CLEAN OUT

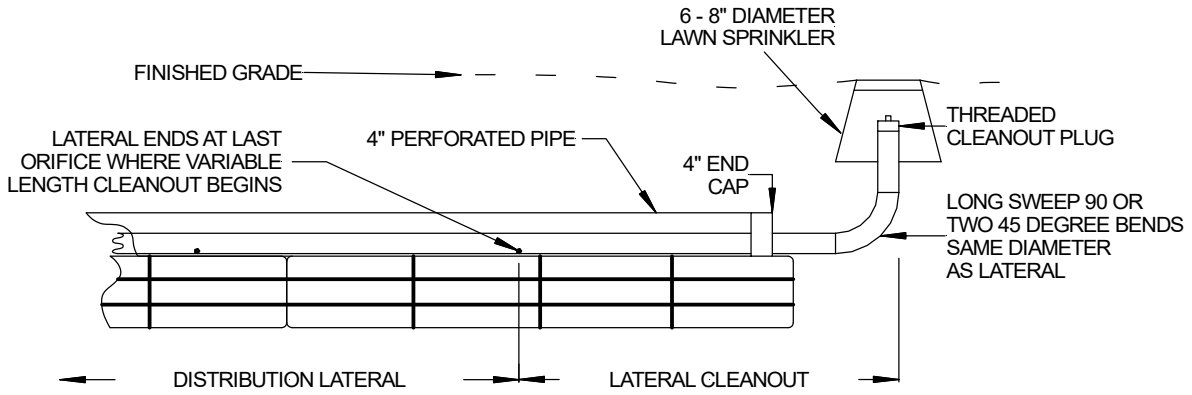
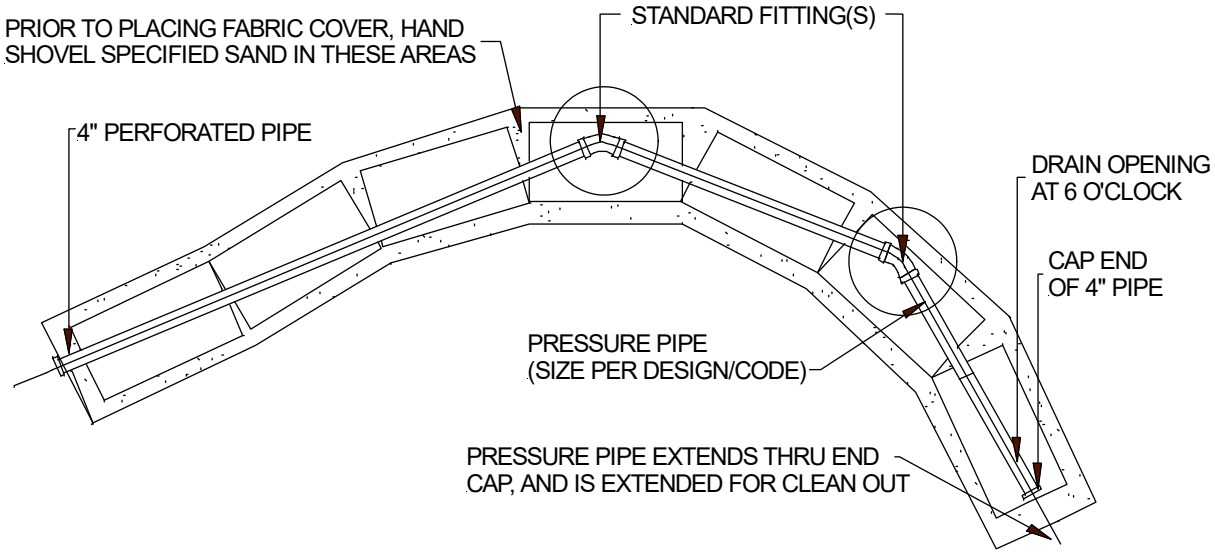


FIGURE 15: CONTOURED TRENCH PRESSURE DISTRIBUTION

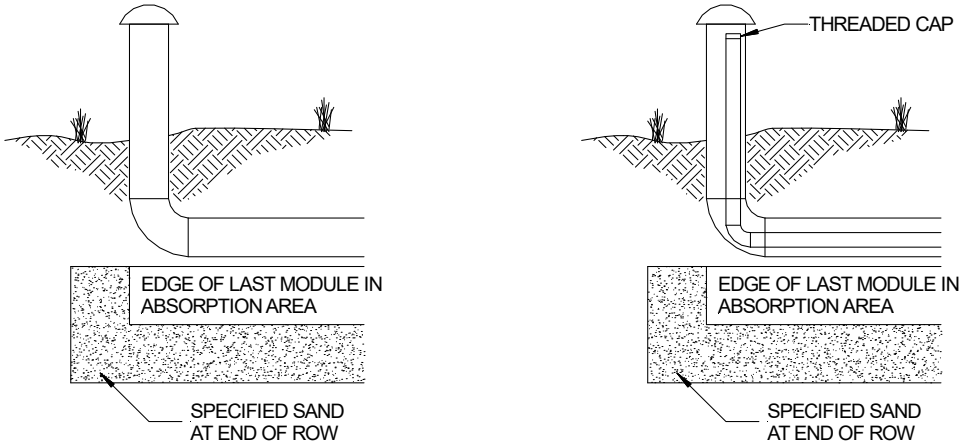


8.0 System Ventilation

8.1 SYSTEM VENTILATION: Air vents are required on all absorption systems located under impervious surfaces or systems **with *more than 18 inches of cover material*** as measured from the top of the GSF module to finished grade. This will ensure proper aeration of the modules and sand filter. The GSF has aeration channels between the rows of GSF modules connecting to cuspations within the GSF modules. Under normal operating conditions, only a fraction of the filter is in use. The unused channels remain open for intermittent peak flows and the transfer of air.

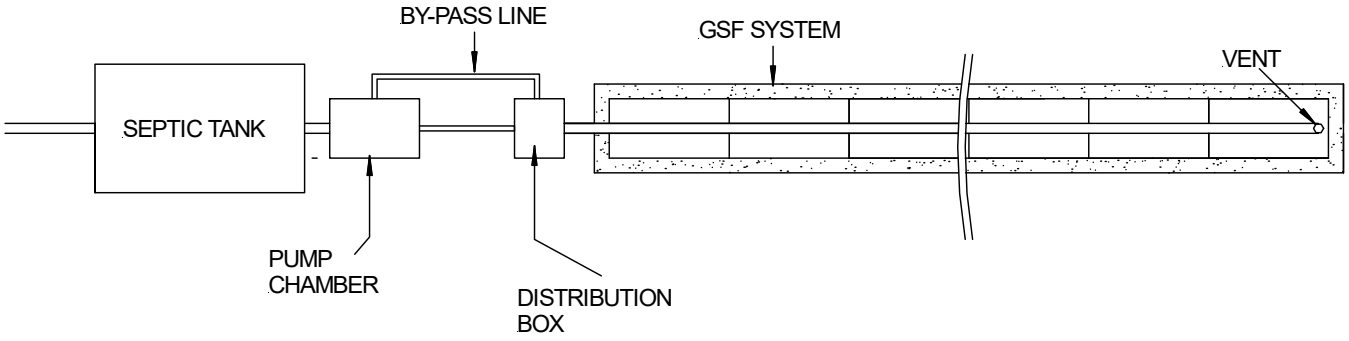
8.2 VENT PIPE FOR GRAVITY AND LOW-PRESSURE SYSTEMS: Systems with more than 18" of cover over the top of the modules require a vent. If the system is a low-pressure distribution system, ensure that the LPP clean out is brought up to grade. It may be located in the vent or in a sprinkler valve box for easy access.

FIGURE 16: VENT LAYOUTS FOR GRAVITY AND LOW-PRESSURE SYSTEMS



8.3 AIR BY-PASS LINE: Systems with more than 18" of cover that are pumped, or pressure dosed require an air by-pass line to continue flow from the low vent on the system to the high vent of the house. Simply plumb an airline from the distribution system back to the pump chamber or septic tank to provide unobstructed flow. Eljen recommends the difference between the high and low vents to be 10'. The use of a high vent is acceptable when the roof vent is not adequate. The high vent shall be attached to a stable structure.

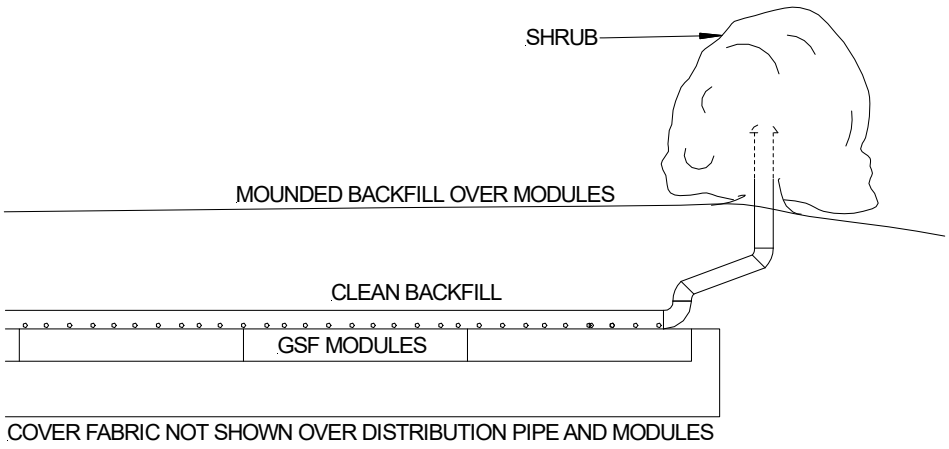
FIGURE 17: AIR BY-PASS LINE PLAN VIEW FOR VENTING OF PUMPED SYSTEMS



8.0 System Ventilation

8.4 VENTILATION PLACEMENT: In a GSF system, the vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs, as shown in the figure below. Corrugated pipe may be used. If using corrugated pipe, ensure that the pipe does not have any bends that will allow condensation to pond in the pipe. This may close off the vent line. The pipe must have an invert higher than the system so that it does not drain effluent.

FIGURE 18: GSF WITH 4" VENT EXTENDED TO CONVENIENT LOCATION



9.0 Commercial Systems

9.1 DESIGN CONSIDERATIONS: Commercial systems differ from residential systems relative to wastewater characteristics, effluent distribution strategies, peak flows, system size and geometry. As these systems are normally larger, the designer must also consider the collection systems and their integrity, groundwater hydrology, drainage upslope and below the GSF system and design accordingly.

Designers should carefully review and document with their client effluent BOD_5 and TSS concentrations and water use volume to determine the design flow. The designer should document that the system installation meets the user's needs to ensure long term performance.

Owners can expect operational issues when occupants are not educated in the maintenance requirements for pretreatment tanks, the discharge of excessive wastewater flows due to leaks, or the impact of toxic chemicals for cleaning or building maintenance. Since the system owners and users may not know the costs associated with these types of problems, they will not be motivated to limit effluent problems and should be educated in these types of systems. Regulators must provide permitting for site specific items and require inspection and evaluation of the overall operating plan. In some cases, local management programs are needed. Designers must provide oversight of system installation and associated system equipment.

9.2 COMMERICAL SYSTEM PLAN REVIEW: Eljen Corporation's Technical Resource Department is available for review of any commercial GSF plans prior to submission for review and approval from the local approving authority. Overall responsibility for system design remains with the licensed designer and/or professional engineer. Contact Eljen for all High Strength system designs, 800-444-1359 or info@eljen.com.

COMPANY HISTORY

Established in 1970, Eljen Corporation created the world's first prefabricated drainage system for foundation drainage and erosion control applications. In the mid-1980s, we introduced our Geotextile Sand Filter products for the passive advanced treatment of onsite wastewater in both residential and commercial applications. Today, Eljen is a global leader in providing innovative products and solutions for protecting our environment and public health.

COMPANY PHILOSOPHY

Eljen Corporation is committed to advancing the onsite industry through continuous development of innovative new products, delivering high quality products and services to our customers at the best price, and building lasting partnerships with our employees, suppliers, and customers.

eljen CORPORATION

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