GSF®

Geotextile Sand Filter

Alabama
Design & Installation Manual

eljen
CORPORATION

Innovative Onsite Products & Solutions Since 1970

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DRAWINGS

TABLES

A42 Module 48” x 24” x 7” (L x W x H)

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.

Crossover A non-perforated pipe that connects on distribution pipe to another installed as specified by the state code.

Design Flow The estimated peak flow that is used to size a GSF system is 150 gallons per day per Bedroom for a 8 bedroom or less dwelling.

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 the 6-inch layer 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.

Serial or Sequential Distribution Designs common to sloping sites where GSF lines are laid on the contour, receiving effluent from a series of Drop-Boxes starting at upper Modified Bed / Line and overflows effluent when required to down-slope Modified Bedes / Lines.

Specified Sand To ensure proper system operation, the system MUST be installed ASTM C33 SAND. Sand must be used with not more than 10% passing the #100 Sieve and not more than 3% passing the # 200 sieve. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

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	< 10
No. 200	75 µm	< 3

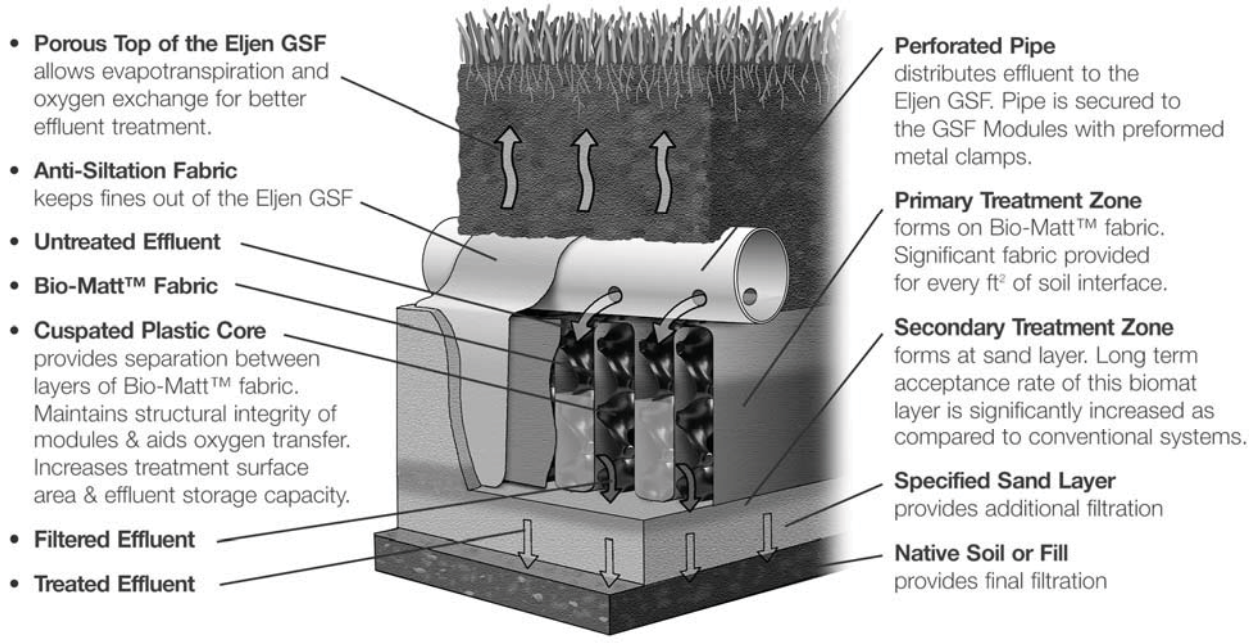
Primary Treatment Zone

- 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: GSF systems must meet the local rules and regulations except as outlined in this manual. Chapter 420-3-1 and the local regulations will be referred to as the *guidelines*.

The sizing charts apply to residential systems treatment systems only and are found in section 2.16. Please contact Eljen's Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

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 soil absorption field.

1.3 GARBAGE DISPOSALS: Eljen discourages the use of garbage disposals with septic systems. If a GSF system is to be designed and installed with garbage disposals measures must be taken to prevent solids from leaving the tank and entering the GSF system. Examples include:

- Increasing the septic tank capacity by a minimum of 30%, or
- Installation of a second septic tank installed in series, or
- Installation of an appropriate sized septic tank outlet effluent filter.

Eljen requires the use of septic tank outlet effluent filters on all systems especially on those systems that have single compartment tanks, even if up-sized, and when the dwelling has a garbage disposal installed.

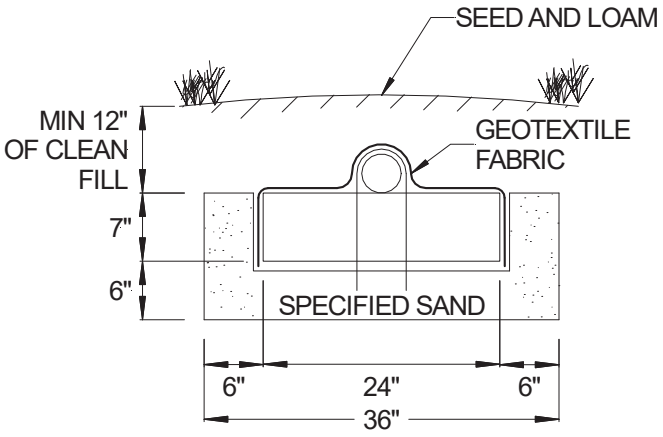
1.4 ADDITIONAL FACTORS AFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water usage may consider increasing the septic tank volume as well as incorporating a multiple compartment septic tank. Consideration for disposal area may be up-sized for expected higher than normal water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

For example:

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

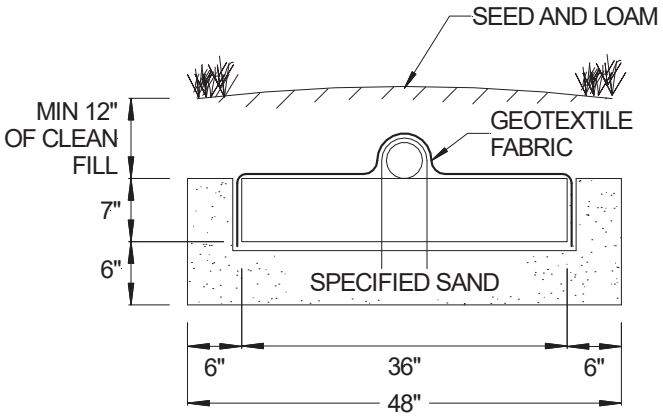
1.5 SYSTEM PROHIBITED AREAS: All vehicular traffic is prohibited over the GSF system. GSF systems shall not be installed under paved or concreted areas. If the system is to be installed in livestock areas, the system must be fenced off around the perimeter to prevent compaction of the cover material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

FIGURE 2: TYPICAL A42 CROSS SECTION



A42 MODULE (L x W x H) 48” x 24” x 7”

FIGURE 3: 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:

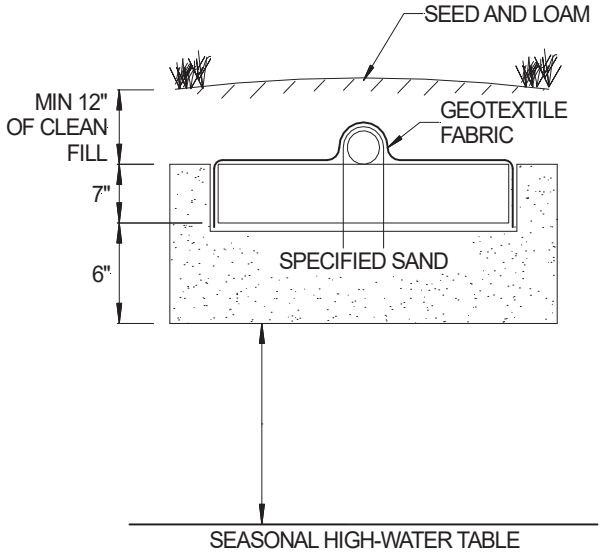
- 6 inches of Specified Sand is at the edges of the GSF module.
- 6 inches of Specified Sand is at the beginning and end of each GSF Row.
- 6 inches of Specified Sand is directly below the GSF module.
- Minimum 12 inches of cover above the module.

2.1 SEPTIC TANK: Septic tanks should be fitted with an effluent filter and sized according to state regulations. 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. Gas baffles and/or effluent filters are also recommended.

2.2 SEPTIC TANK FILTERS: Septic tank effluent filters are ***REQUIRED*** on the outlet end of septic tank. Filter manufactures require that filters be cleaned from time to time. Ask your installer or designer for specific cleaning requirements based on the type or make of the filter installed. Eljen requires the septic tank to be pumped every three years or as needed which would be a good time to check and conduct filter maintenance.

2.3 SEASONAL HIGH-WATER TABLE: Vertical separation is measured to the bottom of the system sand.

FIGURE 4: VERTICAL SEPARATION DISTANCE



2.4 SPECIFIED SAND SPECIFICATION FOR GSF SYSTEMS: The first 6 inches of Specified Sand immediately under, between rows and around the perimeter of the GSF system must be an ***ASTM C33 WASHED CONCRETE SAND WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 3% PASSING A #200 SIEVE.*** Please place a prominent note to this effect on each design drawing. See Table 1 for more information on the ASTM C33 sand and sieve specifications.

2.5 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.

2.6 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 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 Bed 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 5.0 of this manual goes into details of how to construct the distribution network. All piping must meet state and local regulations.

2.7 CONNECTIONS AND FITTINGS: Connections of lines to tanks and distribution boxes must be made using watertight seals. Use of any grouting material is not permitted.

2.8 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. Set a 2-inch minimum drop for dosed systems from the D-box to the 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.

2.9 INSTALLING ON SLOPING TERRAIN: Provide a D-box at the beginning of the first row of modules for effluent distribution and velocity reduction and as a system inspection port. Lower rows may also be loaded from one or more D-boxes with Flow Dials to insure effluent is distributed per design requirements. Serial or equal distribution is permitted.

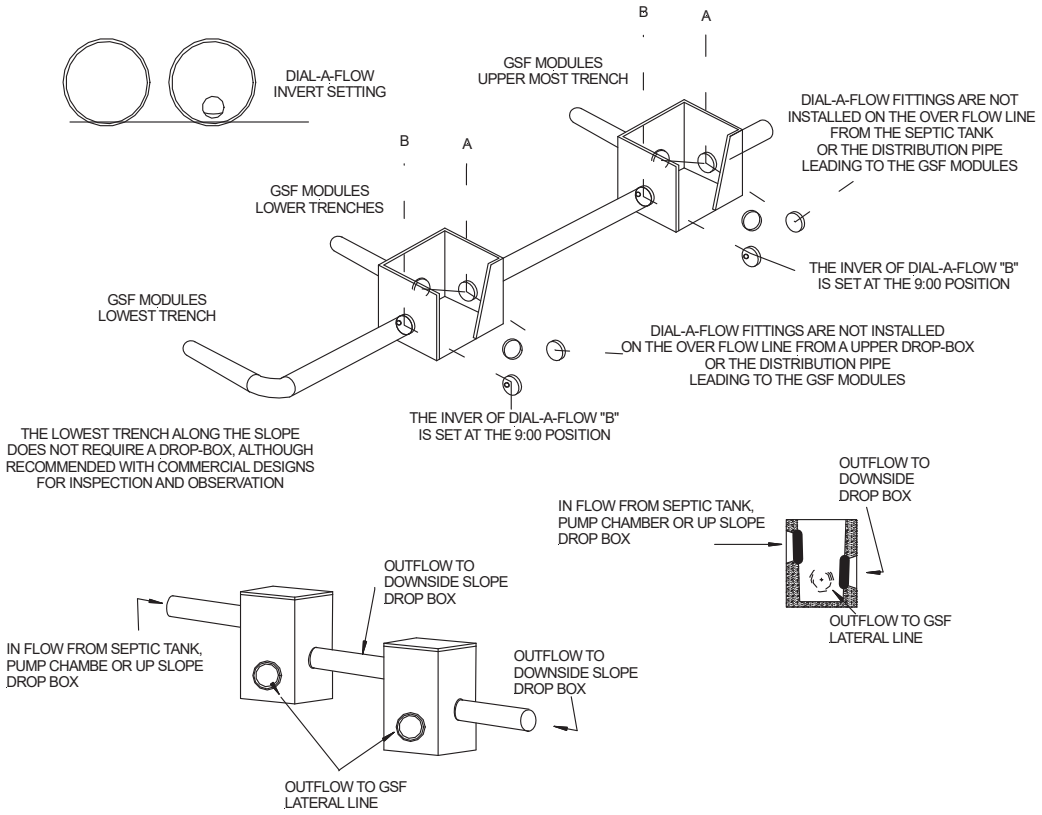
Equal Distribution: Set Flow Dials to insure effluent is distributed equally to all rows in the system.

Serial Distribution: Set Flow Dials to insure effluent is loaded to the upslope Bed first before continuing to lower Beds within the system.

2.9 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 Bed systems.

2.10 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 5: SEQUENTIAL DISTRIBUTION DROP–BOX DETAIL



2.11 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.

2.12 SYSTEM VENTING: It is required to vent all systems that are over 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 7.0 for a more detailed explanation of venting GSF products.

2.13 BACKFILL & FINISH GRADING: Complete backfill with a minimum of 12 inches of clean porous 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.

2.14 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.

It is acceptable to space the units to maximize points of application to the basal area.

2.15 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of six (6) A42 modules per bedroom or five (5) B43 modules per bedroom. See Section 2.16 for more information on systems sizing.

2.16 SYSTEM SIZING: When determining the correct sizing for your GSF system, it is important to follow your local codes and regulations for proper surface and subsurface classifications.

TABLE 2: SQUARE FOOT PER MODULE (TRENCH ONLY)

Unit	Effective Bottom Area (ft^2)
A42	18

TABLE 3: LOADING RATES AND LINEAR LOADING RATES

PERC RATE min/inch	LINEAR LOADING RATE gal/d/ft	SOIL GROUP U.S.D.A. Textures	LOADING RATE gpd/ft^2
5	10	Group 1 Sand, Loamy Sand	1.50
10	10		1.50
15	10		1.50
20	9	Group 2 Sandy Loam, Loam	1.00
25	8		1.00
30	7		1.00
35	6	Group 3 Sandy Clay Loam, Silt Loam, Silty Clay Loam, Clay Loam	0.71
40	5.8		0.71
45	5.6		0.71
50	5.4		0.71
55	5.2		0.71
60	5		0.71
65	4	Group 4A Sandy Clay, Silty Clay, Clay	0.36
70	4		0.36
75	3.5		0.36
80	3.5		0.28
85	3		0.28
90	3		0.28
95	NOT SUITABLE	Group 4B High Shrink-Swell Clay, Poorly Structured Soil	0.28
100			0.28
105			0.28
110			0.28
115			0.28
120			0.28

House size: 3 Bedrooms
Soil Percolation Rate min/in: 45 min/in
Design Flow: 150 gpd x 3 bedrooms = 450 gpd

Loading Rate (using Table 3)

PERC RATE min/inch	LINEAR LOADING RATE gal/d/ft	SOIL GROUP U.S.D.A. Textures	LOADING RATE gpd/ft^2
45	5.6	Group 3	0.71
50	5.4	Sandy Clay Loam, Silt	0.71
55	5.2	Loam, Silty Clay	0.71
60	5	Loam, Clay Loam	0.71

Trench Construction

Design Flow ÷ Loading Rate ÷ Effective Bottom Area = Modules Required

A42
450 gpd ÷ 0.71 gpd/ft^2 ÷ 18 ft^2/unit = 35.2
35.2 units, round to 36 A42 units

Calculate Minimum Trench Length
A42: 36 units x 4 ft per unit + 1 ft per trench =
145 linear ft

Trench Width
A42: 3 ft

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

A42

Min. Trench Length	145 ft.
Trench Width	3 ft.
Minimum Number of Units	36 A42s
System Area	435 ft^2

FIGURE 6: PLAN VIEW – TRENCH SYSTEM EXAMPLE

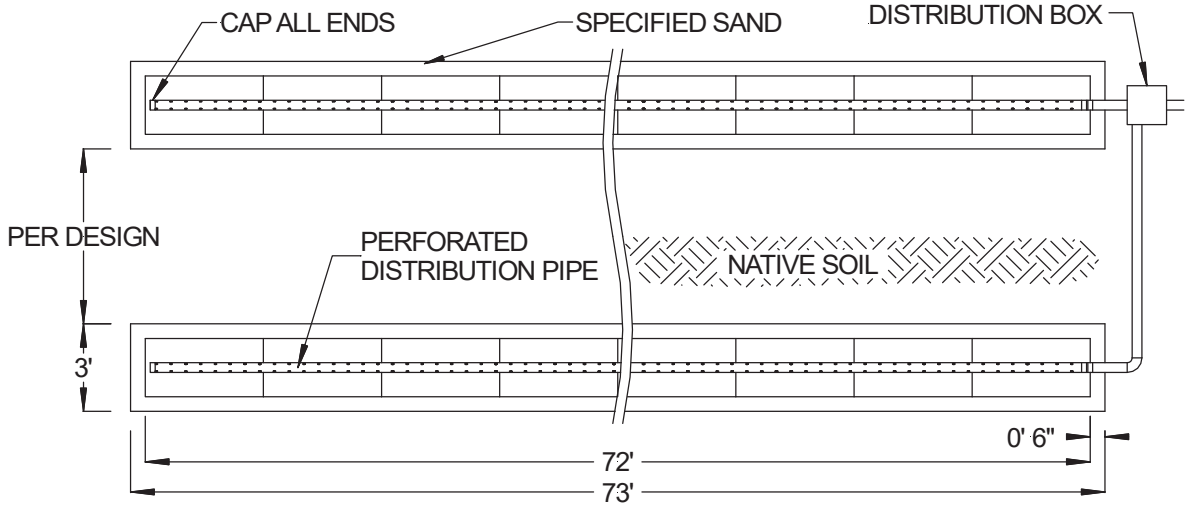


FIGURE 7: SECTION VIEW – TRENCH SYSTEM EXAMPLE – LEVEL SITE

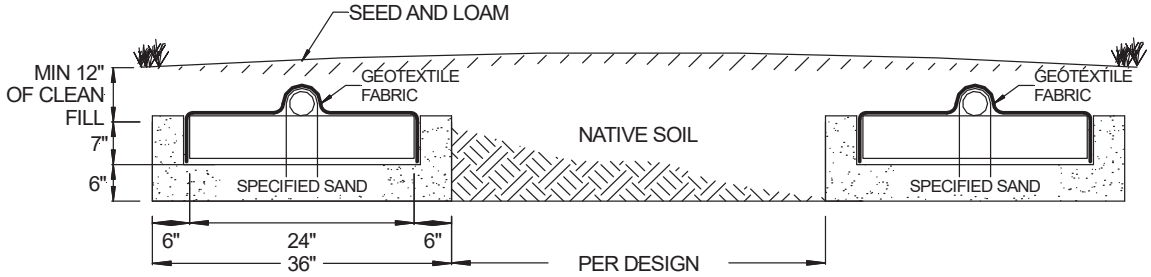
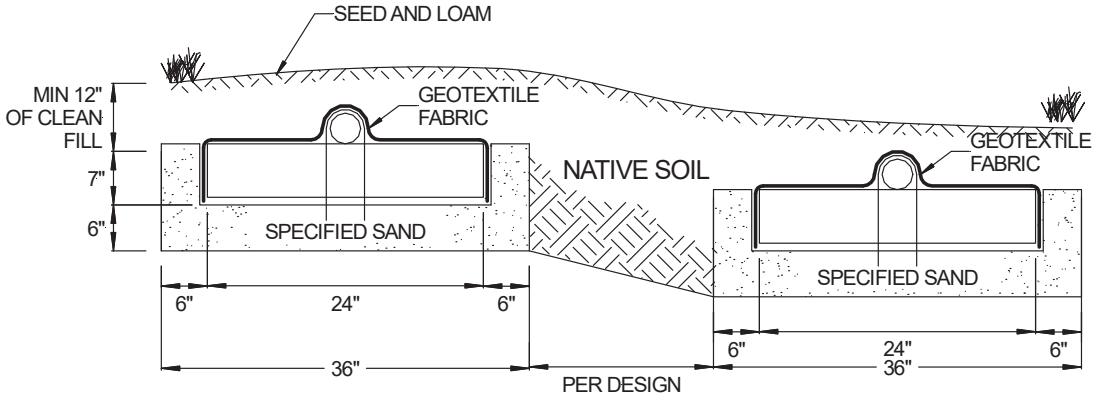


FIGURE 8: SECTION VIEW – TRENCH SYSTEM – SLOPING SITE



House size: 4 Bedrooms
Soil Percolation Rate min/in: 45 min/in
Design Flow: 150 gpd x 4 bedrooms = 600 gpd

Linear Loading Rate and Loading Rate (using Table 3)

PERC RATE min/inch	LINEAR LOADING RATE gal/d/ft	SOIL GROUP U.S.D.A. Textures	LOADING RATE gpd/ft^2
45	5.6	Group 3	0.71
50	5.4	Sandy Clay Loam, Silt	0.71
55	5.2	Loam, Silty Clay	0.71
60	5	Loam, Clay Loam	0.71

Linear Loading Rate: 5.6 gal/d/ft Loading Rate: 0.71 gal/

Minimum Bed Length required

Design Flow ÷ Linear Loading Rate
600 gpd ÷ 5.6 gal/d/ft = 107.14 ft, round to 108 ft.

Minimum Bed Width required

Linear Loading Rate ÷ Loading Rate
5.6 gal/d/ft ÷ 0.71 gal/ft^2 = 7.9 ft, round to 8 ft.

Minimum Units required

A42: 4 Bedrooms x 6 Units per Bedroom
24 A42 Units

B43: 4 Bedrooms x 5 Units per Bedroom
20 A42 Units

Maximum Units per Row

(Bed Length – 1) ÷ 4

(108 – 1) ÷ 4 = 26.75, round down to 26 Modules
One row is required for the system.

Final Dimension Layout

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

A42

Min. Bed Length	108 ft.
Bed Width	8 ft.
Minimum Number of Units	26 A42s
System Area	864 ft^2

B43

Min. Bed Length	108 ft.
Bed Width	8 ft.
Minimum Number of Units	26 B43s
System Area	864 ft^2

FIGURE 9: PLAN VIEW – BED SYSTEM EXAMPLE

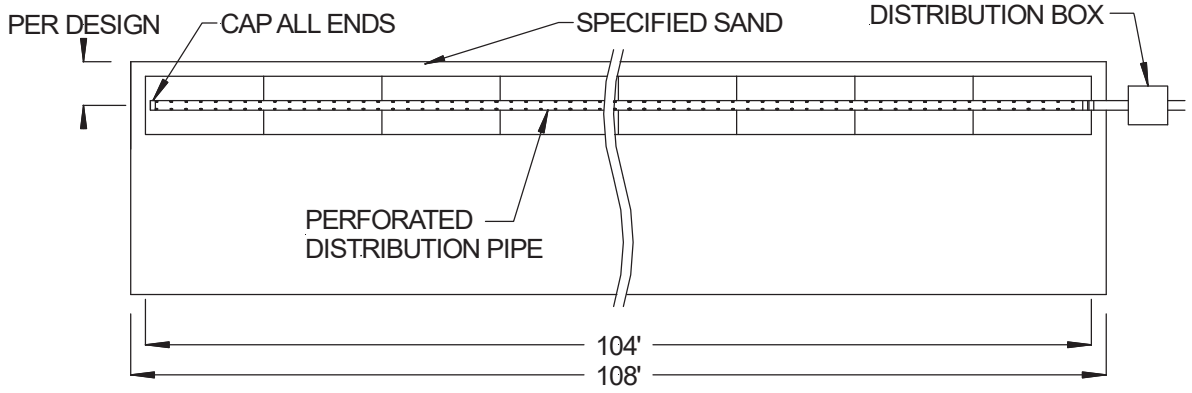
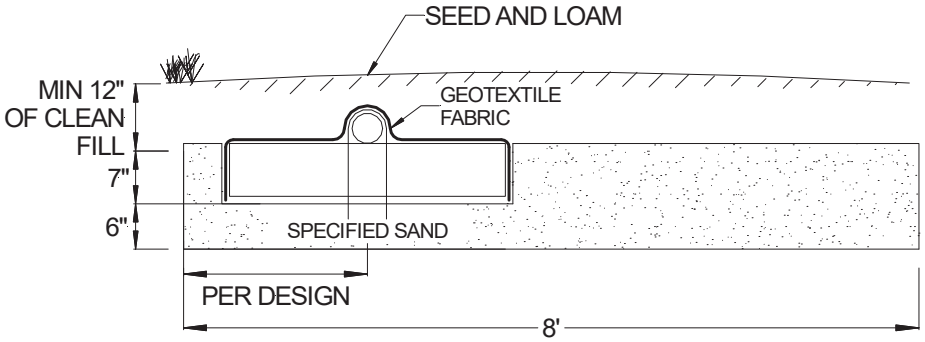


FIGURE 10: SECTION VIEW – BED SYSTEM EXAMPLE



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

6. Minimize walking in the Bed 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 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. 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 Bed, 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 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 Bed.

14. Complete backfill with a minimum of 12 inches of clean porous 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.

5.0 Mound Installation Guidelines

5.1 MOUND REFERENCE: The following sizing and guidelines provide the dimensions of the dispersal bed for your mound. Consult the local regulations for more information on the construction of the mound system.

5.2 MOUND EXAMPLE:

House size:	4 bedrooms
Slope of site:	4%
Daily Design Flow: 150 gpd x 4 bedrooms =	600 gpd
Nature of Limiting Condition:	High water table at 18 inches
Perc Rate:	60 mpi

FIGURE 11: CROSS SECTION – MOUND SYSTEM

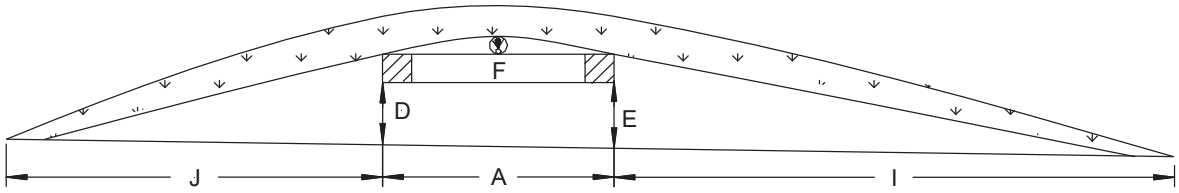
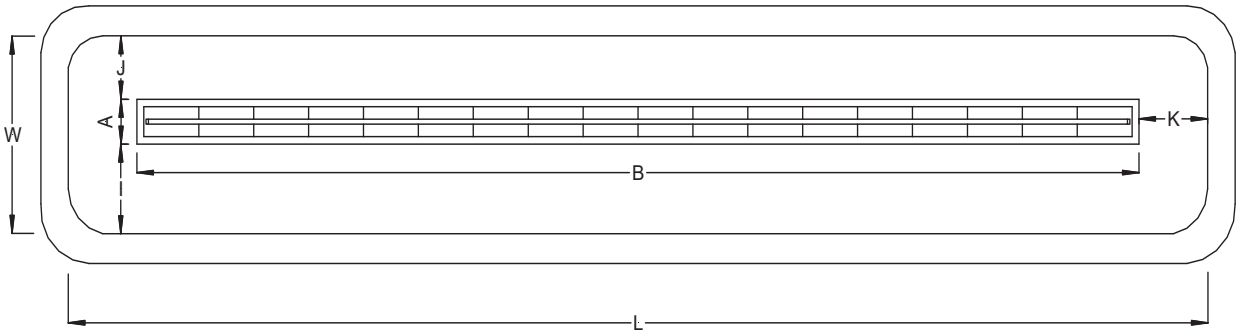


FIGURE 12: PLAN VIEW – MOUND SYSTEM



A – Dispersal bed width (accounts for sand) –**Minimum 3 ft for A42**
B – Dispersal bed length
D – Up slope fill depth under dispersal bed – **Minimum 1 ft**
E – Down slope fill depth under dispersal bed – **Minimum 1 ft**
F – Dispersal bed depth – **Constant 7 in**
I – Distance from edge of dispersal bed to down slope edge of fill
J – Distance from edge of dispersal bed to up slope edge of fill
K– Distance from end of dispersal bed to edge of fill
L – Overall mound fill length
W – Overall mound fill width

5.4 CALCULATE VARIABLES: The following equations are from the Regulation.

Determine the Linear Loading Rate and Loading Rate from Table 3:

PERC RATE min/inch	LINEAR LOADING RATE gal/d/ft	SOIL GROUP U.S.D.A. Textures	LOADING RATE gpd/ft^2
35	6	Group 3 Sandy Clay Loam, Silt Loam, Silty Clay Loam, Clay Loam	0.71
40	5.8		0.71
45	5.6		0.71
50	5.4		0.71
55	5.2		0.71
60	5		0.71

Linear Loading Rate: 5.0 gal/d/ft Loading Rate: 0.71 gal/

A – Maximum Dispersal Bed Width
Linear Loading Rate ÷ Loading Rate
5.0 gal/d/ft ÷ 0.71 gal/ft^2 = 7.04 ft, round up to 8 ft.

B – Dispersal Bed Length
Design Flow ÷ Linear Loading Rate
600 gpd ÷ 5.0 gal/d/ft = 120 ft

D – Upslope fill depth under dispersal bed = **Minimum 1 ft**
(***NOTE:*** For this example, assume the depth of fill at the up-slope edge of the dispersal bed is **1 ft**.)

E – Downslope fill depth under dispersal bed = **Minimum 1 ft**
C + (Slope of site stated as a decimal x Dispersal bed width)
1 ft + (0.04 x 8 ft) = **1.32 ft**

F – Dispersal Bed Depth – Constant 7 in., convert to feet – **0.583 ft**

I – Downslope Width = (Downslope Fill Depth + Dispersal Bed Depth) x 3 x Downslope Correction Factor

Slope %	Downslope (I) Correction Factor	Upslope (J) Correction Factor
0	1	1
2	1.06	0.94
4	1.14	0.89
6	1.22	0.86
8	1.32	0.8
10	1.44	0.77
12	1.57	0.73
14	1.72	0.71
16	1.92	0.68
18	2.17	0.65
20	2.5	0.62

Downslope Width = (1.32 ft + 0.583 ft) x 3 x 1.14 = 6.5, round to **6.5 ft**.

J – Upslope Width = (Upslope Fill Depth + Dispersal Bed Depth) x 3 x Upslope Correction Factor

Slope %	Downslope (I) Correction Factor	Upslope (J) Correction Factor
0	1	1
2	1.06	0.94
4	1.14	0.89
6	1.22	0.86
8	1.32	0.8
10	1.44	0.77
12	1.57	0.73
14	1.72	0.71
16	1.92	0.68
18	2.17	0.65
20	2.5	0.62

Upslope Width = (1 ft + 0.583 ft) x 3 x 0.89 = 4.22, round to **4.25 ft**.

K – End Slope Length = (((Downslope Fill Depth + Upslope Fill Depth)/2) + Dispersal Bed Depth) x 3
End Slope Length = (((1.32 ft + 1)/2 + 0.583 ft) x 3 = 5.23 ft, round to **5.25 ft**.

L – Overall Mound Length = Dispersal Bed Length + 2 x End Slope Length
120 ft + 2 x 5.25 ft = **130.5 ft**

W – Overall Mound Width = Dispersal Bed Width + Downslope Width + Upslope Width
8 ft + 6.5 ft + 4.25 ft = **18.75 ft**

Basal Area Calculation
Level Sites = Overall Mound Length x Overall Mound Width

Sloping Sites = Dispersal Bed Length x (Dispersal Bed Width + Downslope Width)
120 ft x (10 + 6.5) = 1,980 ft^2

The above calculation must exceed the Basal Area Required = Daily Design Flow ÷ Soil Infiltration Rate
600 gpd ÷ 0.71 gpd/ft^2 = 845 ft^2

System does meets the requirements.

If the system does not meet the requirements, extend downslope width to meet basal area required.
Adjusted Downslope Width = (Basal Area Required ÷ Dispersal Bed Length) – Dispersal Bed Width

5.5 DISPERSAL BED CONSTRUCTION –
Width – 10 ft
Length – 120 ft

A42 Modules needed for this system: (Length – 1) ÷ 4

(120 ft – 1) ÷ 4 ft/module = 29.75, round down to 29 A42 Modules

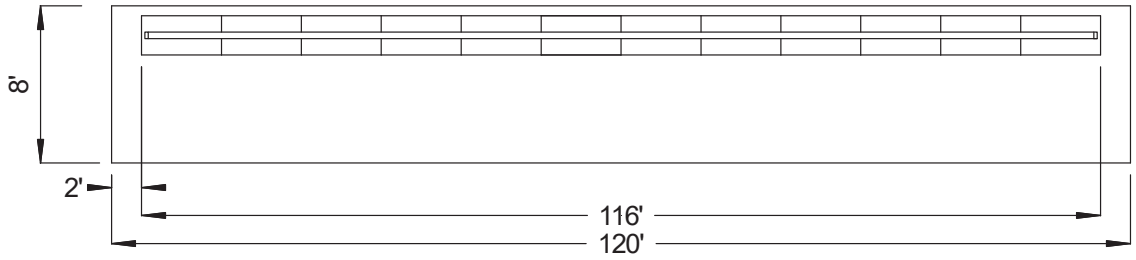
Determine End Spacing of A42s inside the dispersal bed:

(Dispersal Bed Length – Modules x 4) ÷ 2

(120 ft – 29 Modules x 4) ÷ 2 = 2 ft

5.6 UNIT PLACEMENT: On sloping sites, maintain a minimum of 6 inches of sand from the upslope edge of the distribution bed to the first unit. On level sites, place module row in middle of bed.

FIGURE 13: PLAN VIEW – 600 GPD – DISPERSAL BED MOUND SYSTEM



5.0 Mound Installation 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. Scarify 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" lifts, stabilize by foot, a hand held tamping tool or a portable vibrating compactor. The stabilized height below the GSF module must meet the mound 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 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 have a clean out at the end of each module row. Refer to Section 5.0 for guidelines on when to use pressure distribution. The distribution pipe is capped at both ends with a hole cut throw to allow the pressure pipe through.

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 mound. Slope the sand away from the mound 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 PUMP TO DISTRIBUTION BOX: Specify an oversized distribution box for pumped dosed systems. Provide velocity reduction in the d-box with a tee or baffle. Set d-box outlets at the same elevation to equalize flow to each line or use drop boxes at the head of each line for serial distribution. If the absorption area is installed deeper than 18 inches, the system must be vented. See section 7.0 of this manual for detailed information on venting of systems.

6.2 DOSING DESIGN AND FLOW RATE: Dosing volume must be set to deliver a maximum of 4 gallons per B43 Module and 3 gallons per A42 Module per dosing cycle. Higher flow rates and short dose cycle push the effluent down the line and thus disperse the effluent over a larger area. A valve on the force main is recommended to set the flow rate so that the outlet pipes are submerged but prevents the d-box from over flowing.

For residential strength wastewater, the maximum B43 Module design flow shall not exceed 30 gallons per day per module; the maximum A42 Module design flow shall not exceed 25 gallons per day per module.

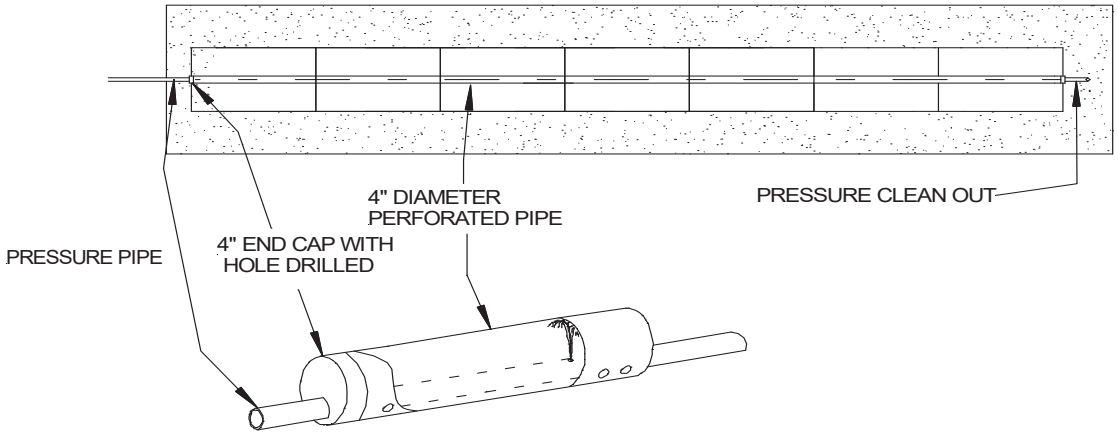
7.0 Pressure Distribution Guidance

7.1 BASAL AREA INFILTRATION RATES – LOW PRESSURE PIPE: The loading rates for secondary treatment in Table 13 are approved for use with this product if approved by the local regulating authority. Otherwise, the loading rates in Table 3 are in effect.

7.2 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 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 is based on design. A ¼ inch diameter drain hole is required at the beginning 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 perforations in the 4-inch outer pipe are 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.

FIGURE 14: PRESSURE PIPE PLACEMENT



PRESSURE PIPE CROSS SECTION FOR ALL APPLICATIONS

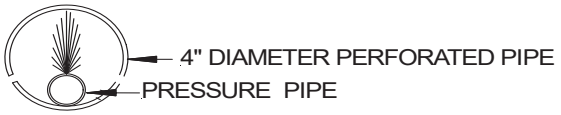


FIGURE 15: PRESSURE CLEAN OUT

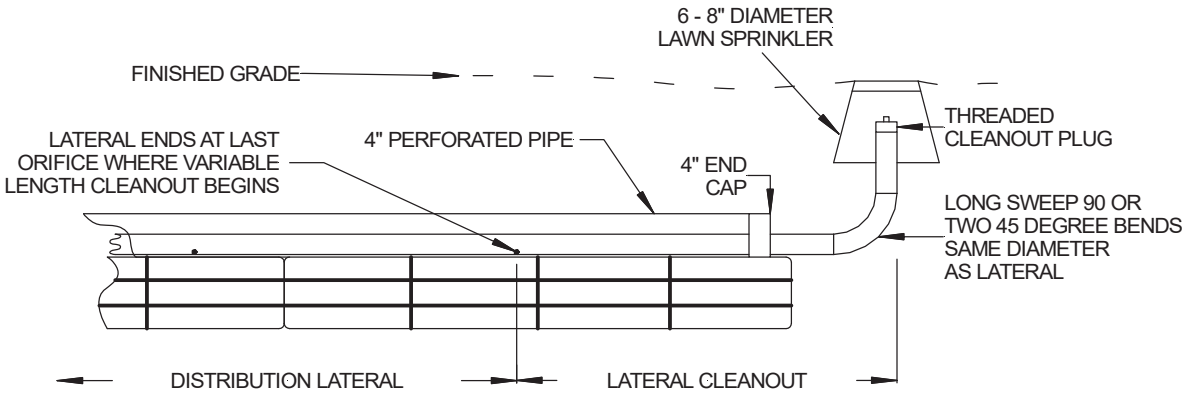
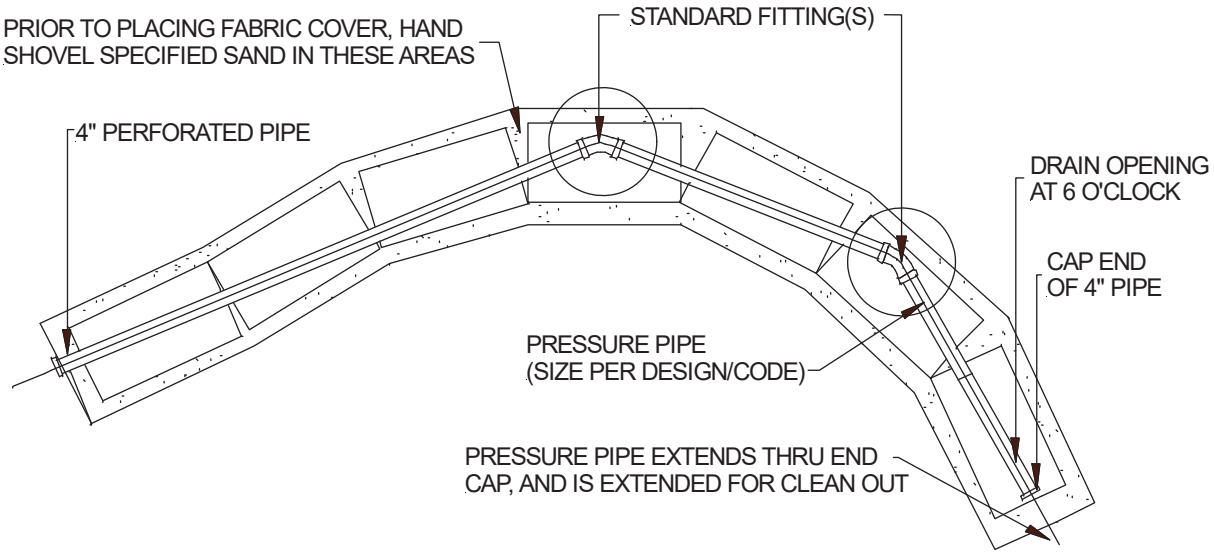


FIGURE 16: CONTOURED BED PRESSURE DISTRIBUTION



GSF Pressure Distribution system placed on a contour 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.

8.0 Pump Controls

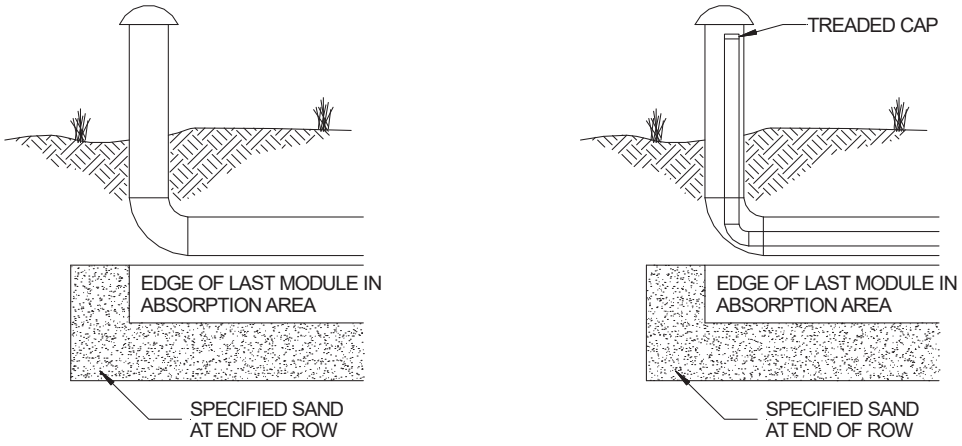
ELECTRICAL CONTROLS: Demand and Pressure Dosed controlled systems will include an electrical control system that has the alarm circuit independent of the pump circuit, controls, and components that are listed by UL or equivalent, is located outside, within line of sight of the pump chamber and is secure from tampering and resistant to weather (minimum of NEMA 4). The control panel shall be equipped with cycle counters and elapsed time meters. Where a water supply water meter is available it may be possible to eliminate the counters or timers.

The control panel shall be equipped with both audible and visual high liquid level alarms installed in a conspicuous location. Float switches shall be mounted independent of the pump and transport line so that they can be easily replaced and/or adjusted without removing the pump.

9.1 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.

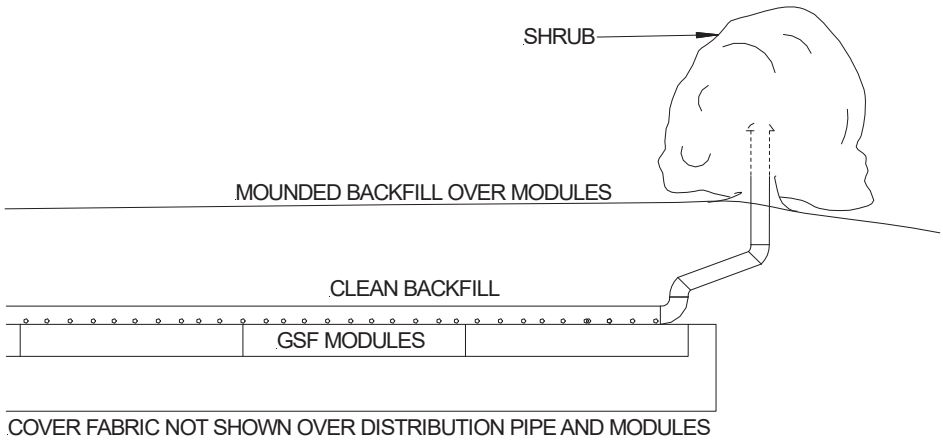
9.2 VENT PIPE FOR GRAVITY AND LOW-PRESSURE SYSTEMS: Systems with over 18" of cover over the top of the modules require a vent. If the system is a low-pressure distribution system, ensure that the LPP clean outs are located in the vent for easy access.

FIGURE 17: VENT LAYOUTS FOR GRAVITY AND LOW-PRESSURE SYSTEMS



9.3 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



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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